

Project Manual



Town of
Boxford
Massachusetts

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER

10 Elm Street
Boxford, Massachusetts 01921

Design Development Submission – December 22, 2020

Owner / Awarding Authority:

TOWN OF BOXFORD

7A Spofford Road
Boxford, Massachusetts 01921

Owner's Project Manager:

P THREE INC

150 Longwater Drive
Norwell, Massachusetts 02061

Architect:

GORMAN RICHARDSON LEWIS ARCHITECTS, INC.

239 South Street
Hopkinton, Massachusetts 01748-1822

GRLA Project Number: 2020120.01

PROJECT MANUAL

PROJECT: THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

OWNER/AWARDING AUTHORITY: TOWN OF BOXFORD, MASSACHUSETTS
7A Spofford Road
Boxford, Massachusetts 01921
Telephone: 978-887-6000

acting by and through its

Town Administrator: Alan J. Benson

Board of Selectmen: Alfred Vaz, Jr., Chair
Mary Anne Nay, Vice-Chair/Clerk
Charles J. Costello, Member
Peter C. Perkins, Member
Barbara G. Jessel, Member

Permanent Building Committee: Margaret Chow-Menzer, Chair
Richard O'Brien, Vice Chair
Robert Hazelwood, Clerk
Scott Novack, Member
Thomas Duval, Member
F. Richard Shaw, Senior Center Designee
Judith Andersen, Senior Center Designee

Council on Aging: Pam Blaquiere, Director
Judith Andersen, Secretary
Stephen Harvey, Member
Richard Shaw, Member
Elizabeth Murphy, Member
Suzanne Cox, Member
Christina Eckert, Member
John Shirley, Member

10 ELM FOUNDATION: Heather Vaz, President

OWNER'S PROJECT MANAGER: P THREE INC
150 Longwater Drive
Norwell, Massachusetts 02061
Telephone: 781-871-3136

ARCHITECT: GORMAN RICHARDSON LEWIS ARCHITECTS, INC.
239 South Street
Hopkinton, Massachusetts 01748-1822
Telephone: 508-544-2600

DESIGN TEAM

ARCHITECT: GORMAN RICHARDSON LEWIS ARCHITECTS, INC.
239 South Street
Hopkinton, Massachusetts 01748
Telephone: 508-544-2600

CIVIL ENGINEERING: NITSCH ENGINEERING, INC.
2 Center Plaza, Suite 430
Boston, Massachusetts 02108
Telephone: 617-338-0063

LANDSCAPE ARCHITECTURE: COSMOS ASSOCIATES
5 Longview Street
Natick, Massachusetts 01760
Telephone: 508-654-6847

STRUCTURAL ENGINEERING: DeSIMONE CONSULTING ENGINEERS
31 Milk Street, Suite 1016
Boston, Massachusetts 02109
Telephone: 617-936-4492

MECHANICAL ENGINEERING:
(Fire Protection, Plumbing, HVAC) GARCIA, GALUSKA & DESOUSA, INC.
375 Faunce Corner Road, Suite D
Dartmouth Massachusetts 02747
Telephone: 508-998-5700

ELECTRICAL ENGINEERING: GARCIA, GALUSKA & DESOUSA, INC.
375 Faunce Corner Road, Suite D
Dartmouth Massachusetts 02747
Telephone: 508-998-5700

FOOD SERVICE CONSULTANT: [TBD]

COST CONSULTANT: ELLANA INC.
98 N Washington Street
Boston, Massachusetts 02114-1918
Telephone: 857-233-4561

GEOTECHNICAL CONSULTANT: [TBD]

SPECIFICATIONS CONSULTANT: PAUL DIBONA SPECIFICATIONS LLC
108 Hayden Rowe Street
Hopkinton, Massachusetts 01748-2508
Telephone: 508-625-1098

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-	DCAMM Sub-Bidder Update Statement**	(10 pages)	03/30/10 -
Document 00 35 50	Form of Non-Collusive Affidavit of Subcontractor**	00 35 50-1	12/22/20 -

* These documents shall be submitted with the General Bid.
 ** These documents shall be submitted with Each Sub-bid.
 *** Not Included

Document/Section No. and Title	Page Numbers	Issue Date	Latest Rev. Date
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 *** Not Included

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Document/Section No. and Title	Page Numbers	Issue Date	Latest Rev. Date
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- Appendix A Geotechnical Report ???***
- Appendix B HazMat Survey / Abatement ??? ***
- Appendix C Code Summary***
- Appendix D Historic Restoration Standards ??? ***
- Appendix E Food Service Equipment / Appliances ??? ??? ***

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LIST OF DRAWINGS

PART 1 - GENERAL

1.01 DRAWING LIST

- A. The List of Drawings for DESIGN DEVELOPMENT SUBMISSION for THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER, 10 Elm Street, Boxford, Massachusetts 01921; GRLA Project No. 2020120.01, is as follows:

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G0.2	12/22/20	-	-	BUILDING AXONS
G0.3	12/22/20	-	-	BUILDING AXONS
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C-200	12/22/20	-	-	CIVIL EROSION CONTROL PLAN
C-300	12/22/20	-	-	CIVIL LAYOUT PLAN
C-400	12/22/20	-	-	CIVIL GRADING PLAN
C-500	12/22/20	-	-	CIVIL UTILITY PLAN
C-600	12/22/20	-	-	CIVIL DETAILS I
C-601	12/22/20	-	-	CIVIL DETAILS II
C-602	12/22/20	-	-	CIVIL DETAILS III
C-603	12/22/20	-	-	CIVIL DETAILS IV
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<u>Drawing No.</u>	<u>Date of Issue</u>	<u>Rev. No.</u>	<u>Rev. Date</u>	<u>Drawing Title</u>
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A1.2	12/22/20	-	-	SECOND FLOOR / ATTIC PLAN
A1.3	12/22/20	-	-	ROOF PLAN
A2.1	12/22/20	-	-	FIRST AND SECOND FLOOR REFLECTED CEILING PLAN
A3.1	12/22/20	-	-	SOUTH AND EAST ELEVATIONS
A3.2	12/22/20	-	-	NORTH AND WEST ELEVATIONS
A5.1	12/22/20	-	-	ENLARGED KITCHEN PLANS AND ELEVATIONS
A5.2	12/22/20	-	-	ENLARGED TOILET ROOMS PLANS AND ELEVATIONS
A6.1	12/22/20	-	-	BUILDING SECTIONS
A11.1	12/22/20	-	-	FIRST FLOOR FURNITURE PLAN
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S1.3	12/22/20	-	-	ROOF FRAMING PLAN
S2.0	12/22/20	-	-	PROGRAM OF SPECIAL INSPECTIONS
S2.1	12/22/20	-	-	GENERAL NOTES
S2.2	12/22/20	-	-	TYPICAL CONCRETE SECTIONS AND DETAILS

<u>Drawing No.</u>	<u>Date of Issue</u>	<u>Rev. No.</u>	<u>Rev. Date</u>	<u>Drawing Title</u>
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M2.3	12/22/20	-	-	EQUIPMENT CONTROLS I - HVAC
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<u>Drawing No.</u>	<u>Date of Issue</u>	<u>Rev. No.</u>	<u>Rev. Date</u>	<u>Drawing Title</u>
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E0.4	12/22/20	-	-	ELECTRICAL SITE DETAILS
E0.5	12/22/20	-	-	ELECTRICAL SITE DETAILS
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E1.2	12/22/20	-	-	SECOND FLOOR PLAN - LIGHTING
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E2.2	12/22/20	-	-	SECOND FLOOR PLAN - POWER
E2.3	12/22/20	-	-	ROOF PLAN
E2.4	12/22/20	-	-	LIGHTNING PROTECTION DETAILS
E3.0	12/22/20	-	-	ONE-LINE POWER RISER
E3.1	12/22/20	-	-	ELECTRICAL DETAILS
E3.2	12/22/20	-	-	ELECTRICAL DETAILS
E3.3	12/22/20	-	-	MECHANICAL AND PLUMBING SCHEDULE
E3.4	12/22/20	-	-	GROUNDING RISER
E4.0	12/22/20	-	-	FIRE ALARM RISER
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E5.0	12/22/20	-	-	SECURITY RISER AND DETAILS
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<u>Drawing No.</u>	<u>Date of Issue</u>	<u>Rev. No.</u>	<u>Rev. Date</u>	<u>Drawing Title</u>
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T0.1	12/22/20	-	-	TECHNOLOGY SYMBOL LIST AND DETAILS
T1.1	12/22/20	-	-	FIRST FLOOR PLAN – TECHNOLOGY
T2.0	12/22/20	-	-	TECHNOLOGY RISER
T2.1	12/22/20	-	-	TECHNOLOGY DETAILS

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF DOCUMENT

DOCUMENT 00 02 00

INVITATION TO BID

THIS PROJECT IS BEING ELECTRONICALLY BID; HARD COPY BIDS WILL NOT BE ACCEPTED.

1.01 RECEIPT OF BIDS ELECTRONICALLY BID (E-BID)

- A. The **TOWN OF BOXFORD MASSACHUSETTS** (Awarding Authority), acting by and through the **BORD OF SELECTMEN**, invites sealed E-Bids for construction of:

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

in accordance with the Bidding and Contract Documents prepared by:

GORMAN RICHARDSON LEWIS ARCHITECTS, INC.
239 South Street
Hopkinton, Massachusetts 01748-1822
Telephone: 508-544-2600

hereinafter referred to as Architect, for the Awarding Authority (Owner) as follows:

TOWN OF BOXFORD, MASSACHUSETTS
7A Spofford Road
Boxford, Massachusetts 01921
Telephone: 978-887-6000

Attn: **Alan J. Benson, Town Administrator**

received by dates and times specified below:

- 1. **Filed Sub-bids: Wednesday, _____, 2021 at 2:00 PM.**
- 2. **General Bids: Wednesday, _____, 2021 at 2:00 PM.**

B. ELECTRONICALLY BID (E-BID) REQUIREMENTS:

- 1. This project is being Electronically Bid (E-Bid). All bids shall be submitted online at www.Projectdog.com. Hard copy bids will not be accepted by the Awarding Authority.
 - a. E-Bid tutorials and instructions are available within the Specifications and online at www.Projectdog.com. For assistance, call Projectdog, Inc. at (978) 499-9014, Monday through Friday, 8:30 AM to 5:00 PM.
- 2. Bid Forms and Contract Documents will be available on or after _____, _____, 2021 at www.Projectdog.com or for pick-up at Projectdog, Inc., 18 Graf Road, Suite 8 Newburyport, MA (978) 499-9014, Monday through Friday, 8:30 AM to 5:00 PM. Go to www.Projectdog.com and login with an existing account or click [Sign Up](#) to register for free. Enter **Project Code xxxxxx** in the project locator box. Select 'Acquire Documents' to download documents, review a hard copy at Projectdog's physical location, or request a free Project CD.

3. All Addenda must be acquired electronically at www.Projectdog.com. It is the intention that each individual or firm recorded as having requested a set of Contract Documents will be electronically notified via email when addenda are issued. That being said, it is the sole responsibility of the bidder to review all Addenda prior to bid opening at www.Projectdog.com or at Projectdog's physical location.

1.02 MANDATORY PRE-BID CONFERENCE AND SITE WALKTHROUGH

- A A **Mandatory Pre-Bid Conference** and **Site Walkthrough** will be held by the Awarding Authority at 10:00 AM, local legal time, on _____, _____, **2021** at the project site (Cummings House, 10 Elm Street, Boxford, MA).

1. Attendees are obligated to wear facial masks and adhere to social distancing.

1.03 DESCRIPTION OF PROJECT, PROJECT DURATION, AND QUALIFICATIONS OF BIDDERS

- A. Project Description: The proposed work includes historic rehabilitation of existing Cummings House per the Design Development Submission Documents; demolishing and removal of existing structures to east of Cummings House (the ell, the stairs, the former library structure, the barn) and replacing with new single story addition for new community/senior center.

1. This work will be publicly bid through MGL Chapter 149.
2. Estimated construction cost for the Base Bid construction is **\$ x,xxx,xxx.**
3. Project is pending approval of funds by TOWN OF BOXFORD vote expected to occur in 2021

- B. Duration of Project:

1. Construction Start: _____, 2021.
2. Date of Substantial Completion: _____, 2022.
3. Final Completion: _____, 2022.
4. Refer to Document 00 31 00, FORM FOR GENERAL BID.

- C. Bidder's Qualifications: The intent that the work of this Contract will be performed by a qualified contractor or General Contractor who has the required qualifications and experience to successfully perform the work and who has the required personnel, equipment, tools, and plant to successfully complete the work in accordance with the requirements of the Contract Documents.

- D. General Bidder and Sub-bidder Certifications:

1. General Bidder: DCAMM Certified 'Prime/General Certification'. General Bidders must include a current DCAMM Certificate of Eligibility and a signed DCAMM Update Statement.
2. Filed Sub-bidders: DCAMM Certified for '_____'. Filed Sub-bidders must include a current DCAMM Certificate of Eligibility and a signed DCAMM Sub-bidder's Update Statement.
3. Signed Bid Certification document must be included with each bid.

- E. CORI Background Checks: As a condition of this Contract any contractor working on the project site must be subject to a background check including federal and state criminal and sex offender (CORI) checks.

1. Upon award of contract, the Prime Contractor/General Contractor must have all employees and subcontractors who will work on this Project site fill out a CORI form. The Contractor will be responsible for performing the background checks. Completed form for each worker will then be sent to the Town Administrator's Office.

2. All background checks shall be conducted in accordance with applicable federal and state laws.
3. The Town of Boxford will have final authority over whether a worker is permitted to be on the job site job based on their CORI results.

1.04 REQUIRED FILED SUB-BIDS

- A. Filed Sub-bids are required for the following classifications of work:

<u>Class of Work</u>	<u>Specification Section No. and Title</u>
Waterproofing, Dampproofing, and Caulking	Section 07 00 01 – WATERPROOFING, DAMPPROOFING, AND CAULKING
Acoustical Tile	Section 09 00 03 – ACOUSTICAL TILE
Resilient Floors	Section 09 00 05 – RESILIENT FLOORS
Painting	Section 09 00 07 – PAINTING
Fire Protection	Section 21 00 00 – FIRE PROTECTION
Plumbing	Section 22 00 00 – PLUMBING
HVAC	Section 23 00 00 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)
Electrical Work	Section 26 00 00 – ELECTRICAL WORK

1.05 AVAILABILITY OF THE BIDDING AND CONTRACT DOCUMENTS

- A. Copies of the Bidding and Contract Documents including Plans, Project Manual including Specifications, and Bid Forms will be available on or after _____, _____, 2021 at the following locations/sources:
1. Bidders may download Electronic Bid Sets by logging in and entering Project Code **xxxxxx** in the Project Locator box and following the "Acquire Documents" link for a free downloadable Bid Set. Bidders may obtain one (1) full set of paper drawings and specifications from Projectdog for a refundable deposit of \$100.00 in the form of a certified check or money order payable to Projectdog. Shipping and Handling charges may apply. The full amount of the deposit will be refunded to all responsive bidders returning the Contract Documents in good condition within ten (10) days after the General Bid opening date. Otherwise, the deposit shall become the property of Projectdog, Inc.
 2. It is the sole responsibility of the contractor, subcontractor, vendor and/or any individual and/or corporation to review any and all ADDENDA forty-eight hours prior to the bid opening at www.projectdog.com, Project Code **xxxxxx** or at the Projectdog Plan Room, 18 Graf Road - Suite 8, Newburyport, Massachusetts 01950.

1.06 EXAMINATION LOCATIONS FOR BIDDING AND CONTRACT DOCUMENTS

- A. Documents may be examined during regular office hours (Monday through Friday between the hours of 9:00 AM to 4:00 PM at the following location (no distribution):

1. TOWN OF BOXFORD OFFICE OF THE TOWN ADMINISTRATOR
7A Spofford Road
Boxford, Massachusetts 01921
Telephone: 978-887-6000
- B. Bid Sets of Bidding and Contract Documents may also be viewed at Projectdog Plan Room
 1. Projectdog
18 Graf Road, Suite 8
Newburyport, Massachusetts 01950
Telephone: 978-499-9014
- 1.07 SALES TAX EXEMPTION
 - A. Materials, equipment and supplies to be used on this project are exempt from sales tax to the extent provided by M.G.L. Chapter 66H, Section 6(f).
- 1.08 BID SECURITY
 - A. Each Bid (General Bids and Sub-bids) must be accompanied by bid security in the amount of 5% of the Total Bid amount. Form of bid security shall either be Certified Check or a Treasurer's or Cashier's Check issued by a responsible bank or trust company, payable to the TOWN OF BOXFORD or a Bid Bond in (a) in a form satisfactory to the Awarding Authority, (b) with a surety company qualified to do business in the Commonwealth of Massachusetts, and (c) conditioned upon faithful performance by the principal of the agreements contained in the Bid. Return of bid security will be in accordance with applicable Massachusetts General Laws.
- 1.09 LIQUIDATED DAMAGES
 - A. Liquidated damages for not completing the work within the time limit specified above will be assessed by the Owner. Liquidated damages will be in the amount as stipulated in Document 00 51 00, AGREEMENT. The liquidated damages amount per calendar day is a minimum damage figure to compensate the Owner for administrative costs and loss or delay of its use of the project, and for added Owner's Project Manager, Architect and consultant fees, and does not limit in any way the liability of the Contractor for damages in excess of the specified liquidated damages amount for other damages, in particular, damages for breach of Contract. It is expressly understood that such liquidated damages do not constitute a penalty.
- 1.10 BONDS (PERFORMANCE BOND AND LABOR AND MATERIALS PAYMENT BOND)
 - A. The successful General Bidder will be required to furnish a Performance Bond and a Labor and Materials Payment Bond, each an amount equal to 100% of the total Contract Amount. The cost of such bonds shall be included in the bid price.
 - B. Bonds shall be with a surety company qualified to do business in the Commonwealth of Massachusetts and acceptable to the Awarding Authority.
- 1.11 PREVAILING WAGE RATES
 - A. Wages and contributions to be paid employees on the Project shall not be less than those established by a schedule issued by the Commissioner of the Department of Labor and Workforce Development of the Commonwealth of Massachusetts, in accordance with MGL c.149, §§ 26 to 27H inclusive, a copy of which is included in the Contract Documents and shall be made a part of the Contract.

- 1.12 REQUIREMENTS REGARDING COVID-19 AND OSHA APPROVED SAFETY AND HEALTH TRAINING
- A. COVID-19 Protocols: Guidelines and Procedures have been established in response to COVID-19 Coronavirus Pandemic. Refer to the requirements of the Contract Documents including provisions stated in Document 00 80 50, COVID-19 GUIDELINES AND PROCEDURES DURING CONSTRUCTION.
 - B. OSHA-Approved Safety and Health Training: All employees who work on Massachusetts public works construction sites must have no less than 10 hours of OSHA-approved safety and health training (per MGL Chapter 306 of the Acts of 2004).
- 1.13 MASSACHUSETTS GENERAL LAWS:
- A. Commonwealth of Massachusetts General Laws are incorporated herein by reference. Any inconsistency between the Invitation to Bid, Instructions to Bidders, Bid Form, Conditions of the Contract, and any other Bidding Documents and these statutes, or any other applicable statutes, bylaws, or regulations existing on the date on which the bids are to be received, shall not be grounds for invalidating the bid solicitation procedures, but, where required by law, such statute, bylaw, or regulation shall be deemed to govern. Reference is made also to the following:
 - 1. Document 00 31 00, FORM FOR GENERAL BID.
 - 2. Document 00 35 00, FORM FOR SUB-BID.
 - 3. Document 00 51 00, AGREEMENT.
 - 4. Document 00 70 00, GENERAL CONDITIONS.
 - 5. Document 00 80 00, SUPPLEMENTARY CONDITIONS.
 - 6. Document 00 80 10, EXCERPTS FROM MGL CHAPTERS 30, 82, AND 149.
- 1.14 AWARD OF CONTRACT AND AWARDED AUTHORITY PROVISIONS
- A. Selection of the Contractor will be based upon bidder qualifications, including evidence of past performance in similar projects, and bid price. The Contract will be awarded to the bidder deemed by the Awarding Authority to be the lowest responsible and eligible bidder in accordance with Massachusetts General Laws.
 - B. The TOWN OF BOXFORD is an affirmative action/equal opportunity owner and encourages participation from certified minority and women-owned businesses.
 - C. The Awarding Authority reserves the right to waive any informalities in or to reject any or all bids or take whatever other action may be deemed to be in the best interest of the TOWN OF BOXFORD to do so, and to act upon the bids and make its award in any lawful manner.
 - D. This Project is subject to funding by the TOWN OF BOXFORD.
- 1.15 BIDDER'S AGREEMENT TO HOLD BID
- A. The bidder agrees that its bid shall be good and may not be withdrawn for a period of thirty (60) days, Saturdays, Sundays and legal holidays excluded, after the opening of the bids.

TOWN OF BOXFORD MASSACHUSETTS
acting through and by its **BOARD OF SELECTMEN**

END OF DOCUMENT

Projectdog, Inc

Supplemental Instructions to Bidders for Electronic Bid Projects (E-Bid)

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Sign Up

Every user of Projectdog.com has a unique username and password for their account. **MANDATORY: All users must keep usernames and passwords PRIVATE and SECURE. Do not share accounts.**

1. Go to www.Projectdog.com.
2. Select the “Sign Up” (Fig 1).
3. Complete all required form fields and press Submit.
An automatic email will be sent to the registered email.
4. Select the confirmation link in the email to complete the registration.

Login

1. Go to www.Projectdog.com.
2. Enter a registered email address and password (Fig 1).
3. Press Login.

Logoff

1. Hover over Home (Fig 2).
2. Select “Logoff”.

Forgotten Password


1. Select “Forgot your password?” (Fig 3).
2. Enter the e-mail address.
3. Select “Send Info”. An automated e-mail will be sent with the password.

Account Information

View and edit user contact information. To change an email address, users must register a new account. Call Projectdog to have the old account removed.

1. Hover over Home (Fig 4).
2. Click “My Information”.
3. Edit information as needed.
4. Click “Save” to finalize edits.

Fig 1



Email:

Password:

[Sign Up](#) [Forgot your password?](#) [Login](#)

Customer Support 978-499-9014

Fig 2

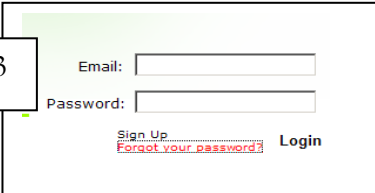


Projectdog

[Home](#) [Project Central](#) [Company](#)

My Information
[Logout](#)

Fig 3

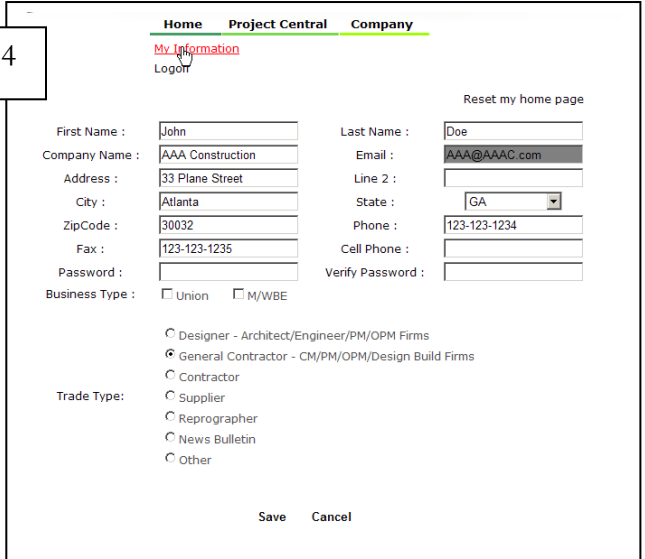


Email:

Password:

[Sign Up](#) [Forgot your password?](#) [Login](#)

Fig 4



[Home](#) [Project Central](#) [Company](#)

[My Information](#)
Logout

Reset my home page

First Name : Last Name :

Company Name : Email :

Address : Line 2 :

City : State :

ZipCode : Phone :

Fax : Cell Phone :

Password : Verify Password :

Business Type : Union M/WBE

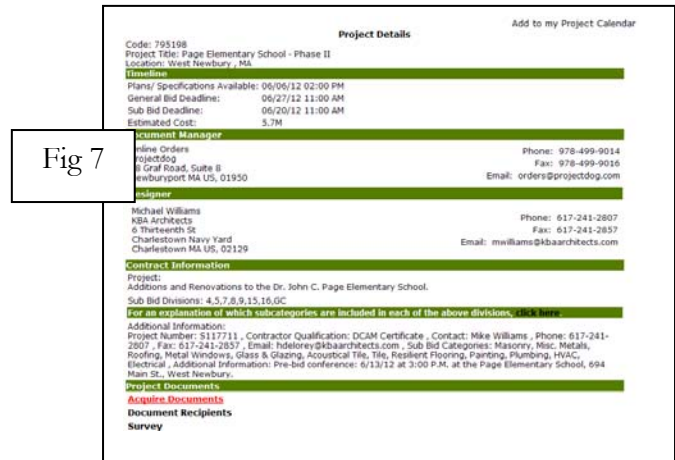
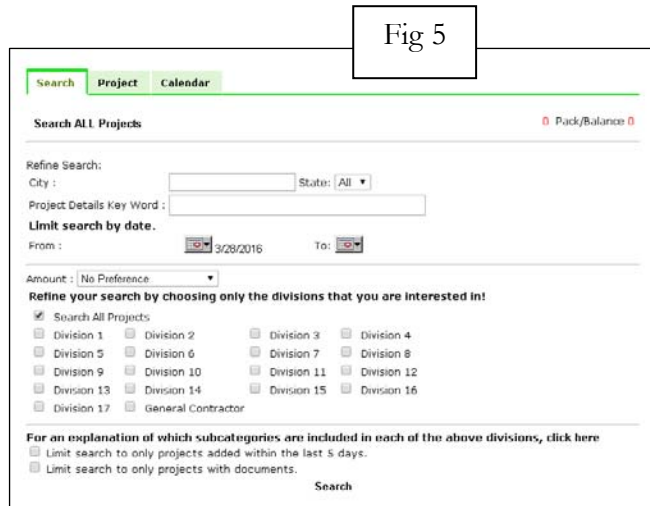
Trade Type:

- Designer - Architect/Engineer/PM/OPM Firms
- General Contractor - CM/PM/OPM/Design Build Firms
- Contractor
- Supplier
- Reprographer
- News Bulletin
- Other

Save Cancel

Project Details

Utilize the search page (Fig 5) or enter a Project Code (Fig 6) to view a project's "Project Details" page (Fig 7).

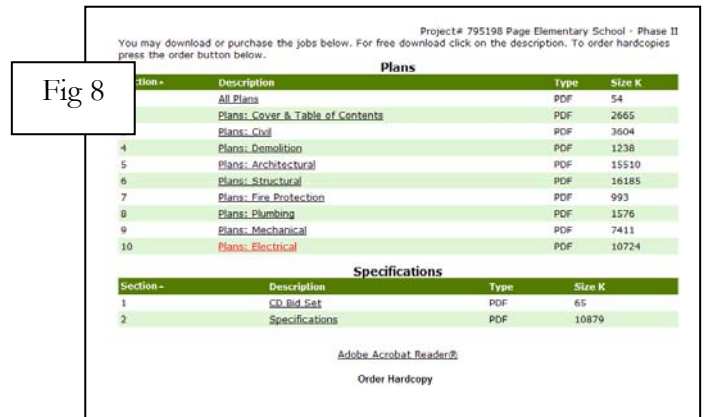


Acquire Documents

Download all project documents.

1. Click "Acquire Documents" link found on a project's "Project Details" page (Fig 7).
2. Respond to the Legal Notice after reviewing.
3. Click on any file description to open, review, or save a document (Fig 8).

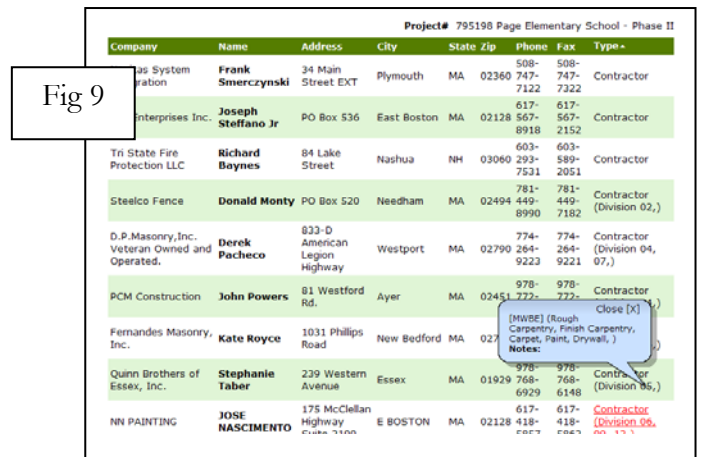
Users are automatically added to the project's "Document Recipients" list to receive update notifications upon viewing any document online.



Document Recipients

Review all plan holders who have acquired documents.

1. Click "Document Recipients" link found on a project's "Project Details" page (Fig 7).
2. All potential bidders are listed and sorted by company type (Fig 9). Click on a column title to sort alphabetically.



Electronic Bid (E-Bid)

This project is being **Electronically Bid** at www.Projectdog.com. Hard copy bids will not be accepted by the Awarding Authority. Go to www.Projectdog.com and Login with an existing account or click [Sign Up](#) to register for free. Enter a project code or search by keyword to access the “Project Details” page. Select “Acquire Documents” to download all bidding documents.

Projectdog

Home Project Central Company

Project Details

Code: 799090
Project Title: Ebid
Location: Newburyport, MA

Timeline
Plans/ Specifications Available: 05/22/13 10:00 AM
General Bid Deadline: 06/21/13 04:00 PM
Sub Bid Deadline: 06/19/13 04:00 PM
Estimated Cost: Negotiated

Project Owner
Sales Department
Projectdog
18 Graf Road
Suite 8
Newburyport MA US, 01950
Phone: 978-499-9014
Fax: 978-499-9014
Email: sales@projectdog.com

Document Manager
Online Orders
Projectdog
18 Graf Road, Suite 8
Newburyport MA US, 01950
Phone: 978-499-9014
Fax: 978-499-9016
Email: orders@projectdog.com

Contract Information
Project:
Ebid Test Demo for Sales Department.
Additional Information:
THIS PROJECT IS BEING ELECTRONICALLY BID AND HARD COPY BIDS WILL NOT BE ACCEPTED. The bids are to be prepared and submitted at www.Projectdog.com. Tutorials and instructions on how to complete the electronic bid documents are available online along with all project documentation.

Project Documents
Acquire Documents
Document Recipients
GC E-Bid
Sub E-Bid

How to Submit an E-Bid

Complete and save all required forms as PDF files. Please be sure to sign all required signatures either digitally or manually.

1. Select the **GC E-Bid** or **Sub E-Bid** link located on the “Project Details” page.

Subcontractors select a bidding trade;

General Contractors will not be able to submit an E-Bid until the official sub bid tabulation is released by the Awarding Authority.

2. Answer / enter / upload all required areas. Enter all dollar value amounts as a whole dollar values only.

3. Select “Submit My E-Bid.” Review the submitted bid package via the “View My Bid Package” link.

Bidding Trades
Please select trade(s) you are bidding.

Section#	Description	Status	Bidding
220000	Plumbing	Incomplete	GO
230000	HVAC	Incomplete	GO
260000	Electrical	Incomplete	GO

It's that simple!

You will not be able to Submit your bid unless all mandatory fields are complete. Please allow yourself sufficient time to upload all information. You will receive an automated email once completed. Please save this for your records.
DHCD 016128 Roof Replacement & Vinyl Siding, Project #811541

Acknowledge Addendum 0, Yes No

Bid Price (Whole Dollar)

Form for General Bid (Signature page) Add File -

Bid Bond Add File -

Bidders Reference Form Add File -

Item 2 Sub-bids as follows:
There are no Sub bids for this project.

Bid Closes in:
0 Days 2 Hours 20 Minutes 20 Seconds.

Save [Submit my E-Bid](#) Close

You will not be able to Submit your bid unless all mandatory fields are complete. Please allow yourself sufficient time to upload all information. You will receive an automated email once completed. Please save this for your records.
DHCD 016128 Roof Replacement & Vinyl Siding, Project #811541

Acknowledge Addendum 0,1, Yes No 4/6/2016

Bid Price (Whole Dollar) twenty-five thousand Dollars.

Form for General Bid (Signature page) View File

Bid Bond View File

Bidders Reference Form View File

Item 2 Sub-bids as follows:
There are no Sub bids for this project.

Bid Closes in:
0 Days 2 Hours 11 Minutes 20 Seconds.

Retract [View My Bid Package](#) Close

Add File

Click “Add File” on the E-Bid page to open the Upload Assistant window. Then click “Browse” or “Choose File” to upload a PDF file.

Warning

E-Bids cannot be submitted unless all areas are complete.

Save before adding files or closing the window or E-Bid data may need to be re-entered.

Projectdog.com server time is set to industry standards at time-a.nist.gov. Bidders are encouraged to update their computer clock.

Bidders may save, submit or modify an Electronic Bid (E-Bid) at any time prior to bid close. Once submitted, a bid cannot be edited. To modify a bid the bidder must retract the bid, make any necessary changes, and then submit the bid again. Upon submitting or retracting the bidder will receive a convenience email for informational purposes only. Bidders are encouraged to contact Projectdog if an email is not received.

It is the bidder’s responsibility to review and confirm online that a bid has been submitted and/or retracted and that the bid is 100% true, complete and accurate. All bidders are required to review their submitted E-Bid via the “[View My Bid Package](#)” link.

If a bid is submitted prior to an addendum being issued the bidder will receive an automated email for informational purposes only stating the bidder must review the addendum, retract the bid, acknowledge all addenda, and submit the bid again. If a bidder fails to acknowledge addenda their bid may be rejected by the Awarding Authority.

Once the bid deadline has closed the E-Bid links are no longer available. All E-Bids are compiled in real time upon bid close and published forthwith on the “Project Details” page titled as “List of Bids Received”. Official bid tabulations are posted at the discretion of the Awarding Authority.

For additional assistance, call Projectdog at (978) 499-9014 (M-F, 9AM-5PM).

DOCUMENT 00 1000

INSTRUCTIONS TO BIDDERS

1.00 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

2.00 RECEIPT AND OPENING OF BIDS

- A. The **TOWN OF BOXFORD MASSACHUSETTS**, hereinafter called the Owner or Awarding Authority, acting through its **BOARD OF SELECTMEN**, will receive sealed Bids in accordance with the requirements of Document 00 0200, INVITATION TO BID.
- B. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified will not be considered. The bidder agrees that this bid shall be good and may not be withdrawn for a period of 30 days, Saturdays, Sundays, and legal holidays excluded, after the opening of bids.
- C. Electronically Bid (E-Bid): This project is being Electronically Bid (E-Bid). All bids shall be submitted online at www.Projectdog.com. Hard copy bids will not be accepted by the Awarding Authority. E-Bid tutorials and instructions are available within the specifications and online at www.Projectdog.com. For assistance, call Projectdog, Inc at (978) 499-9014, M-F 8:30 AM-5:00 PM.
- All required bid forms must be submitted in **PDF** format only. The bidder must complete all required signatures either digitally (using Adobe Acrobat) or manually (print, sign and scan as a PDF file).
 - Bid Bonds issued by a surety company shall be submitted on the E-Bid page. Bid bonds in the form of cash or check shall be completed and delivered as outlined on the Bid Bond Affidavit form.
 - The bidder must enter bid price on the E-Bid form as a whole dollar value only with no punctuation. Sums shall be expressed in both words and figures on the bid form. Note: The E-Bid form will automatically match the word value to the numeric figure entered by the bidder.
 - Bidders may save, submit or modify an E-Bid at any time prior to bid close. Once submitted, a bid cannot be edited. To modify a bid the bidder must retract the bid, make any necessary changes, and then submit the bid again. Upon submitting or retracting the bidder will receive a convenience email for informational purposes only. Bidders are encouraged to contact Projectdog, Inc at (978) 499-9014, M-F 8:30 AM-5:00 PM, if an email is not received.
 - If a bid is submitted prior to an Addendum being issued, the bidder will receive an automated email for informational purposes only. The bidder must review the addendum, retract the bid, acknowledge all addenda, and submit the bid again. If a bidder fails to acknowledge addenda their bid may be rejected by the Awarding Authority.

- Timely submission of an E-Bid shall be the full responsibility of the Bidder. The server clock is the time of record. It is the bidder's responsibility to review and confirm online that a bid has been submitted and/or retracted and that the bid is 100% true, complete and accurate. All bidders are required to review their submitted E-Bid via the "**View My Bid Package**" link.

1. Refer to Projectdog, Inc. 'Supplemental Instructions to Bidders for Electronic Bid Projects (E-Bid)' (5 pages total); a copy of which immediately follows this Document in this Project Manual.
2. Refer to Projectdog, Inc. 'Bid Bond Affidavit' (one page total); a copy of which immediately follows Document 00 31 70, BID SECURITY FORM in this Project Manual.

3.00 COMPLEMENTARY DOCUMENT

- A. Document 00 02 00, INVITATION TO BID, included herewith, is complementary to this document and shall be carefully reviewed by Proposers for specific instructions which are not repeated herein.

4.00 STATUTES REGULATING COMPETITIVE PROPOSAL SOLICITATION

- A. Proposal solicitation procedures and award of contract shall be in accordance with the General Laws of the Commonwealth of Massachusetts, including all current amendments.
- B. In the event of any discrepancy or inconsistency between the provisions of these Document 00 10 00, INSTRUCTIONS TO BIDDERS and Document 00 02 00, INVITATION TO BID and the above-mentioned statutes, the provisions of the above-mentioned statutes shall govern. In such event, the application of all remaining provisions not in conflict to any circumstance other than that in which the conflict occurs shall not be affected thereby.

5.00 BIDDER'S QUALIFICATIONS

- A. No individual or firm may submit a Proposal unless it includes, in the Bid Form, a list of at least three (3) references of similar projects completed in the last five (5) years.
- B. The Awarding Authority will reject bids when required to do so by the above- referenced General Laws. In addition, the Awarding Authority reserves the right to waive any informalities in proposal solicitation and to reject any and all bids if it deems to be in the public interest to do so. Also, the Awarding Authority reserves the right to reject any bid if it determines that such bid does not represent the bid of a person or firm competent to perform the work as specified, or if less than three bids are received, or if proposed prices are not acceptable without further competition.

6.00 INTERPRETATION OF DOCUMENTS: NOTIFICATION OF ERRORS

- A. Interpretation of the provisions of the Bidding Documents will be made by the Architect, **GORMAN RICHARDSON LEWIS ARCHITECTS (GRLA)**, attention: **George O'Neil, Project Manager**, Goneill@grlarchitects.com. upon written request of any Bidder, provided that such request is received by the Architect at least five (5) business days prior to date of applicable proposal opening, and that the Architect considers such interpretation to be of sufficient importance. Oral or telephone interpretations will not generally be made, and if made, shall be strictly informal and not legally valid or binding.
- B. Architect's interpretations shall be in the form of Addenda to the Bidding Documents.

- C. Proposers are urged to communicate all errors or discrepancies found in the Bidding Documents to the Architect. Telephone calls pointing out any such errors or discrepancies will be taken by the Architect, but only for the purpose of receiving the information in order that it may be properly processed, and not for interpretation or clarification.

7.00 EXAMINATION OF BIDDING DOCUMENTS AND SITE

- A. Each Proposer shall carefully examine the Bidding Documents to obtain a thorough understanding of the work of his bid in addition to work of related trades. In addition, each bidder shall personally visit the site to become thoroughly acquainted with the conditions as they exist thereon.
- B. Failure of any Proposer to thoroughly examine the Bidding Documents or to visit and examine the site shall in no way relieve the bidder of any obligation with respect to his bid or of any responsibility assigned the Bidder under the Contract.

8.00 PRE-BID SITE VISIT

- A. A mandatory pre-bid site visit will be held at location and time stipulated in the Document 00 02 00, INVITATION TO BID.

9.00 MODIFICATION AND WITHDRAWAL OF BIDS

- A. Modifications of bids will be permitted after submission of such bids provided clearly written, readily understandable instructions for same are received by the Awarding Authority in writing prior to time established for opening of such bids.
- B. No bid may be withdrawn for a period of 30 days, excluding Saturdays, Sundays, and legal holidays, after actual date of the bid opening.

10.00 ADDENDA

- A. Addenda may be required during the proposal solicitation period to modify, clarify, or interpret the Bidding Documents. It is intended, but not guaranteed, that such Addenda shall be issued per Document 00 02 00, INVITATION TO BID and this Document 00 10 00, INSTRUCTIONS TO BIDDERS. Failure to receive such Addenda shall in no way relieve any bidder from the execution of its provisions. All bidders are cautioned to verify the number of Addenda that have been issued and to secure any needed addenda before submitting a bid.

11.00 UNIT PRICES

- A. (Not Applicable)

12.00 ALTERNATES

- A. Refer to Section 01 23 00, ALTERNATES.

13.00 BONDS

- A. A performance bond in an amount equal to 100 percent of the total amount of the bid and meeting requirements of MGL will be required for the faithful performance of the Contract.
- B. A payment bond (labor and materials payment bond) in an amount equal to 100 percent of the total amount of the bid and meeting requirements of MGL will be required.

- C. The cost of each bond shall be included in the bid price.
- D. Bonds shall be with a surety company qualified to do business in the Commonwealth of Massachusetts and be acceptable to the Awarding Authority.
 - 1. Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the Commonwealth of Massachusetts.

14.00 FOREIGN CORPORATIONS

- A. The attention of Proposers is called to the General Laws, Chapter 30, Section 39L, as amended by The Acts of 1967, Chapter 3, under which the Awarding Authority may not enter into a contract with a foreign corporation (a corporation not organized under the Laws of Massachusetts), nor approve a foreign corporation as a contractor, unless the foreign corporation has filed with the Awarding Authority a certificate by the State Secretary stating that the foreign corporation has complied with General Laws, Chapter 181, Sections 3 and 5, and stating the date of such compliance.

15.00 AWARD OF CONTRACT

- A. The Contract will be awarded to the lowest responsible, competent and eligible Proposer except in the event of substitution as provided under Chapter 149, Sections 44E and 44F of the above-referenced General Laws.

16.00 COMMENCEMENT AND COMPLETION OF WORK

- A. The successful Proposer, upon execution of the Contract Agreement, which may constitute as the Notice to Proceed unless specifically indicated by Awarding Authority otherwise, shall commence the work of the Contract within seven (7) calendar days. Thereafter the Contractor shall diligently and continuously carry on the work in such manner as to substantially complete the work of on or before the date as stipulated in Document 00 51 00, AGREEMENT.
- B. Duration of Project: The duration of this Project to Substantial Completion shall be **days** from date of Notice to Proceed or date of Contract Agreement.

17.00 LIQUIDATED DAMAGES

- A. Liquidated damages for not completing the work within the time limit specified above will be assessed by the Owner. Liquidated damages will be in the amount as stipulated Document 00 51 00, AGREEMENT.
 - 1. The liquidated damages amount per calendar day is a minimum damage figure to compensate the Owner for administrative costs and loss or delay of its use of the project, and for added Owner's Project Manager, Architect and consultant fees, and does not limit in any way the liability of the Contractor for damages in excess of the specified liquidated damages amount for other damages, in particular, damages for breach of Contract. It is expressly understood that such liquidated damages do not constitute a penalty.
 - 2. Liquidated damages for this Project will be **five hundred dollars (\$500.)** per calendar day.

18.00 PROPRIETARY MATERIALS

- A. Attention is directed to the provisions of MGL Chapter 30, Section 39M, which require full competition on each item of material to be furnished under contracts for public work, except those items recorded in the public record of the Awarding Authority (Town of Dracut Permanent Building Committee), deemed to be in the public interest.

19.00 FORMS/DOCUMENTS TO BE SUBMITTED WITH BIDS

- A. General Bids: All General Bids shall be submitted using Document 00 31 00, FORM FOR GENERAL BID. The following Documents shall be submitted with this BID FORM:
1. Bid Bond / Bid Security: 5% bid bond; refer to Document 00 31 70, BID SECURITY FORM.
 2. DCAMM Prime / General Contractor Update Statement for Certification; refer to Document 00 31 20, DCAMM PRIME / GENERAL CONTRACTOR UPDATE STATEMENT.
 3. Non-Collusion Affidavit; refer to Document 00 31 50, FORM OF NON-COLLUSIVE AFFIDAVIT OF GENERAL BIDDER.
 4. Tax Compliant Certificate; refer to Document 00 31 60, CERTIFICATE OF TAX COMPLIANCE.
- B. Filed Sub-bids: All Filed Sub-bids shall be submitted using Document 00 35 00, FORM OF SUB-BID: The following Documents shall be submitted with this SUB-BID FORM:
1. DCAMM Sub-bidder Update Statement for Certification; refer to Document 00 35 20, DCAMM SUB-BIDDER UPDATE STATEMENT.
 2. Non-Collusion Affidavit; refer to Document 00 35 50, FORM OF NON-COLLUSIVE AFFIDAVIT OF SUBCONTRACTOR.

20.00 THE TOWN OF BOXFORD BY-LAWS AND ZONING BY-LAWS

- A. The Town of Boxford By-Laws and Zoning By-Laws are included by reference as part of the Contract Documents. Contractor shall abide by all applicable by-laws.

END OF DOCUMENT

DOCUMENT 00 23 10

EXISTING CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 INFORMATION NOT GUARANTEED

- A. Information on the Drawings and in the Project Manual relating to existing conditions of building and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

1.03 EXISTING CONDITIONS

- A. Coordinate and comply with requirements regarding use of the site, buildings, access, dumpster locations, utilities, and related facilities, as agreed to between the Owner and the Contractor.
- B. Information on existing conditions, such as existing building(s) dimensions, existing building(s) construction and similar information, which is bound with the Contract Documents or otherwise made available to the Contractor was obtained by the Owner for use by the Architect in the design of the Project.
 - 1. Accuracy and Completeness: The Owner and Architect do not warrant or contend that this information is complete or accurate. The Contractor may use this information at his sole risk and judgment.
 - 2. Concealed Conditions: No claim for extra cost or extension of time may be made because of the use of this information by the Contractor, except as provided in the Conditions of the Contract regarding *Concealed Conditions*. The Contractor may obtain additional information on existing conditions at his sole expense, if prior approval is obtained from the Owner.
- C. Contractor's Responsibilities:
 - 1. The Contractor shall become thoroughly familiar with the existing information and shall carefully examine the existing record information prior to construction including attachment, cutting, and drilling to avoid accidental damage to existing conditions including utilities and to avoid cutting structure not specifically indicated to be cut.
 - 2. The Contractor shall examine existing building and structure to verify existing conditions including building and elevations, dimensions, and locations and conditions affecting proposed renovations and improvements.
- D. Asbestos and Other Hazardous Materials Abatement: It is not anticipated that the existing building structure, piping, finishes, equipment, and building areas may contain asbestos-containing materials (ACM) or other hazardous materials. If asbestos or other hazardous material is found on the site and recognized as such, all work will cease without penalty to the Contractor or Architect so that the Owner can take appropriate steps for its legal removal and disposal.

GRLA 2020120.01

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF DOCUMENT

DOCUMENT 00 23 30

GEOTECHNICAL DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 GEOTECHNICAL DATA

- A. Information Not Guaranteed: Information on the Drawings and in the Project Manual relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.
- B. Geotechnical Report: The following geotechnical report was prepared by the Geotechnical Consultant, for use by Architect in the design of the Project.
 - 1. " _____ ", dated _____ , 2020.
 - 2. A copy of this report is included in this Project Manual as Appendix A – GEOTECHNICAL REPORT.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF DOCUMENT

DOCUMENT 00 30 00

BIDDER'S CHECKLIST

This checklist is provided to assist Bidders (General Bidders and File Sub-bidders) in determining what documents are required to be submitted with each bid.

GENERAL BIDS: EACH GENERAL BID SHALL BE ACCOMPANIED BY:

1. Form For General Bid: Refer to Document 00 31 00, FORM FOR GENERAL BID.
2. DCAMM Certificate of Eligibility and a signed DCAMM Prime/General Contractor Update Statement: Refer to Document 00 31 20, DCAMM PRIME/GENERAL CONTRACTOR UPDATE STATEMENT.
3. Certificate as to Corporate Bidder: Refer to Document 00 31 40, CERTIFICATE AS TO CORPORATE BIDDER.
4. Non-Collusive Affidavit of General Bidder: Refer to Document 00 31 50, FORM OF NON-COLLUSIVE AFFIDAVIT OF GENERAL BIDDER.
5. Certificate of Tax Compliance: Refer to Document 00 31 60, CERTIFICATE OF COMPLIANCE WITH TAX LAWS.
6. Bid Bond: Refer to Document 00 31 70, BID SECURITY FORM.
7. Bid Bond Affidavit: Refer to Projectdog, Inc. 'BID BOND AFFIDAVIT' (immediately following Document 00 31 70).

FILE SUB-BIDS: EACH FILE SUB-BID SHALL BE ACCOMPANIED BY:

1. Form of Sub-bid: Refer to Document 00 35 00, FORM FOR SUB-BID
2. DCAMM Certificate of Eligibility and a signed DCAMM Sub-bidder Update Statement: Refer to Document 00 35 20 DCAMM SUB-BIDDER UPDATE STATEMENT.
3. Non-Collusive Affidavit of Subcontractor: Refer to Document 00 35 50, FORM OF NON-COLLUSIVE AFFIDAVIT OF SUBCONTRACTOR

END OF CHECKLIST

DOCUMENT 00 31 00

FORM FOR GENERAL BID

TO: The **TOWN OF BOXFORD, MASSACHUSETTS** acting by and through its **BOARD OF SELECTMEN** (hereinafter called "Awarding Authority" or "Owner")

A. The Undersigned (hereinafter referred as "Bidder"), proposes to furnish all labor and materials required for construction of:

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

in accordance with the accompanying Bidding and Contract Documents (Plans and Specifications) prepared by the Architect, **GORMAN RICHARDSON LEWIS ARCHITECTS, INC.**, for the Base Bid Contract Price specified below, subject to additions and deductions according to the terms of the Specifications.

B. ADDENDA: This Bid includes Addenda numbered _____

C. BASE BID CONTRACT PRICE: The proposed Base Bid Contract Price is _____

Dollars (\$ _____).

For Alternate No. ___ Add \$ _____ Subtract \$ _____

For Alternate No. ___ Add \$ _____ Subtract \$ _____

For Alternate No. ___ Add \$ _____ Subtract \$ _____

D. SUBDIVISION OF CONTRACT PRICE: The subdivision of the proposed Contract Price is as follows:

Item 1. The work of the General Contractor, being all work other than that covered by Item 2:

_____ .

Item 2. Sub-bids as follows:

<u>Sub Trade /</u>			Bonds required
<u>Section No.</u>	<u>Name of Sub-bidder</u>	<u>Amount</u>	indicated by
			<u>'Yes' or 'No'</u>
Waterproofing, Dampproofing, and Caulking	_____	\$ _____	_____
Section 07 00 01 - WATERPROOFING, DAMPPROOFING, AND CAULKING			

<u>Sub Trade /</u> <u>Section No.</u>	<u>Name of Sub-bidder</u>	<u>Amount</u>	<u>Bonds required</u> <u>indicated by</u> <u>'Yes' or 'No'</u>
Acoustical Tile Section 09 00 03 - ACOUSTICAL TILE	_____	\$ _____	_____
Resilient Floors Section 09 00 05 - RESILIENT FLOORS	_____	\$ _____	_____
Painting Section 09 00 07 - PAINTING	_____	\$ _____	_____
Fire Protection Section 21 00 00 - FIRE PROTECTION	_____	\$ _____	_____
Plumbing Section 22 00 00 - PLUMBING	_____	\$ _____	_____
HVAC Section 23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	_____	\$ _____	_____
Electrical Work Section 26 00 00 - ELECTRICAL WORK	_____	\$ _____	_____

E. SCHEDULE OF UNIT PRICES: Should certain additional work be required, or should the quantities of certain classes of work be increased or decreased from those required by the Contract Documents, by authorization of the Owner, the unit prices included in Section 01 02 20, UNIT PRICES shall, at the option of the Owner, be the basis of payment to the Contractor or credit to the Owner, for such increase or decrease in the work. The Unit Prices shall represent the exact net amount per unit to be paid the Contractor (in the case of additions or increases) or to be refunded the Owner (in the case of decreases). No additional adjustment will be allowed for overhead, profit, insurance, or other direct or indirect expenses of the Contractor or Subcontractors.

NO.	DESCRIPTION OF WORK	UNIT	BASE BID QUANTITY	ADD/DEDUCT PRICE (Insert only one number)
1.				\$ _____
2.				\$ _____
3.				\$ _____

NO.	DESCRIPTION OF WORK	UNIT	BASE BID QUANTITY	ADD/DEDUCT PRICE (Insert only one number)
4.				\$ _____

F. AWARD OF CONTRACT/NOTICE TO PROCEED; COMMENCEMENT OF WORK; DATES FOR SUBSTANTIAL COMPLETION AND FINAL COMPLETION

1. Award of Contract/Notice to Proceed: The Bidder hereby agrees to commence work under this Contract on or before a date to be specified in written "Notice to Proceed" issued by the Owner, and to thereafter diligently and continuously carry on the Work. It is anticipated that the Award of Contract and Notice to Proceed will be by
 - a. _____ , _____ , 2021.
2. Commencement of Work: The Bidder hereby agrees to commence work under this Contract on or after
 - a. _____ , _____ , 2021.
3. Substantial Completion Date: The undersigned agrees to substantially complete the Work on or before
 - a. _____ , _____ , 2022.
4. Final Completion Date: The undersigned agrees to a final completion of the Contract Work on or before on or before
 - a. _____ , _____ , 2022.

G. LIQUIDATED DAMAGES: Liquidated damages for not completing the work within the time limit specified above will be assessed by the Owner. Liquidated damages will be in the amount as stipulated Document 00 51 00, AGREEMENT.

1. The liquidated damages amount per calendar day is a minimum damage figure to compensate the Owner for administrative costs and loss or delay of its use of the project, and for added Owner’s Project Manager, Architect, and consultant fees, and does not limit in any way the liability of the Contractor for damages in excess of the specified liquidated damages amount for other damages, in particular, damages for breach of Contract. It is expressly understood that such liquidated damages do not constitute a penalty.
2. Liquidated damages for this Project will be **five hundred dollars (\$500.00)** per calendar day.

H. EXECUTION OF CONTRACT AND BONDS: The undersigned agrees that, if selected as General Contractor, he will within five (5) days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the Awarding Authority, execute a Contract in accordance with the terms of this Bid and furnish a 100% Performance Bond and a 100% Labor and Materials Payment Bond, of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the Awarding Authority and each in the sum of the Contract Price, the premiums for which are to be paid by the General Contractor and are included in the Contract Price.

I. The undersigned offers the following information as evidence of his qualifications to perform the work as proposed upon according to all the requirements of the Contract Documents:

1. Have been in business under present business name for _____ years.

2. Ever failed to complete any work awarded? _____ .

3. List three (3) separate Owner references for projects completed in the past five (5) years on which you served as contractor for work of similar character as required for this project:

<u>Project</u>	<u>Owner</u>	<u>Ref. Name</u>	<u>Telephone No.</u>	<u>Amount of Contract</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

4. Bank Reference: _____ .

J. The undersigned hereby certifies, under the pains and penalties of perjury, that he has carefully examined the Contract Documents, established a thorough understanding of the existing conditions, and has obtained sufficient information for executing the work of his Proposal and the work of all related trades.

K. The undersigned agrees that, if selected as Contractor, he will within five (5) days, Saturdays, Sundays, and legal holidays excluded, after presentation thereof by the Awarding Authority, execute the Contract in accordance with the terms of this Bid.

L. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards made subject to MGL Section 44A.

M. The undersigned further certifies that all employees to be employed at the work site have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least ten (10) hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that he will comply fully with all laws and regulations applicable to award of contracts subject to MGL Section 44F.

N. The undersigned bidder hereby certifies, under the pains and penalties of perjury, that the foregoing bid is based upon the payment to laborers to be employed on the project of wages in an amount no less than the applicable prevailing wage rates established for the project by the Massachusetts Department of Labor and Workforce Development, Division of Occupational Safety. The undersigned bidder agrees to indemnify the Awarding Authority for, from and against any loss, expense, damages, actions or claims, including any expense incurred in connection with any delay or stoppage of the project work, arising out of or as a result of (1) the failure of the said bid to be based upon the payment of the said applicable prevailing wage rates or (2) the failure of the bidder, if selected as the contractor, to pay laborers employed on the project the said applicable prevailing wage rates.

- O. The undersigned further certifies that he has reviewed the requirements of the Contract Documents regarding site safety and will as part of the requirements of this Contract after award of Contract submit to Owner and Architect an acceptable OSHA-approved Health and Safety Plan for this Contract.
- P. The undersigned further certifies that he will comply with affirmative action/equal opportunity provisions of this Contract.
- Q. The undersigned further certifies under the penalties of perjury that this Proposal is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.
- R. Pursuant to M.G.L. CH. 62C, Sec 49A, I certify under the penalties of perjury that I have filed all state tax returns and paid all State Taxes required under law.

Date: _____

By: _____
(Signature)

(SEAL - if bid is by a corporation)

(Name of Bidder)

(Title)

(Business Address)

(City and State)

(Telephone No. and Fax No.)

END OF DOCUMENT

DOCUMENT 00 31 05

FORM FOR GENERAL BID (SAMPLE)

The FORM FOR GENERAL BID (Sample) (two pages total) immediately follows this Document.
[Hard Copy forms will not be accepted; refer to Electronic Bid Instructions for Submission of Bid.]

END OF DOCUMENT

FORM FOR GENERAL BID

TO THE AWARDING AUTHORITY

A. The undersigned proposes to furnish all labor and materials required for _____ for the
PROJECT
in _____, Massachusetts,
in accordance with the accompanying plans and
specifications prepared by _____

Name of Engineer/Architect

For the contract price specified below, subject to additions and deductions according to the terms of the specifications.

B. This bid includes addenda numbered: _____

C. The proposed contract price is:

Dollars \$ _____

Bid Amount in Words	Bid Amount in Numbers
---------------------	-----------------------

For Alternate	No. _____	Add \$ _____	Subtract \$ _____
	No. _____	\$ _____	\$ _____
	No. _____	\$ _____	\$ _____
	No. _____	\$ _____	\$ _____
	No. _____	\$ _____	\$ _____

Each Alternate shall be listed separately

D. The subdivision of the proposed contract price is as follows:

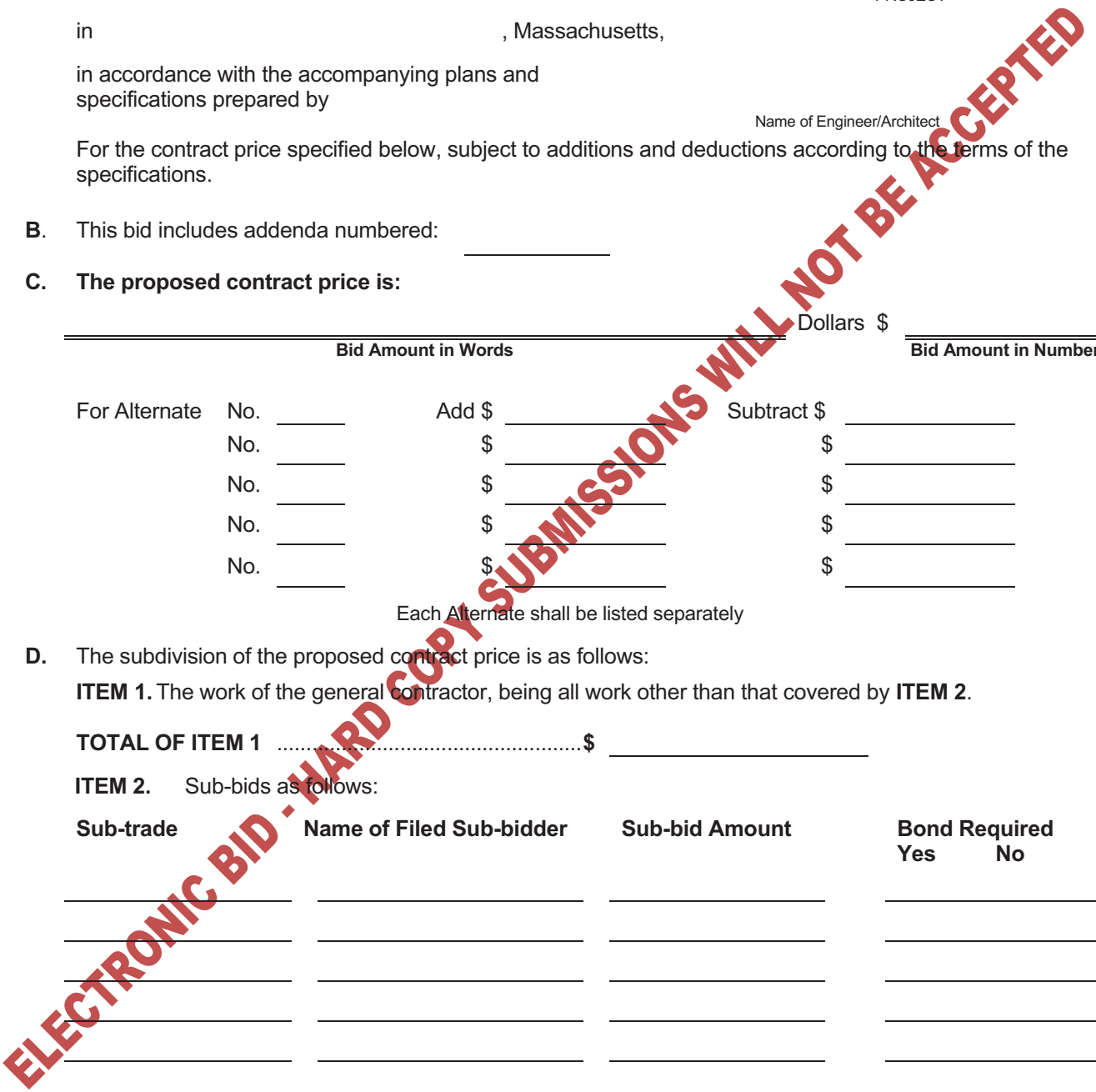
ITEM 1. The work of the general contractor, being all work other than that covered by **ITEM 2.**

TOTAL OF ITEM 1\$ _____

ITEM 2. Sub-bids as follows:

Sub-trade	Name of Filed Sub-bidder	Sub-bid Amount	Bond Required	
			Yes	No
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

TOTAL OF ITEM 2\$ _____



The undersigned agrees that each of the above named sub-bidders will be used for the work indicated at the amount stated, unless a substitution is made. The undersigned further agrees to pay the premiums for the performance and payment bonds furnished by sub-bidders as requested herein and that all of the cost of all such premiums is included in the amount set forth in Item I of this bid.

The undersigned agrees that if selected as general contractor, he will promptly confer with the awarding authority on the question of sub-bidders; and that the awarding authority may substitute for any sub-bid listed above a sub-bid filed with the awarding authority by another sub-bidder for the sub-trade against whose standing and ability the undersigned makes no objection; and that the undersigned will use all such finally selected sub-bidders at the amounts named in their respective sub-bids and be in every way as responsible for them and their work as if they had been originally named in this general bid, the total contract price being adjusted to conform thereto.

- E. The undersigned agrees that, if he is selected as general contractor, he will within five days, Saturdays, Sundays, and legal holidays excluded, after presentation thereof by the awarding authority, execute a contract in accordance with the terms of this bid and furnish a performance bond and also a labor and materials or payment bond, each of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority and each in the sum of the contract price, the premiums for which are to be paid by the general contractor and are included in the contract price; provided, however, that if there is more than 1 surety company, the surety companies shall be jointly and severally liable. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that he will comply fully with all laws and regulations applicable to awards made subject to section 44A.

The undersigned further certifies under the penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of section twenty-nine F of chapter twenty-nine, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated there under.

NAME OF BIDDER

SIGNATURE AND TITLE OF PERSON SIGNING BID

Date:

BUSINESS ADDRESS

DOCUMENT 00 31 10

GENERAL BIDDER CERTIFICATIONS

This Document is a supplement to the FORM FOR GENERAL BID and includes GENERAL BIDDER CERTIFICATIONS to provide with the FORM FOR GENERAL BID.

- 1.0. The undersigned hereby certifies, under the pains and penalties of perjury, that he has carefully examined the Contract Documents, established a thorough understanding of the existing conditions, and has obtained sufficient information for executing the work of his Proposal and the work of all related trades.
- 2.0. The Bidder hereby agrees to commence work under this Contract on or before a date to be specified in written "Notice to Proceed" issued by the Owner, and to thereafter diligently and continuously carry on the Work. It is anticipated that the anticipated Award of Contract and Notice to Proceed will be on or after _____ 2021.
 - a. Commencement of Work: The Bidder hereby agrees to commence work under this Contract on or after _____ , 2021.
 - b. Substantial Completion Date: The undersigned agrees to substantially complete the Work within ___ calendar days after Notice to Proceed.
 - c. Final Completion Date: The undersigned agrees to a final completion of the Contract Work within ___ calendar days after Notice to Proceed.
- 3.0. Liquidated damages for not completing the work within the time limit specified above will be assessed by the Owner.
 - a. The liquidated damages amount per calendar day is a minimum damage figure to compensate the Owner for administrative costs and loss or delay of its use of the project, and for added Owner's Project Manager, Architect and consultant fees, and does not limit in any way the liability of the Contractor for damages in excess of the specified liquidated damages amount for other damages, in particular, damages for breach of Contract. It is expressly understood that such liquidated damages do not constitute a penalty.
 - b. Liquidated damages will be five hundred dollars (\$500.00) per calendar day.
- 4.0. The undersigned bidder hereby certifies, under the pains and penalties of perjury, that the foregoing bid is based upon the payment to laborers to be employed on the project of wages in an amount no less than the applicable prevailing wage rates established for the project by the Massachusetts Department of Labor and Workforce Development, Division of Occupational Safety. The undersigned bidder agrees to indemnify the Awarding Authority for, from and against any loss, expense, damages, actions or claims, including any expense incurred in connection with any delay or stoppage of the project work, arising out of or as a result of (1) the failure of the said bid to be based upon the payment of the said applicable prevailing wage rates or (2) the failure of the bidder, if selected as the contractor, to pay laborers employed on the project the said applicable prevailing wage rates.
- 5.0. The undersigned further certifies that he has reviewed the requirements of the Contract Documents regarding the requirements of this Contract regarding adherence to COVID-19 Protocols; refer to Document 00 80 50, COVID-19 GUIDELINES AND PROCEDURES DURING CONSTRUCTION.
- 6.0. The undersigned further certifies that he will comply with affirmative action/equal opportunity provisions of this Contract.

- 7.0 The undersigned further certifies that its bid shall be good and may not be withdrawn for a period of 60 days, Saturdays, Sundays and legal holidays excluded, after the opening of the bids.
- 8.0 Additional Certifications: The undersigned further certifies that he has submitted the following additional documents with the FORM FOR GENERAL BID:
 - a. DCAMM Certificate of Eligibility and a signed DCAMM Prime/General Contractor Update Statement: Refer to Document 00 31 20, DCAMM PRIME/GENERAL CONTRACTOR UPDATE STATEMENT.
 - b. Certificate as to Corporate Bidder: Refer to Document 00 31 40, CERTIFICATE AS TO CORPORATE BIDDER.
 - c. Non-Collusive Affidavit of General Bidder: Refer to Document 00 31 50, FORM OF NON-COLLUSIVE AFFIDAVIT OF GENERAL BIDDER.
 - d. Certificate of Tax Compliance: Refer to Document 00 31 60, CERTIFICATE OF COMPLIANCE WITH TAX LAWS.
 - e. Bid Bond: Refer to Document 00 31 70, BID SECURITY FORM.

Date: _____
(SEAL - if bid is by a corporation)

By: _____
(Signature)

(Name of Bidder)

(Title)

(Business Address)

(City and State)

(Telephone No. and Fax No.)

END OF DOCUMENT

DOCUMENT 00 31 20

DCAMM PRIME / GENERAL CONTRACTOR UPDATE STATEMENT

The DCAMM Prime / General Contractor Update Statement (10 pages total) immediately follows this Document.

END OF DOCUMENT

SPECIAL NOTICE TO AWARDING AUTHORITY
BIDDERS' UPDATE STATEMENTS ARE NOT PUBLIC RECORDS AND
ARE NOT OPEN TO PUBLIC INSPECTION (M.G.L. C.149, §44D)

EFFECTIVE MARCH 30, 2010

Commonwealth of Massachusetts
Division of Capital Asset Management
PRIME/GENERAL CONTRACTOR
UPDATE STATEMENT

TO ALL BIDDERS AND AWARDING AUTHORITIES

A COMPLETED AND SIGNED PRIME/GENERAL CONTRACTOR UPDATE STATEMENT MUST BE SUBMITTED WITH EVERY PRIME/GENERAL BID FOR A CONTRACT PURSUANT TO M.G.L. c.149, §44A AND M.G.L. c. 149A. ANY PRIME/GENERAL BID SUBMITTED WITHOUT AN APPROPRIATE UPDATE STATEMENT IS INVALID AND MUST BE REJECTED.

Caution: This form is to be used for submitting Prime/General Contract bids. It is not to be used for submitting Filed Sub-Bids or Trade Sub-Bids.

AWARDING AUTHORITIES

If the Awarding Authority determines that the bidder does not demonstrably possess the skill, ability, and integrity necessary to perform the work on the project, it must reject the bid.

BIDDER'S AFFIDAVIT

I swear under the pains and penalties of perjury that I am duly authorized by the bidder named below to sign and submit this Prime/General Contractor Update Statement on behalf of the bidder named below, that I have read this Prime/General Contractor Update Statement, and that all of the information provided by the bidder in this Prime/General Contractor Update Statement is true, accurate, and complete as of the bid date.

Bid Date

Print Name of Prime/General Contractor

Project Number (or
name if no number)

Business Address

Awarding Authority

Telephone Number

SIGNATURE →

Bidder's Authorized Representative

INSTRUCTIONS

INSTRUCTIONS TO BIDDERS

- This form must be completed and submitted by all Prime/General contractors bidding on projects pursuant to M.G.L. c. 149, §44A and M.G.L. c. 149A.
- You must give complete and accurate answers to all questions and provide all of the information requested. **MAKING A MATERIALLY FALSE STATEMENT IN THIS UPDATE STATEMENT IS GROUNDS FOR REJECTING YOUR BID AND FOR DEBARRING YOU FROM ALL PUBLIC CONTRACTING.**
- **This Update Statement must include all requested information that was not previously reported on the Application used for your firm's most recently issued (not extended or amended) Prime/General Contractor Certificate of Eligibility. The Update Statement must cover the entire period since the date of your Application, NOT since the date of your Certification.**
- You must use this official form of Update Statement. Copies of this form may be obtained from the awarding authority and from the Asset Management Web Site: www.mass.gov/dcam.
- If additional space is needed, please copy the appropriate page of this Update Statement and attach it as an additional sheet.
- See the section entitled "Bidding Limits" in the *Instructions to Awarding Authorities* for important information concerning your bidding limits.

INSTRUCTIONS TO AWARDING AUTHORITIES

Determination of Bidder Qualifications

- It is the awarding authority's responsibility to determine who is the lowest eligible and responsible bidder. You must consider all of the information in the low bidder's Update Statement in making this determination. **Remember:** this information was not available to the Division of Capital Asset Management at the time of certification.
- The bidder's performance on the projects listed in Parts 1 and 2 must be part of your review. Contact the project references.
- **AWARDING AUTHORITIES ARE STRONGLY ENCOURAGED TO REVIEW THE LOW BIDDER'S ENTIRE CERTIFICATION FILE AT THE DIVISION OF CAPITAL ASSET MANAGEMENT. Telephone (617) 727-9320 for an appointment.**

Bidding Limits

Single Project Limit: The total amount of the bid, including all alternates, may not exceed the bidder's Single Project Limit.

Aggregate Work Limit: The annual value of the work to be performed on the contract for which the bid is submitted,

when added to the annual cost to complete the bidder's other currently held contracts, may not exceed the bidder's Aggregate Work Limit. Use the following procedure to determine whether the low bidder is within its Aggregate Work Limit:

Step 1 Review Update Statement Question #2 to make sure that all requested information is provided and that the bidder has accurately calculated and totaled the annualized value of all incomplete work on its currently held contracts (column 9).

Step 2 Determine the annual dollar value of the work to be performed on your project. This is done as follows:

- (i) If the project is to be completed in less than 12 months, the annual dollar value of the work is equal to the full amount of the bid.
- (ii) If the project will take more than 12 months to complete, calculate the number of years given to complete the project by dividing the total number of months in the project schedule by 12 (calculate to 3 decimal places), then divide the amount of the bid by the calculated number of years to find the annual dollar value of the work.

Step 3 Add the annualized value of all of the bidder's incomplete contract work (the total of column 9 on page 5) to the annual dollar value of the work to be performed on your project. **The total may not exceed the bidder's Aggregate Work Limit.**

Correction of Errors and Omissions in Update Statements

Matters of Form: An awarding authority shall not reject a contractor's bid because there are mistakes or omissions of form in the Update Statement submitted with the bid, provided the contractor promptly corrects those mistakes or omissions upon request of the awarding authority. [810 CMR 8.05(1)].

Correction of Other Defects: An awarding authority may, in its discretion, give a contractor notice of defects, other than mistakes or omissions of form, in the contractor's Update Statement, and an opportunity to correct such defects, provided the correction of such defects is not prejudicial to fair competition. An awarding authority may reject a corrected Update Statement if it contains unfavorable information about the contractor that was omitted from the Update Statement filed with the contractor's bid. [810 CMR 8.05(2)].

PART 1 - COMPLETED PROJECTS

LIST ALL PUBLIC AND PRIVATE *BUILDING* PROJECTS YOUR FIRM HAS COMPLETED SINCE THE DATE OF APPLICATION FOR YOUR MOST RECENTLY ISSUED (NOT EXTENDED OR AMENDED) DCAM CERTIFICATE OF ELIGIBILITY. YOU MUST REPORT ALL REQUESTED INFORMATION NOT PREVIOUSLY REPORTED ON THAT DCAM APPLICATION*.

PROJECT TITLE & LOCATION	WORK CATEGORY	CONTRACT PRICE	START DATE	DATE COMPLETED

Attach additional sheets if necessary

* If your firm has been terminated from a project prior to completion of the work or has failed or refused to complete its work under any contract, full details and an explanation must be provided. See Part 3 of this Update Statement.

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH COMPLETED PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above, either through a business or family relationship? YES NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? YES NO

If you have answered YES to either question, explain. _____

PART 2 - CURRENTLY HELD CONTRACTS

LIST ALL PUBLIC AND PRIVATE BUILDING AND NON-BUILDING *CONSTRUCTION* PROJECTS YOUR FIRM HAS UNDER CONTRACT ON THIS DATE REGARDLESS OF WHEN OR WHETHER THE WORK COMMENCED.

1	2	3	4	5	6	7	8	9
PROJECT TITLE & LOCATION	WORK CATEGORY	START AND END DATES	ON SCHEDULE (yes / no)	CONTRACT PRICE	% NOT COMPLETE	\$ VALUE OF WORK NOT COMPLETE (col. 5 X col. 6)	NO. OF YEARS REMAINING (see note below)	ANNUALIZED VALUE OF INCOMPLETE WORK (col. 7 ÷ col. 8) (divided by)

ANNUALIZED VALUE OF ALL INCOMPLETE CONTRACT WORK (Total of Column 9)

\$ _____

Column 8

- If less than one year is left in the project schedule, write 1.
- If more than 12 months are left in the project schedule, divide the number of months left in the project schedule by 12 (calculate to three decimal places).

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH INCOMPLETE PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above either through a business or family relationship? YES NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? YES NO

If you have answered YES to either question, explain. _____

PART 3 - PROJECT PERFORMANCE

For Parts 3 and 4, if you answer YES to any question, please provide on a separate page a complete explanation. Information you provide herein must supplement the Application for your most recently issued (not extended or amended) DCAM Certificate of Eligibility. You must report all requested information not previously reported on that DCAM Application for Prime/General Certificate of Eligibility. Include all details [project name(s) and location(s), names of all parties involved, relevant dates, etc.].

	YES	NO
1. Has your firm been terminated on any contract prior to completing a project or has any officer, partner or principal of your firm been an officer, partner or principal of another firm that was terminated or failed to complete a project?	<input type="checkbox"/>	<input type="checkbox"/>
2. Has your firm failed or refused either to perform or complete any of its work under any contract prior to substantial completion?	<input type="checkbox"/>	<input type="checkbox"/>
3. Has your firm failed or refused to complete any punch list work under any contract?	<input type="checkbox"/>	<input type="checkbox"/>
4. Has your firm filed for bankruptcy, or has any officer, principal or individual with a financial interest in your current firm been an officer, principal or individual with a financial interest in another firm that filed for bankruptcy?	<input type="checkbox"/>	<input type="checkbox"/>
5. Has your surety taken over or been asked to complete any of your work under any contract?	<input type="checkbox"/>	<input type="checkbox"/>
6. Has a payment or performance bond been invoked against your current firm, or has any officer, principal or individual with a financial interest in your current firm been an officer, principal or individual with a financial interest in another firm that had a payment or performance bond invoked?	<input type="checkbox"/>	<input type="checkbox"/>
7. Has your surety made payment to a materials supplier or other party under your payment bond on any contract?	<input type="checkbox"/>	<input type="checkbox"/>
8. Has any subcontractor filed a demand for direct payment with an awarding authority for a public project on any of your contracts?	<input type="checkbox"/>	<input type="checkbox"/>
9. Have any of your subcontractors or suppliers filed litigation to enforce a mechanic's lien against property in connection with work performed or materials supplied under any of your contracts?	<input type="checkbox"/>	<input type="checkbox"/>
10. Have there been any deaths of an employee or others occurring in connection with any of your projects?	<input type="checkbox"/>	<input type="checkbox"/>
11. Has any employee or other person suffered an injury in connection with any of your projects resulting in their inability to return to work for a period in excess of one year?	<input type="checkbox"/>	<input type="checkbox"/>

PART 4 - Legal or Administrative Proceedings; Compliance with Laws

Please answer the following questions. Information must supplement all judicial and administrative proceedings involving bidder’s firm, which were instituted or concluded (adversely or otherwise) since your firm’s Application for your most recently issued (not extended or amended) Certificate of Eligibility. You must report all requested information not previously reported on that DCAM Application for Prime/General Certificate of Eligibility.

The term “administrative proceeding” as used in this Prime/General Contractor Update Statement includes (i) any action taken or proceeding brought by a governmental agency, department or officer to enforce any law, regulation, code, legal, or contractual requirement, except for those brought in state or federal courts, or (ii) any action taken by a governmental agency, department or officer imposing penalties, fines or other sanctions for failure to comply with any such legal or contractual requirement.

The term “anyone with a financial interest in your firm” as used in this Section “I”, shall mean any person and/or entity with a 5% or greater ownership interest in the applicant’s firm.

If you answer YES to any question, on a separate page provide a complete explanation of each proceeding or action and any judgment, decision, fine or other sanction or result. Include all details (name of court or administrative agency, title of case or proceeding, case number, date action was commenced, date judgment or decision was entered, fines or penalties imposed, etc.).

	YES	NO
1. Have any civil, judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to the procurement or performance of any construction contract, including but not limited to actions to obtain payment brought by subcontractors, suppliers or others?	<input type="checkbox"/>	<input type="checkbox"/>
2. Have any criminal proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to the procurement or performance of any construction contract including, but not limited to, any of the following offenses: fraud, graft, embezzlement, forgery, bribery, falsification or destruction of records, or receipt of stolen property?	<input type="checkbox"/>	<input type="checkbox"/>
3. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of any state’s or federal procurement laws arising out of the submission of bids or proposals?	<input type="checkbox"/>	<input type="checkbox"/>
4. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of M.G.L. Chapter 268A, the State Ethics Law?	<input type="checkbox"/>	<input type="checkbox"/>

PART 4 - Legal or Administrative Proceedings; Compliance with Laws (continued)

	YES	NO
5. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of any state or federal law regulating hours of labor, unemployment compensation, minimum wages, prevailing wages, overtime pay, equal pay, child labor or worker's compensation?	<input type="checkbox"/>	<input type="checkbox"/>
6. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of any state or federal law prohibiting discrimination in employment?	<input type="checkbox"/>	<input type="checkbox"/>
7. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a claim of repeated or aggravated violation of any state or federal law regulating labor relations?	<input type="checkbox"/>	<input type="checkbox"/>
8. Have any proceedings by a municipal, state, or federal agency been brought, concluded, or settled relating to decertification, debarment, or suspension of your firm or any principal or officer or anyone with a financial interest in your firm from public contracting?	<input type="checkbox"/>	<input type="checkbox"/>
9. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of state or federal law regulating the environment?	<input type="checkbox"/>	<input type="checkbox"/>
10. Has your firm been fined by OSHA or any other state or federal agency for violations of any laws or regulations related to occupational health or safety? Note: this information may be obtained from OSHA's Web Site at www.osha.gov	<input type="checkbox"/>	<input type="checkbox"/>
11. Has your firm been sanctioned for failure to achieve DBE/MBE/WBE goals, workforce goals, or failure to file certified payrolls on any public projects?	<input type="checkbox"/>	<input type="checkbox"/>
12. Other than previously reported in the above paragraphs of this Section I, have any administrative proceedings or investigations involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled by any local, state or federal agency relating to the procurement or performance of any construction contract?	<input type="checkbox"/>	<input type="checkbox"/>
13. Are there any other issues that you are aware which may affect your firm's responsibility and integrity as a building contractor?	<input type="checkbox"/>	<input type="checkbox"/>

PART 5 - SUPERVISORY PERSONNEL

List all supervisory personnel, such as project managers and superintendents, who will be assigned to the project if your firm is awarded the contract. **Attach the resume of each person listed below.**

NAME	TITLE OR FUNCTION

PART 6 - CHANGES IN BUSINESS ORGANIZATION OR FINANCIAL CONDITION

Have there been any changes in your firm’s business organization, financial condition or bonding capacity since the date your current Certificate of Eligibility was issued? Yes No
If YES, attach a separate page providing complete details.

PART 7 – LIST OF COMPLETED CONSTRUCTION PROJECTS SUBMITTED TO THE DIVISION OF CAPITAL ASSET MANAGEMENT.

Attach here a copy of the list of completed construction projects which was submitted with your firm’s DCAM Application for your most recently issued (not extended or amended) DCAM Certificate of Eligibility. The Attachment must include a complete copy of the entire Section G – “Completed Projects” and the final page – “Certification” (Section J) containing the signature and date that the Completed Projects list (Section G) was submitted to the Division of Capital Asset Management.

DOCUMENT 00 31 40

CERTIFICATE AS TO CORPORATE BIDDER

I

certify that I am _____ of the

Corporation named as Bidder in the within Bid Form that _____

_____ who signed said Bid Form on behalf of the

Bidder was then _____ of said

Corporation; that I know his signature and that his signature hereto is genuine and that said Bid Form was duly signed, sealed, and executed for and on behalf of said Corporation by authority of its Board of Directors.

(Corporate Seal)

(Signature)

(Title)

This Certificate must be completed where the Bidder is a Corporation and should be so completed by its Clerk. In the event that the Clerk is the person signing the Proposal on behalf of the Corporation, this Certificate must be completed by another Officer of the Corporation.

END OF DOCUMENT

DOCUMENT 00 31 50

FORM OF NON-COLLUSIVE AFFIDAVIT OF GENERAL BIDDER

The undersigned certifies that under penalties of perjury that this bid has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word 'person' shall mean any natural person, business, partnership, corporation, union, committee, club or other organization, entity or group of individuals.

Bidder _____

By _____

Title _____

Subscribed and sworn to before me this _____ day of _____, 2021

(Name)

(Title)

My commission expires _____

END OF DOCUMENT

DOCUMENT 00 31 60

CERTIFICATION OF COMPLIANCE WITH TAX LAWS

Pursuant to Commonwealth of Massachusetts General Laws, Chapter 62C, Section 49A, I certify

under the pains and penalties of perjury that, _____
(Contractor)

has filed all Commonwealth of Massachusetts state tax returns, has complied with all Commonwealth of Massachusetts laws relating to taxes, and has paid all Commonwealth of Massachusetts State Taxes required under law.

(Contractor)

By: _____

Contractor's Federal Tax I.D. No. _____

END OF DOCUMENT

DOCUMENT 00 31 70

BID SECURITY FORM

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned, _____

_____, as Principal, and
(insert name of bidder)

_____, as Surety,
(insert name of surety)

and firmly bound unto the **TOWN OF BOXFORD, MASSACHUSETTS** acting by and through its

BOARD OF SELECTMEN as Owner, in the sum of _____

_____ Dollars (\$ _____)

for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

The condition of this obligation is such that whereas the Principal has submitted to the Owner a certain Bid, attached hereto and hereby made a part hereof, to enter into a contract in writing, hereinafter referred to as the "AGREEMENT" for:

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

NOW THEREFORE,

- (a) If said BID shall be rejected, or in the alternative,
- (b) If said BID shall be accepted and the Principal shall duly execute and deliver the form of AGREEMENT attached hereto and shall furnish the specified bonds for the faithful performance of the Contract and for the payment for labor and materials furnished for the performance of the AGREEMENT, then this obligation shall be void, otherwise it shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder in no event shall exceed the amount of this obligation as herein stated.

The Surety, for value received, hereby agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extensions of the time within which the Owner may accept such BID; and said Surety does hereby waive notice of any such extensions.

IN WITNESS WHEREOF, the parties to these presents have duly executed this bond on this _____

_____ day of _____, 2021.

(SEAL)

(Name of Principal)

By: _____

(SEAL)

(Name of Surety)

By: _____

Sealed and delivered in the presence of

END OF DOCUMENT

Bid Bond Affidavit

This document is an affidavit form that is drafted to serve as a statement wherein the person (Bidder) who signs it swears under penalty of perjury that the facts and information that are identified in this affidavit are true. This affidavit is in lieu of an insurance bid bond certificate.

Bidders submitting the Bid Bond Affidavit and 5% Bid Deposit in the form of cash, certified check, treasurer's or cashier's check issued by a responsible bank or trust company shall ensure that these documents be received by the Awarding Authority prior to the closing of the electronic bid.

Both the Bid Bond Affidavit and Bid Deposit shall be enclosed in a sealed envelope with the following plainly marked on the outside:

DO NOT OPEN BEFORE

Date and time of bid opening:

Project name:

Project number:

Bidder's Name:

Business Address:

Phone Number:

It is the bidder's responsibility to ensure that the Bid Bond Affidavit and Bid Deposit be submitted as stated above and received by the Awarding Authority prior to the closing of electronic bids. Upon completion of this form it must also be uploaded via the project E-bid "Bid Bond" link at www.Projectdog.com.

The Bidder understands and consents that any failure to do so whether his own or other fault may result in the rejection of said bid. The Bidder is solely responsible for the accuracy and value of bid deposit. In the event that it is less than the required amount as outlined in the project specifications the bid may be rejected.

Example: \$12,345

Bid Deposit Amount:

Cash

OR

Certified, treasurers, or cashier's check

Signature:

Company:

Address:

Date:

DOCUMENT 00 35 00

FORM FOR SUB-BID

To all General Bidders Except Those Excluded:

- A. The undersigned proposes to furnish all labor and materials required for completion, in accordance with the Contract Documents dated _____, together with all Addenda issued and received prior to closing time for receipt of Bids of all the work specified in Section(s) _____ of the Specifications and in any Drawings specified in these Sections, prepared by:

GORMAN RICHARDSON LEWIS ARCHITECTS, INC. (GRLA)

239 South Street
Hopkinton, Massachusetts 01748
Phone: 508-544-2600

for construction of:

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER

10 Elm Street
Boxford, Massachusetts 01921

for the Contract Sum of: _____

_____ Dollars (_____)

For Alternate No. ___ Add \$ _____ Subtract \$ _____

For Alternate No. ___ Add \$ _____ Subtract \$ _____

For Alternate No. ___ Add \$ _____ Subtract \$ _____

- B. This sub-bid includes the following addenda:

Addendum No. __, __, __, __, __, __, __.

- C. This Sub-bid:

[] may be used by any General Bidder except: _____

[] may only be used by the following General Bidders: _____

(To exclude General Bidders, insert "X" in one box only and fill in blank following that box.
Do not answer C. if no General Bidders are excluded.)

D. The undersigned agrees that, if he/she is selected as sub-bidder, he/she will within five days, Saturdays, Sundays, and legal holidays excluded, after presentation of a subcontract by the General Bidder selected as the General Contractor, execute with such General Bidder a subcontract in accordance with the terms of this sub-bid and contingent upon the execution of the General Contract, and, if requested to do so in the general bid by such general bidder, who shall pay the premiums therefore, furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and satisfactory to the Awarding Authority, in the full sum of the subcontract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the section of the specifications for this subtrade require a listing in this paragraph, (including the undersigned if customarily furnished by persons on his/her own payroll and in the absence of a contrary provision in the specifications) the name of each such class of work or part thereof and the bid price for each such class of work or part thereof are:

<u>Name</u>	<u>Class of Work</u>	<u>Bid Price</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Do not give price for any class or part thereof furnished by the undersigned.)

F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described Drawings, Specifications, and Addenda and that, if the undersigned is awarded the Contract, they will be used for the work indicated at the amounts stated, if satisfactory to the Awarding Authority.

G. The undersigned further agrees to be bound to the General Contractor by the terms of the hereinbefore described Drawings, Specifications (including all General Conditions and Supplemental Conditions stated therein), and Addenda, and to assume toward him/her all the obligations and responsibilities that he/she, by those documents, assumes toward the Awarding Authority.

H. The undersigned offers the following information as evidence of his/her qualifications to perform the work as bid upon according to all the requirements of the Contract Documents:

1. Have been in business under present business name for _____ years.
2. Ever failed to complete any work awarded? _____ .
3. List one or more recent buildings with names of General Contractor and Architect on which you served as subcontractor for work of similar character as required for the above-named building.

<u>Building</u>	<u>Architect</u>	<u>General Contractor</u>	<u>Amount of Contract</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

4. Bank Reference: _____ .

- J. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he/she will comply fully with all laws and regulations applicable to awards of subcontracts subject to Section 44F.
- K. The undersigned further certifies under penalties of perjury that this sub-bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation, or other business or legal entity.
- L. The undersigned further certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section 29F of Chapter 29, or any other applicable debarment provisions of any chapter of the Massachusetts General Laws or any rule or regulation promulgated thereunder.

Date: _____

(Name of Sub-bidder)

By: _____

(Name and Title of Person Signing Bid)

(Seal)

(Business Address)

(City and State)

(Telephone)

END OF DOCUMENT

DOCUMENT 00 35 05
FORM FOR SUB-BID (SAMPLE)

The FORM FOR SUB-BID (Sample) (two pages total) immediately follows this Document.
[Hard Copy forms will not be accepted; refer to Electronic Bid Instructions for submission of Sub-bid.]

END OF DOCUMENT

FORM FOR SUB-BID

TO ALL GENERAL BIDDERS EXCEPT THOSE EXCLUDED:

A. The undersigned proposes to furnish all labor and materials required for completing, in accordance with the hereinafter described plans, specifications and addenda, all the work specified in Section No _____ of the specifications and in any plans specified in such section

prepared by _____ for _____

for the _____ in, _____ Massachusetts,

for the contract sum of :

		Dollars \$	
For Alternate	No.	Bid Amount in Words	Bid Amount in Numbers
	_____	Add \$ _____	Subtract \$ _____
	_____	\$ _____	\$ _____
	_____	\$ _____	\$ _____
	_____	\$ _____	\$ _____

Each Alternate shall be listed separately.

B. This Sub-bid includes addenda numbered _____

C. This Sub-bid

May be used by any General Bidder Except:

May only be used by the following General Bidders:

To exclude general bidders, insert "X" in one box only and fill in blank following that box.
Do not answer C if no general bidders are excluded

D. The undersigned agrees that, if selected as a sub-bidder, he will, within five days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a subcontract in accordance with the terms of this sub-bid, and contingent upon the execution of the general contract, and, if requested to do so in the general bid by such general bidder, who shall pay the premiums therefor, or if prequalification is required pursuant to Section 44D 3/4 , furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority, in the full sum of the subcontract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the section of the specifications for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his own payroll and in the absence of a contrary provision in the specifications, the name of each such class of work or part thereto and the bid price for such class of work or part thereof are:

NAME	CLASS OF WORK	BID PRICE
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(Do not give bid price for any class or part thereof furnished by the undersigned).

- F. The undersigned agrees that the above list of bids of the undersigned represents bona fide bids based on hereinbefore described plans, specifications and addenda, and that, if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the awarding authority.
- G. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him all the obligations and responsibilities that he, by those documents, assumes toward the owner.
- H. The undersigned offers the following information as evidence of his qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

1. Have been in business under present business name for _____ years
2. Ever failed to complete any work awarded? _____
3. List one or more recent buildings with names of general contractor and architect on which you served as subcontractor for work of similar character as required for the above-named building

Building Type	Architect	General Contractor	Contract Amount
_____	_____	_____	\$ _____
_____	_____	_____	\$ _____
_____	_____	_____	\$ _____

4. Bank Reference: _____

- I. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that he will comply fully with all laws and regulations applicable to awards of subcontracts subject to section 44F. **The safety training requirement in this paragraph is effective July 1, 2006.**

The undersigned further certifies under penalty of perjury that this sub-bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of section twenty-nine F of chapter twenty-nine, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

NAME OF SUB-BIDDER

SIGNATURE & TITLE OF PERSON SIGNING BID

BUSINESS ADDRESS

DOCUMENT 00 35 10

SUB-BIDDER CERTIFICATIONS

This Document is a supplement to the FORM FOR SUB-BID and includes SUB-BIDDER CERTIFICATIONS to provide with the FORM FOR SUB-BID.

- 1.0. The undersigned hereby certifies, under the pains and penalties of perjury, that he has carefully examined the Contract Documents, established a thorough understanding of the existing conditions, and has obtained sufficient information for executing the work of his Proposal and the work of all related trades and general construction.
- 2.0 The Bidder hereby agrees to commence work under this Contract on or before a date to be specified in written "Notice to Proceed" and to thereafter diligently and continuously carry on the Work in accordance with the Project Schedule.
- 3.0 The undersigned bidder hereby certifies, under the pains and penalties of perjury, that the foregoing bid is based upon the payment to laborers to be employed on the project of wages in an amount no less than the applicable prevailing wage rates established for the project by the Massachusetts Department of Labor and Workforce Development, Division of Occupational Safety.
- 4.0 The undersigned further certifies that he has reviewed the requirements of the Contract Documents regarding the requirements of this Contract regarding adherence to COVID-19 Protocols; refer to Document 00 80 50, COVID-19 GUIDELINES AND PROCEDURES DURING CONSTRUCTION.
- 5.0. The undersigned further certifies that he will comply with affirmative action/equal opportunity provisions of this Contract.
- 6.0 Additional Certifications: The undersigned further certifies that he has submitted the following additional documents with the FORM FOR SUB-BID:
 - a. DCAMM Certificate of Eligibility and a signed DCAMM Sub-bidder Update Statement: Refer to Document 00 35 20 DCAMM SUB-BIDDER UPDATE STATEMENT.
 - b. Non-Collusive Affidavit of Subcontractor: Refer to Document 00 35 50, FORM OF NON-COLLUSIVE AFFIDAVIT OF SUBCONTRACTOR

Date: _____

By: _____
(Signature)

(Name of Sub-Bidder)

(Title)

(Business Address)

(City and State)

(Telephone No. and Fax No.)

END OF DOCUMENT

DOCUMENT 00 35 20

DCAMM SUB-BIDDER UPDATE STATEMENT

The DCAMM Sub-bidder Update Statement (10 pages total) immediately follows this Document.

END OF DOCUMENT

*

SPECIAL NOTICE TO AWARDING AUTHORITY
SUB-BIDDERS' UPDATE STATEMENTS ARE NOT PUBLIC RECORDS AND
ARE NOT OPEN TO PUBLIC INSPECTION (M.G.L. C.149, §44D)

EFFECTIVE MARCH 30, 2010

Commonwealth of Massachusetts
Division of Capital Asset Management



SUB-BIDDER
UPDATE STATEMENT
TO ALL SUB-BIDDERS, TRADE CONTRACTORS AND AWARDING
AUTHORITIES

A COMPLETED AND SIGNED SUB-BIDDER UPDATE STATEMENT MUST BE SUBMITTED WITH EVERY FILED SUB-BID PURSUANT TO M.G.L. c.149, §44F AND EVERY TRADE SUB-BID PURSUANT TO M.G.L. c. 149A. ANY FILED SUB-BID OR TRADE SUB-BID SUBMITTED WITHOUT AN APPROPRIATE SUB-BIDDER UPDATE STATEMENT IS INVALID AND MUST BE REJECTED.

Caution: This form is to be used for submitting Filed Sub-Bids and Trade Sub-Bids. It is not to be used for submitting Prime/General Contract bids.

AWARDING AUTHORITIES

If the Awarding Authority determines that the sub-bidder is not competent to perform the work as specified on the project, it should reject the bid.

SUB-BIDDER'S AFFIDAVIT

I swear under the pains and penalties of perjury that I am duly authorized by the bidder named below to sign and submit this Sub-bidder Update Statement on behalf of the bidder named below, that I have read this Sub-bidder Update Statement, and that all of the information provided by the bidder in this Sub-bidder Update Statement is true, accurate, and complete as of the bid date.

Bid Date

Print Name of Sub-bidder or Trade Contractor

Project Number (or
name if no number)

Business Address

Awarding Authority

Telephone Number

SIGNATURE⇒

Bidder's Authorized Representative

INSTRUCTIONS

INSTRUCTIONS TO SUB-BIDDERS

- This form must be completed and submitted by all Filed Sub-Bidders bidding on projects pursuant to M.G.L. c. 149, §44F and Trade Contractors bidding on projects pursuant to M.G.L. c. 149A.
- You must give complete and accurate answers to all questions and provide all of the information requested. **MAKING A MATERIALLY FALSE STATEMENT IN THIS SUB-BIDDER UPDATE STATEMENT IS GROUNDS FOR REJECTING YOUR BID AND FOR DEBARRING YOU FROM ALL PUBLIC CONTRACTING.**
- **This Sub-Bidder Update Statement must include all requested information that was not previously reported on the Application used for your firm's most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. The Sub-Bidder Update Statement must cover the entire period since the date of that Application, NOT since the date of your Certification.**
- You must use this official form of Sub-bidder Update Statement. Copies of this form may be obtained from the awarding authority and from the DCAM Web Site: www.mass.gov/dcam.
- If additional space is needed, please copy the appropriate page of this Sub-bidder Update Statement and attach it as an additional sheet.

INSTRUCTIONS TO AWARDING AUTHORITIES

Determination of Sub-Bidder Qualifications

- It is the awarding authority's responsibility to determine each responsible bidder. You must consider all of the information in the bidder's Sub-bidder Update Statement in making this determination. Remember: this information was not available to the Division of Capital Asset Management at the time of certification.
- The sub-bidder's performance on the projects listed in Parts 1 and 2 must be part of your review. Contact the project references.
- **AWARDING AUTHORITIES ARE STRONGLY ENCOURAGED TO REVIEW THE SUB-BIDDER'S ENTIRE CERTIFICATION FILE AT THE DIVISION OF CAPITAL ASSET MANAGEMENT. Telephone (617) 727-9320 for an appointment.**

Correction of Errors and Omissions in Sub-bidder Update Statements

Matters of Form: An awarding authority shall not reject a sub-bidder's bid because there are mistakes or omissions of form in the Sub-bidder Update Statement submitted with the bid pursuant to M.G.L. c.149, §44D, provided the sub-bidder promptly corrects those mistakes or omissions upon request of the awarding authority. [810 CMR 8.13(1)].

Correction of Other Defects: An awarding authority may, in its discretion, give a sub-bidder notice of minor defects and omissions as to form in the Sub-bidder's Update Statement and provide an opportunity to correct its Sub-bidder Update Statement. However, the sub-bidder shall not be allowed to make corrections to a Sub-bidder Update Statement if material information about the sub-bidder was omitted from the Sub-bidder Update Statement filed with the sub-bidder's bid. The Awarding Authority shall advise DCAM of any material omissions in a Sub-bidder's Update Statement.. [810 CMR 8.13(2)].

PART 1 - COMPLETED PROJECTS

LIST ALL PUBLIC AND PRIVATE PROJECTS OF \$20,000 OR MORE THAT YOUR FIRM HAS COMPLETED SINCE THE DATE OF APPLICATION FOR YOUR MOST RECENTLY ISSUED (NOT EXTENDED OR AMENDED) SUB-BIDDER CERTIFICATE OF ELIGIBILITY*.

PROJECT TITLE & LOCATION	WORK CATEGORY	CONTRACT PRICE	START DATE	DATE COMPLETED

Attach additional sheets if necessary

* If your firm has been terminated from a project prior to completion of the work or has failed or refused to complete its work under any contract, full details and an explanation must be provided. See Part 3 of this Sub-bidder Update Statement.

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH COMPLETED PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above, either through a business or family relationship? YES NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? YES NO

If you have answered YES to either question, explain. _____

PART 2 - CURRENTLY HELD CONTRACTS

LIST ALL PUBLIC AND PRIVATE PROJECTS OF \$20,000 OR MORE THAT YOUR FIRM HAS UNDER CONTRACT ON THIS DATE REGARDLESS OF WHEN OR WHETHER THE WORK COMMENCED.

1	2	3	4	5	6	7
PROJECT TITLE & LOCATION	WORK CATEGORY	START AND END DATES	ON SCHEDULE (yes / no)	CONTRACT PRICE	% NOT COMPLETE	\$ VALUE OF WORK NOT COMPLETE (col. 5 X col. 6)

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH INCOMPLETE PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone
	OWNER: Owner	Contact Person	Telephone
	DESIGNER: Designer	Contact Person	Telephone
	GC: GC	Contact Person	Telephone

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above either through a business or family relationship? YES NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? YES NO

If you have answered YES to either question, explain. _____

PART 3 - PROJECT PERFORMANCE

For Parts 3 and 4, if you answer YES to any question, please provide on a separate page a complete explanation. Information you provide herein must supplement the Application for your most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. You must report all requested information not previously reported on that Application. Include all details [project name(s) and location(s), names of all parties involved, relevant dates, etc.].

	YES	NO
1. Has your firm been terminated on any contract prior to completing a project or has any officer, partner or principal of your firm been an officer, partner or principal of another firm that was terminated or failed to complete a project?	<input type="checkbox"/>	<input type="checkbox"/>
2. Has your firm failed or refused either to perform or complete any of its work under any contract prior to substantial completion?	<input type="checkbox"/>	<input type="checkbox"/>
3. Has your firm failed or refused to complete any punch list work under any contract?	<input type="checkbox"/>	<input type="checkbox"/>
4. Has your firm filed for bankruptcy, or has any officer, principal or individual with a financial interest in your current firm been an officer, principal or individual with a financial interest in another firm that filed for bankruptcy?	<input type="checkbox"/>	<input type="checkbox"/>
5. Has your surety taken over or been asked to complete any of your work under any contract?	<input type="checkbox"/>	<input type="checkbox"/>
6. Has a payment or performance bond been invoked against your current firm, or has any officer, principal or individual with a financial interest in your current firm been an officer, principal or individual with a financial interest in another firm that had a payment or performance bond invoked?	<input type="checkbox"/>	<input type="checkbox"/>
7. Has your surety made payment to a materials supplier or other party under your payment bond on any contract?	<input type="checkbox"/>	<input type="checkbox"/>
8. Has any subcontractor filed a demand for direct payment with an awarding authority for a public project on any of your contracts?	<input type="checkbox"/>	<input type="checkbox"/>
9. Have any of your subcontractors or suppliers filed litigation to enforce a mechanic's lien against property in connection with work performed or materials supplied under any of your contracts?	<input type="checkbox"/>	<input type="checkbox"/>
10. Have there been any deaths of an employee or others occurring in connection with any of your projects?	<input type="checkbox"/>	<input type="checkbox"/>
11. Has any employee or other person suffered an injury in connection with any of your projects resulting in their inability to return to work for a period in excess of one year?	<input type="checkbox"/>	<input type="checkbox"/>

PART 4 - Legal or Administrative Proceedings; Compliance with Laws

Please answer the following questions. Information must supplement all judicial and administrative proceedings involving bidder’s firm, which were instituted or concluded (adversely or otherwise) since your firm’s Application for your most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. You must report all requested information not previously reported on that DCAM Application.

The term “administrative proceeding” as used in this Sub-Bidder Update Statement includes (i) any action taken or proceeding brought by a governmental agency, department or officer to enforce any law, regulation, code, legal, or contractual requirement, except for those brought in state or federal courts, or (ii) any action taken by a governmental agency, department or officer imposing penalties, fines or other sanctions for failure to comply with any such legal or contractual requirement.

The term “anyone with a financial interest in your firm” as used in this Section “I”, shall mean any person and/or entity with a 5% or greater ownership interest in the applicant’s firm.

If you answer YES to any question, on a separate page provide a complete explanation of each proceeding or action and any judgment, decision, fine or other sanction or result. Include all details (name of court or administrative agency, title of case or proceeding, case number, date action was commenced, date judgment or decision was entered, fines or penalties imposed, etc.).

	YES	NO
1. Have any civil, judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to the procurement or performance of any construction contract, including but not limited to actions to obtain payment brought by subcontractors, suppliers or others?	<input type="checkbox"/>	<input type="checkbox"/>
2. Have any criminal proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to the procurement or performance of any construction contract including, but not limited to, any of the following offenses: fraud, graft, embezzlement, forgery, bribery, falsification or destruction of records, or receipt of stolen property?	<input type="checkbox"/>	<input type="checkbox"/>
3. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of any state’s or federal procurement laws arising out of the submission of bids or proposals?	<input type="checkbox"/>	<input type="checkbox"/>
4. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of M.G.L. Chapter 268A, the State Ethics Law?	<input type="checkbox"/>	<input type="checkbox"/>

PART 4 - Legal or Administrative Proceedings; Compliance with Laws (continued)

	YES	NO
5. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of any state or federal law regulating hours of labor, unemployment compensation, minimum wages, prevailing wages, overtime pay, equal pay, child labor or worker's compensation?	<input type="checkbox"/>	<input type="checkbox"/>
6. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of any state or federal law prohibiting discrimination in employment?	<input type="checkbox"/>	<input type="checkbox"/>
7. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a claim of repeated or aggravated violation of any state or federal law regulating labor relations?	<input type="checkbox"/>	<input type="checkbox"/>
8. Have any proceedings by a municipal, state, or federal agency been brought, concluded, or settled relating to decertification, debarment, or suspension of your firm or any principal or officer or anyone with a financial interest in your firm from public contracting?	<input type="checkbox"/>	<input type="checkbox"/>
9. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of state or federal law regulating the environment?	<input type="checkbox"/>	<input type="checkbox"/>
10. Has your firm been fined by OSHA or any other state or federal agency for violations of any laws or regulations related to occupational health or safety? Note: this information may be obtained from OSHA's Web Site at www.osha.gov	<input type="checkbox"/>	<input type="checkbox"/>
11. Has your firm been sanctioned for failure to achieve DBE/MBE/WBE goals, workforce goals, or failure to file certified payrolls on any public projects?	<input type="checkbox"/>	<input type="checkbox"/>
12. Other than previously reported in the above paragraphs of this Section I, have any administrative proceedings or investigations involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled by any local, state or federal agency relating to the procurement or performance of any construction contract?	<input type="checkbox"/>	<input type="checkbox"/>
13. Are there any other issues that you are aware which may affect your firm's responsibility and integrity as a building contractor?	<input type="checkbox"/>	<input type="checkbox"/>

PART 5 - SUPERVISORY PERSONNEL

List all supervisory personnel who will be assigned to the project if your firm is awarded the contract. **Attach the resume of each person listed below.**

NAME	TITLE OR FUNCTION

PART 6 - CHANGES IN BUSINESS ORGANIZATION OR FINANCIAL CONDITION

Have there been any changes in your firm’s business organization, financial condition or bonding capacity since the date your current Certificate of Eligibility was issued? Yes No
If YES, attach a separate page providing complete details.

PART 7 – LIST OF COMPLETED CONSTRUCTION PROJECTS SUBMITTED TO THE DIVISION OF CAPITAL ASSET MANAGEMENT ALONG WITH CERTIFICATION PAGE.

Attach here a copy of the list of completed construction projects which was submitted with your firm’s Application for your most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. The Attachment must include a complete copy of the entire Section F – “Completed Projects” (Section G – “Completed Projects” for firms certified based upon their Prime/General Application), and the final page – “Certification Page”, (Section I in the Sub-bidder Application or Section J in Prime/General Application) containing the signature and date that the Completed Projects list (Section F or G) was submitted to the Division of Capital Asset Management.

DOCUMENT 00 35 50

FORM OF NON-COLLUSIVE AFFIDAVIT OF SUBCONTRACTOR

The undersigned certifies that under penalties of perjury that this bid has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word 'person' shall mean any natural person, business, partnership, corporation, union, committee, club or other organization, entity or group of individuals.

Bidder _____

By _____

Title _____

Subscribed and sworn to before me this _____ day of _____, 2021.

(Name)

(Title)

My commission expires _____

END OF DOCUMENT

DOCUMENT 00 51 00

AGREEMENT

THIS AGREEMENT, made this _____ day of _____, 2021 by and between the party of the first part, the TOWN OF BOXFORD MASSACHUSETTS hereinafter called "OWNER" or "AWARDING AUTHORITY", acting herein through its _____, and the party of the second part, _____, doing business as a corporation located in the City/Town of _____, County of _____, State of _____, hereinafter called the "CONTRACTOR"

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned, to be made and performed by the OWNER, the CONTRACTOR hereby agrees with the OWNER to commence and complete the project described as follows:

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

hereinafter called the "PROJECT" for the sum of _____ Dollars (\$ _____)

The Contract Sum includes incorporation into the Contract of Alternate(s) _____ as described in Section 01 23 00, ALTERNATES of the Specifications and all extra work in connection therewith, under the terms as stated in the Contract Documents; and at his (its or their) own proper cost and expense to furnish all the materials, supplies, machinery equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said project in accordance with the conditions and prices stated in Document 00 31 00, FORM FOR GENERAL BID; Document 00 70 00, GENERAL CONDITIONS and all the BIDDING REQUIREMENTS, CONTRACTING REQUIREMENTS and DIVISION 01 - GENERAL REQUIREMENTS, as listed in the PROJECT MANUAL and the Specifications (refer to Document 00 01 10, TABLE OF CONTENTS) and the plans, which include all maps, plates, blue prints (refer to Document 00 01 15, LIST OF DRAWINGS) and all other Contract Documents as prepared by the OWNER all of which are attached hereto and incorporated by reference herein in their entirety.

The undersigned CONTRACTOR agrees to commence work on the Contract on or before the _____ (____ th) day following the Notice of Award and to thereafter diligently and continuously carry out the work in such manner as to fully complete all the different elements of the work within _____ (____) days thereafter.

The CONTRACTOR agrees not to discriminate against or exclude any person from participation herein on grounds of race, religion, color, sex, age or national origin; and that it shall take affirmative actions to insure that applicants are employed, and that employees are treated during their employment, without regard to race, religion, color, sex, age, handicapped status, or national origin.

The CONTRACTOR agrees not to participate in or cooperate with an international boycott, as defined in Section 999 (b)(3) and (4) of the Internal Revenue Code of 1954, as amended, or engage in conduct declared to be unlawful by Section 2 of Chapter 151E of the Commonwealth of Massachusetts General Laws.

Pursuant to M.G.L. c. 62(c), §49 (a), the individual signing this Agreement on behalf of the CONTRACTOR hereby certifies, under the penalties of perjury, that to the best of his or her knowledge and belief the CONTRACTOR has complied with any and all applicable state and federal tax laws. The individual signing this Agreement on behalf of the CONTRACTOR further certifies under penalties of perjury that the Contractor is not presently debarred from doing public construction work in the Commonwealth under the provisions of M.G.L. c. 29, § 29F, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder and is not presently debarred from doing public construction work by any agency of the United States Government.

The OWNER agrees to pay the CONTRACTOR in current funds for the performance of the contract, subject to additions and deductions, as provided in Document 00 80 00, GENERAL CONDITIONS, and to make payments on account thereof as provided therein.

IN WITNESS WHEREOF, the parties to these presents have executed this contract in two (2) counterparts, each of which shall be deemed an original, on the year and day first above mentioned.

AGREED:

OWNER: TOWN OF BOXFORD MASSACHUSETTS

by its _____

By: _____

CONTRACTOR: _____
(Name of Company)

By: _____
(Name)

(Title)

(Address)

(City and State)

In accordance with M.G.L. c. 44, Section 31C, this is to certify that an appropriation in the amount of this Contract is available therefor and that the _____ has been authorized to execute the Contract and approve all requisitions and change orders.

By: _____
(Town Treasurer)

END OF DOCUMENT

DOCUMENT 00 59 00

SUBCONTRACT

THIS AGREEMENT made this _____ day of _____, 2021

by and between _____

a corporation organized and existing under the laws of _____

a partnership consisting of _____

an individual doing business as _____

hereinafter called the "Contractor", and _____

a corporation organized and existing under the laws of _____

a partnership consisting of _____

an individual doing business as _____

hereinafter called the "Subcontractor",

WITNESSETH that the Contractor and the Subcontractor, for the considerations hereafter named, agree as follows:

- The Subcontractor agrees to furnish all labor and materials required for the completion of all work specified in Section No(s) _____ of the Specifications for _____ and the Drawings referred (Name of Subtrade)

to therein and Addenda No. ____, ____, ____, ____, ____, ____, ____, for construction of:

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
 10 Elm Street
 Boxford, Massachusetts 01921

all as prepared by the Architect, Gorman Richardson Lewis Architects, Inc., 239 South Street, Hopkinton, Massachusetts 01748 for the sum _____ Dollars (\$ _____)

and the Contractor agrees to pay the Subcontractor said sum for said work.

This price includes the following alternates (and other items set forth in the sub-bid):

Alternate No(s): _____

- (a) The Subcontractor agrees to be bound to the Contractor by the terms of the hereinbefore described Drawings, Specifications (including all General Conditions stated therein) and Addenda and to assume to the Contractor all the obligations and responsibilities that the Contractor by those documents assumes to the TOWN OF BOXFORD MASSACHUSETTS hereinafter called the "Awarding Authority", except to the extent that provisions contained therein are by their terms or by law applicable only to the Contractor.
 - (b) The Contractor agrees to be bound to the Subcontractor by the terms of the hereinbefore described documents and to assume to the Subcontractor all the obligations and responsibilities that the Awarding Authority by the terms of the hereinbefore described-documents assumes to the Contractor, except to the extent that provisions contained therein are by their terms or by law applicable only to the Awarding Authority.
2. The Contractor agrees to begin, prosecute, and complete the entire Work specified by the Awarding Authority in an orderly manner so that the Subcontractor will be able to begin, prosecute, and complete the work described in this Subcontract; and, in consideration thereof, upon notice from the Contractor, either oral or in writing, the Subcontractor agrees to begin, prosecute, and complete the work described in this Subcontract in an orderly manner and with due consideration to the date or time specified by the Awarding Authority for the completion of the entire Work.
 3. The Subcontractor agrees to furnish to the Contractor within a reasonable time after the execution of this Subcontract, evidence of Workmen's Compensation Insurance as required by law, and evidence of Public Liability and Property Damage Insurance of the type and in limits required to be furnished to the Awarding Authority by the Contractor.
 4. The Contractor agrees that no claim for services rendered or materials furnished by the Contractor to the Subcontractor shall be valid unless written notice thereof is given by the Contractor to the Subcontractor during the first ten (10) days of the calendar month following that in which the claim originated.
 5. This Agreement is contingent upon the execution of a General Contract between the Contractor and the Awarding Authority for the complete Work.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement the day and year first above-written.

SEAL

ATTEST _____

(Name of Subcontractor)

By: _____
(Name and Title of Person Signing Subcontract)

SEAL

ATTEST _____

(Name of Contractor)

By: _____
(Name and Title of Person Signing Subcontract)

END OF DOCUMENT

DOCUMENT 00 61 00
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we _____

(Name of Contractor)

as Principal a _____
(Corporation, Partnership, or Individual)

hereinafter called "Principal" and _____

(Surety)

_____ of _____,

State of _____, hereinafter called the

"Surety", are held and firmly bound into the **TOWN OF BOXFORD MASSACHUSETTS** acting by and through its **BOARD OF SELECTMEN** hereinafter called the "Owner" or the "Awarding Authority", in the

penal sum of _____

_____ Dollars (\$ _____), in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain

contract with the Owner, dated the _____ day of _____, 2021; a

copy of which is hereto attached and made a part hereof for the construction of:

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation of this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, the parties to these present have duly executed in this bond on the _____

_____ day of _____, 2021.

ATTEST:

(SEAL)

(Principal)

By _____
(Secretary)

(Address - Zip Code)

(SEAL)

(Witness as to Principal)

(Address - Zip Code)

NOTE:

1. Date of Bond must not be prior to date of Contract. If Contractor is a Partnership, all partners should execute Bond.
2. Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the Project is located).

END OF DOCUMENT

DOCUMENT 00 62 00

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we _____

(Name of Contractor)

as Principal a _____
(Corporation, Partnership, or Individual)

hereinafter called "Principal" and _____

(Surety)

_____ of _____ State of

_____, hereinafter called the "Surety", are

held and firmly bound into the **TOWN OF BOXFORD MASSACHUSETTS** acting by and through its **BOARD OF SELECTMEN** hereinafter called the "Owner" or the "Awarding Authority", in the penal sum

of _____

_____ Dollars (\$ _____),

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the Owner, dated the _____ day of _____, _____, 2021; a copy of which is hereto attached and made a part hereof for the construction of:

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

NOW, THEREFORE, if the Contractor and his Sub-contractors shall pay for labor performed and materials used or employed in the prosecution of the work provided for in said Contract, and for all other items of the kind and nature specified in Chapter 149, Section 29, of the General Laws of Massachusetts, then this obligation shall be void; otherwise to remain in full force and effect;

PROVIDED, HOWEVER, that in order to obtain the benefits of this bond, all claimants shall comply with all the provisions of said Chapter 149, Section 29, which are pertinent to their claims, and all rights and liabilities on this bond shall be determined and limited by said section to the same extent as if this were copied at length herein."

IN WITNESS WHEREOF, the parties to these present have duly executed in this bond on this _____

_____ day of _____ 2021.

ATTEST:

(SEAL)

(Principal)

By _____
(Secretary)

(Address - Zip Code)

(SEAL)

(Witness as to Principal)

(Address - Zip Code)

NOTE:

1. Date of Bond must not be prior to date of Contract. If Contractor is a Partnership, all partners should execute Bond.
2. Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the Project is located).

END OF DOCUMENT

DRAFT AIA[®] Document A201[™] - 1997

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address):

The American Institute of Architects
THE OWNER:
(Name and address):

THE ARCHITECT:
(Name and address):

TABLE OF ARTICLES

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ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document has been approved and endorsed by The Associated General Contractors of America



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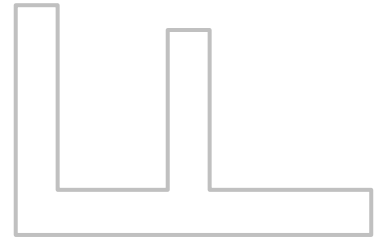
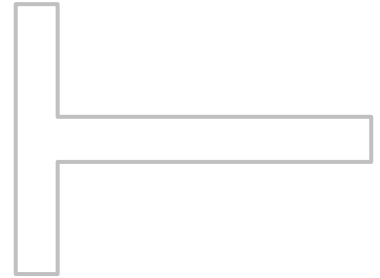
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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of the Agreement between Owner and Contractor (hereinafter the Agreement), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents such as bidding requirements (advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or portions of Addenda relating to bidding requirements).

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Architect and Contractor, (2) between the Owner and a Subcontractor or Sub-subcontractor, (3) between the Owner and Architect or (4) between any persons or entities other than the Owner and Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 THE PROJECT MANUAL

The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 CAPITALIZATION

§ 1.3.1 Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

§ 1.4.1 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 EXECUTION OF CONTRACT DOCUMENTS

§ 1.5.1 The Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

§ 1.5.2 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 1.6 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.6.1 The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Instruments of Service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants, and unless otherwise indicated the Architect and the Architect's consultants shall be deemed the authors of them and will retain all common law, statutory and other reserved rights, in addition to the copyrights. All copies of Instruments of Service, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' copyrights or other reserved rights.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 The Owner shall, at the written request of the Contractor, prior to commencement of the Work and thereafter, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Furnishing of such evidence shall be a condition precedent to commencement or

continuation of the Work. After such evidence has been furnished, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees, including those required under Section 3.7.1, which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 Information or services required of the Owner by the Contract Documents shall be furnished by the Owner with reasonable promptness. Any other information or services relevant to the Contractor's performance of the Work under the Owner's control shall be furnished by the Owner after receipt from the Contractor of a written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals as are reasonably necessary for execution of the Work.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

§ 2.3.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or persistently fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

§ 2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a three-day period. If the Contractor within such three-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Since the Contract Documents are complementary, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the

Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, any errors, inconsistencies or omissions discovered by the Contractor shall be reported promptly to the Architect as a request for information in such form as the Architect may require.

§ 3.2.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect.

§ 3.2.3 If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Architect in response to the Contractor's notices or requests for information pursuant to Sections 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Sections 4.3.6 and 4.3.7. If the Contractor fails to perform the obligations of Sections 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor recognized such error, inconsistency, omission or difference and knowingly failed to report it to the Architect.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 The Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

§ 3.5 WARRANTY

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

§ 3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES AND NOTICES

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

§ 3.7.4 If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents:

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances;
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner in sufficient time to avoid delay in the Work.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important

communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare and keep current, for the Architect's approval, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Architect reasonable time to review submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

§ 3.11.1 The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record field changes and selections made during construction, and one record copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect without action.

§ 3.12.6 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

§ 3.13 USE OF SITE

§ 3.13.1 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

§ 3.16 ACCESS TO WORK

§ 3.16.1 The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

§ 3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Section 11.3, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

§ 4.1 ARCHITECT

§ 4.1.1 The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a new Architect against whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the former Architect.

§ 4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents, and will be an Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Section 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 4.2.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and

deficiencies in the Work, and (3) to determine in general if the Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will neither have control over or charge of, nor be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect will have authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion, will receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and initial decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.3 CLAIMS AND DISPUTES

§ 4.3.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 4.3.2 Time Limits on Claims. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated by written notice to the Architect and the other party.

§ 4.3.3 Continuing Contract Performance. Pending final resolution of a Claim except as otherwise agreed in writing or as provided in Section 9.7.1 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 4.3.4 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 21 days after the Architect has given notice of the decision. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Section 4.4.

§ 4.3.5 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.6.

§ 4.3.6 If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with this Section 4.3.

§ 4.3.7 Claims for Additional Time

§ 4.3.7.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

§ 4.3.7.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 4.3.8 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 4.3.9 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 4.3.10 Claims for Consequential Damages. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 4.3.10 shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 4.4 RESOLUTION OF CLAIMS AND DISPUTES

§ 4.4.1 Decision of Architect. Claims, including those alleging an error or omission by the Architect but excluding those arising under Sections 10.3 through 10.5, shall be referred initially to the Architect for decision. An initial decision by the Architect shall be required as a condition precedent to mediation, arbitration or litigation of all Claims between the Contractor and Owner arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered by the Architect. The Architect will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 4.4.2 The Architect will review Claims and within ten days of the receipt of the Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Architect is unable to resolve the Claim if the Architect lacks sufficient information to evaluate the merits of the Claim or if the Architect concludes that, in the Architect's sole discretion, it would be inappropriate for the Architect to resolve the Claim.

§ 4.4.3 In evaluating Claims, the Architect may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Architect in rendering a decision. The Architect may request the Owner to authorize retention of such persons at the Owner's expense.

§ 4.4.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either provide a response on the requested supporting data, advise the Architect when the response or supporting data will be furnished or advise the Architect that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Architect will either reject or approve the Claim in whole or in part.

§ 4.4.5 The Architect will approve or reject Claims by written decision, which shall state the reasons therefor and which shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be final and binding on the parties but subject to mediation and arbitration.

§ 4.4.6 When a written decision of the Architect states that (1) the decision is final but subject to mediation and arbitration and (2) a demand for arbitration of a Claim covered by such decision must be made within 30 days after the date on which the party making the demand receives the final written decision, then failure to demand arbitration within said 30 days' period shall result in the Architect's decision becoming final and binding upon the Owner and Contractor. If the Architect renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence, but shall not supersede arbitration proceedings unless the decision is acceptable to all parties concerned.

§ 4.4.7 Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect or the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Architect or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 4.4.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines prior to resolution of the Claim by the Architect, by mediation or by arbitration.

§ 4.5 MEDIATION

§ 4.5.1 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Sections 4.3.10, 9.10.4 and 9.10.5 shall, after initial decision by the Architect or 30 days after submission of the Claim to the Architect, be subject to mediation as a condition precedent to arbitration or the institution of legal or equitable proceedings by either party.

§ 4.5.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract and with the American Arbitration Association. The request may be made concurrently with the filing of a demand for arbitration but, in such event, mediation shall proceed in advance of arbitration or legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order.

§ 4.5.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 4.6 ARBITRATION

§ 4.6.1 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Sections 4.3.10, 9.10.4 and 9.10.5, shall, after decision by the Architect or 30 days after submission of the Claim to the Architect, be subject to arbitration. Prior to arbitration, the parties shall endeavor to resolve disputes by mediation in accordance with the provisions of Section 4.5.

§ 4.6.2 Claims not resolved by mediation shall be decided by arbitration which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect. The demand for arbitration shall be filed in writing with the other party to the Contract and with the American Arbitration Association, and a copy shall be filed with the Architect.

§ 4.6.3 A demand for arbitration shall be made within the time limits specified in Sections 4.4.6 and 4.6.1 as applicable, and in other cases within a reasonable time after the Claim has arisen, and in no event shall it be made after the date when institution of legal or equitable proceedings based on such Claim would be barred by the applicable statute of limitations as determined pursuant to Section 13.7.

§ 4.6.4 Limitation on Consolidation or Joinder. No arbitration arising out of or relating to the Contract shall include, by consolidation or joinder or in any other manner, the Architect, the Architect's employees or consultants, except by written consent containing specific reference to the Agreement and signed by the Architect, Owner, Contractor and any other person or entity sought to be joined. No arbitration shall include, by consolidation or joinder or in any other manner, parties other than the Owner, Contractor, a separate contractor as described in Article 6 and other persons substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in arbitration. No person or entity other than the Owner, Contractor or a separate contractor as described in Article 6 shall be included as an original third party or additional third party to an arbitration whose interest or responsibility is insubstantial. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of a Claim not described therein or with a person or entity not named or described therein. The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 4.6.5 Claims and Timely Assertion of Claims. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 4.6.6 Judgment on Final Award. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitute.

§ 5.3 SUBCONTRACTUAL RELATIONS

§ 5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Section 4.3.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work or defective construction of a separate contractor.

§ 6.2.4 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

§ 6.3.1 If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect, stating their agreement upon all of the following:

- .1 change in the Work;
- .2 the amount of the adjustment, if any, in the Contract Sum; and
- .3 the extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 as provided in Section 7.3.6.

§ 7.3.4 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.5 A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.6 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.6 shall be limited to the following:

- .1 costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.7 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.8 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs. That determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a claim in accordance with Article 4.

§ 7.3.9 When the Owner and Contractor agree with the determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

§ 7.4 MINOR CHANGES IN THE WORK

§ 7.4.1 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by the Contract Documents or a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, or by delay authorized by the Owner pending mediation and arbitration, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Section 4.3.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

§ 9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to

payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.8, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Such applications may not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of:

- .1 defective Work not remedied;

- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or another contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 persistent failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 Payment to material suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

§ 9.7.1 If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by arbitration, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.4.1.5 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the

final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

§ 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 The Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. The Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up, which adjustments shall be accomplished as provided in Article 7.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) and provided that such damage, loss or expense is not due to the sole negligence of a party seeking indemnity.

§ 10.4 The Owner shall not be responsible under Section 10.3 for materials and substances brought to the site by the Contractor unless such materials or substances were required by the Contract Documents.

§ 10.5 If, without negligence on the part of the Contractor, the Contractor is held liable for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.6 EMERGENCIES

§ 10.6.1 In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Section 4.3 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- .2 claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 claims for damages insured by usual personal injury liability coverage;
- .5 claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 claims for bodily injury or property damage arising out of completed operations; and
- .8 claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Section 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

§ 11.2 OWNER'S LIABILITY INSURANCE

§ 11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE

§ 11.3.1 Optionally, the Owner may require the Contractor to purchase and maintain Project Management Protective Liability insurance from the Contractor's usual sources as primary coverage for the Owner's, Contractor's and Architect's vicarious liability for construction operations under the Contract. Unless otherwise required by the Contract Documents, the Owner shall reimburse the Contractor by increasing the Contract Sum to pay the cost of purchasing and maintaining such optional insurance coverage, and the Contractor shall not be responsible for purchasing any other liability insurance on behalf of the Owner. The minimum limits of liability purchased with such coverage shall be equal to the aggregate of the limits required for Contractor's Liability Insurance under Sections 11.1.1.2 through 11.1.1.5.

§ 11.3.2 To the extent damages are covered by Project Management Protective Liability insurance, the Owner, Contractor and Architect waive all rights against each other for damages, except such rights as they may have to the proceeds of such insurance. The policy shall provide for such waivers of subrogation by endorsement or otherwise.

§ 11.3.3 The Owner shall not require the Contractor to include the Owner, Architect or other persons or entities as additional insureds on the Contractor's Liability Insurance coverage under Section 11.1.

§ 11.4 PROPERTY INSURANCE

§ 11.4.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.4 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.4.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.4.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance which will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.4.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.4.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.4.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.4.2 Boiler and Machinery Insurance. The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.4.3 Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.4.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.4.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.4.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.4.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.4. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.4.7 Waivers of Subrogation. The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.4 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.4.8 A loss insured under Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.4.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.4.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or in accordance with an arbitration award in which case the procedure shall be as provided in Section 4.6. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.4.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved as provided in Sections 4.5 and 4.6. The Owner as fiduciary shall, in the case of arbitration, make settlement with insurers in accordance with directions of the arbitrators. If distribution of insurance proceeds by arbitration is required, the arbitrators will direct such distribution.

§ 11.5 PERFORMANCE BOND AND PAYMENT BOND

§ 11.5.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.5.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered which the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

§ 12.2.1.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract

Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

§ 12.3.1 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

§ 13.1.1 The Contract shall be governed by the law of the place where the Project is located.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to an institutional lender providing construction financing for the Project. In such event, the lender shall assume the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

§ 13.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

§ 13.6.1 Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

§ 13.7.1 As between the Owner and Contractor:

- .1 Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
- .2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
- .3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 issuance of an order of a court or other public authority having jurisdiction which requires all Work to be stopped;
- .2 an act of government, such as a declaration of national emergency which requires all Work to be stopped;
- .3 because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 the Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work

by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor:

- .1 persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 accept assignment of subcontracts pursuant to Section 5.4; and
- .3 finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work;
and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.



DOCUMENT 00 70 00

GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 GENERAL CONDITIONS

- A. The American Institute of Architects (AIA) Document A201, entitled "General Conditions of the Contract for Construction", 1997 Edition, to the extent applicable and except as otherwise revised, amended or supplemented hereinafter, on the Drawings or in other parts of the Contract Documents, whether attached hereto or not, are hereby made a part of the specifications for this project and shall apply to all work under the Contract. Unless otherwise amended or supplemented hereinafter, references to terms such as "the Agreement", "the Contract" and the "Contractor" in the aforementioned AIA Document A201, shall be interpreted to mean the Agreement, Contract, and the Contractor for this Project.
- B. This General Conditions is incorporated into the Bidding and Contract Documents by reference. Copies of this General Conditions (AIA Document A201, 1997 edition) are available through the Architect.
- C. Reference to SUPPLEMENTARY CONDITIONS or to MODIFICATIONS TO GENERAL CONDITIONS shall mean Modifications to these General Conditions; refer to Document 00 80 00, SUPPLEMENTARY CONDITIONS.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF DOCUMENT

DOCUMENT 00 80 00

SUPPLEMENTARY CONDITIONS

I. THE GENERAL CONDITIONS

The "General Conditions of the Contract for Construction," AIA Document A201, (1997), Articles 1 through 14 inclusive (referred to in the Contract Document as the "General Conditions", and designated as Document 00 70 00, GENERAL CONDITIONS of the Project Manual), is a part of this contract.

II. THE SUPPLEMENTARY CONDITIONS

The following supplements modify, delete and/or add to the General Conditions. Where any Article, Paragraph or subparagraph in the General Conditions is supplemented by one of the following paragraphs, the provisions of such Article, Paragraph, or subparagraph shall remain in effect and the supplemental provisions shall be considered as added thereto. Where any Article, Paragraph, or subparagraph in the General Conditions is amended, voided or superseded by any of the following paragraphs, the provisions of such Article, Paragraph or subparagraph not so amended, voided, or superseded shall remain in effect.

Any other provisions required by statute to be included herein to be consistent with the requirements of Massachusetts statutes governing public construction contracts in the Commonwealth of Massachusetts (referred to in such paragraphs or subparagraphs as the "Commonwealth") shall be deemed to be so included. In addition, the Owner and Contract recognize that other rights, duties and obligations with respect to public construction contracts are provided for by statute, notwithstanding the fact that they are not provided for in the Contract Documents. In case of conflict between the asterisked provisions and other provisions of the Contract Documents, the asterisked provisions shall govern. In case of conflict between the provisions of the Contract Documents and the provisions of any applicable statute, the statutory provisions shall govern. Where the term "Awarding Authority" appears in any asterisked provision, it shall mean the Owner.

III. MODIFICATIONS TO VARIOUS ARTICLES OF THE AIA GENERAL CONDITIONS1. Article 1.1.1

In the third sentence delete the words "Unless specifically enumerated in the Agreement," and the word "not".

Add the following at the end of subparagraph 1.1.1:

"In the event of any conflict among the Contract Documents, the Documents shall be construed according to the following priorities:

Highest Priority:	Modifications
Second Priority:	Agreement
Third Priority:	Addenda – later date to take precedence
Fourth Priority:	Supplementary Conditions
Fifth Priority:	General Conditions
Sixth Priority:	Specifications with respect to quality and general performance of the Work.
Seventh Priority:	Drawings with respect to quantity of materials and general location of the Work. Detail drawings shall take precedence over small scale drawings.
Eighth Priority:	Request for Proposal."

2. Articles 1.11.2 - 1.1.1.6

Add the following new subparagraphs: 1.1.1.2, 1.1.1.3, 1.1.1.4, 1.1.1.5 and 1.1.1.6:

"Article 1.1.1.2

Products: Means new material, machinery, components, equipment, fixtures and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

Article 1.1.1.3

Furnish or Supply: Means to supply and deliver, unload, inspect for damage.

Article 1.1.1.4

Install: Means to unpack, assemble, erect, apply, place, finish, cure, protect, clean, and ready for use.

Article 1.1.1.5

Provide: Means to furnish or supply, plus install.

Article 1.1.1.6

Project Manual: The Project Manual is the volume usually assembled for the Work which includes the Bid Documents, Contract Documents, and Specifications."

3. Article 1.1.2

Insert the phrase "Except as provided in Article 3.18," prior to the sentence starting with "The Contract Documents shall" in line four.

4. Article 1.2.1

Add the following at the end of subparagraph 1.2.1:

"All Work mentioned or indicated in the Contract Documents shall be performed by the Contractor as part of this Contract unless it is specifically indicated in the Contract Documents that such Work is to be done by others. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of Work unless otherwise directed by written addendum to the Contract."

5. Article 1.2.4

Add the following as new subparagraph 1.2.4:

"The Contractor and all Subcontractors shall refer to all of the Drawings, including those showing primarily the Work of the mechanical, electrical and other specialized trades, and to all of the sections of the Specifications, and shall perform all Work reasonably inferable therefrom as being necessary to produce the indicated results."

6. Articles 1.2.5 - 1.2.9

Add new subparagraphs 1.2.5 through 1.2.9, as follows:

"Article 1.2.5

All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract Documents.

Article 1.2.6

Where codes, standards, requirements and publications of public and private bodies are referred to in the Specifications, references shall be understood to be to the latest revision prior to the date of receiving bids, except where otherwise indicated.

Article 1.2.7

Where no explicit quality or standards for materials or workmanship are established for Work, such Work is to be of good quality for the intended use and consistent with the quality of the surrounding Work and of the construction of the Project generally.

Article 1.2.8

All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract Documents.

Article 1.2.9

Where the Work is to fit with existing conditions or work to be performed by others, the Contractor shall fully and completely join the Work with such conditions or work, unless otherwise specified."

7. Article 1.5.1

At to the beginning of the provision add: "Three (3) signed sets of"

At the end of the provision add: "A copy of the signed set shall be deposited with the Architect."

8. Article 1.5.2

Delete the word "generally" in line 2.

9. Article 1.6.1

Delete subparagraph 1.6.1 in its entirety and insert the following:

"All Drawings, Specifications and copies thereof furnished by the Owner are and shall remain the Owner's property. They are to be used only with respect to this Project and are not to be used on any other project without the prior written consent of the Owner. With the exception of one contract set for each party to the Contract, such documents are to be returned or suitably accounted for to the Owner at the completion of the Work. Submission or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of any reserved rights."

10. Article 2.1.2

Delete subparagraph 2.1.2 in its entirety.

11. Article 2.2.1

Delete the second and third sentences.

12. Article 2.2.3

In the first line of subparagraph 2.2.3 insert the word "available" after the word "furnish".

Delete all text after the word "Owner" in line 3 and insert the following:

"except to the extent that the Contractor's review thereof reveals, or in the exercise of reasonable diligence should have revealed, any inaccuracy or incompleteness therein. The Contractor shall exercise proper precautions relating to the safe performance of the Work."

13. Article 2.2.4

Delete the second sentence.

14. Article 2.2.5

In the second line of subparagraph 2.2.5 delete the word "such" and insert "five (5)".

Add the following to the end of subparagraph 2.2.5: ", all additional copies will be furnished upon request at the cost of reproduction."

15. Article 2.3.1

Add the following to the end of subparagraph 2.3.1:

"The Contractor shall resume the Work after such stoppage promptly upon written notice to do so from the Owner. If such stoppage is required through no fault of the Contractor, the Contract Time (and the dates for achieving Substantial Completion and Final Completion) shall be extended by a period equal to the period of the stoppage, and the Contractor shall be compensated for its reasonable and justifiable costs incurred as a result of such stoppage."

16. Article 2.4.1

In the eighth line down delete the words "Change Order" and replace with "Construction Change Directive". Delete the second sentence starting from the bottom.

Delete the following words in subparagraph 2.4.1 beginning in line four:

"the Owner may after such seven-day period give the Contractor a second written notice...fails to commence and continue to correct any deficiencies,"

Delete the fourth sentence.

17. Article 3.15.1

At the end of the second sentence add the following sentence:

"Contractor is aware that Owner will continue to utilize a portion of the premises to which the Contract pertains for educational and social purposes. Contractor agrees to take reasonable steps so as to assure that areas adjacent to the project site, generally, and parking areas specifically, are clear of equipment, materials and/or debris, so as to allow reasonable safe access and use of those portions of the premises not under construction."

18. Article 3.2.1

Delete the second sentence of subparagraph 3.2.1.

19. Article 3.2.2

Insert a period after the word "Architect" in line 2, delete the balance of subparagraph 3.2.2 and substitute the following:

"The Contractor shall not be liable to the Owner or Architect for damage resulting from errors, inconsistencies or omissions in the Contract Documents, but shall be liable for damage to the extent he reasonably should have, but failed to, discover such error, inconsistency or omission. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Architect, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for such correction."

20. Article 3.2.3

Delete the third sentence.

21. Articles 3.2.4 - 3.2.6

Add new paragraphs 3.2.4 through 3.2.6., as follows:

Article 3.2.4

Any claim by the Contractor or Subcontractors that, in submitting their respective bids, they did not include all items as shown in the Contract Documents, will be given no consideration for an adjustment of any kind. If any item is specified in a Section which would not normally furnish this items it shall be the responsibility of the Contractor to coordinate the situation with the Subcontractor, and if the item under consideration is not to be provided by the Subcontractor it shall be the responsibility of the Contractor to provide the work in question, without any additional cost to the Owner.

Article 3.2.5

The Contractor shall give the Architect timely notice of any additional Drawings, Specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work.

Article 3.2.6

The Contractor shall not proceed with any Work not clearly and consistently defined in detail in the Contract Documents but shall request additional drawings or instructions from the Architect as provided in subparagraph 3.2.4. If the Contractor proceeds with such Work without obtaining further Drawings, Specifications or instructions, the Contractor shall correct Work incorrectly done at the Contractor's own expense."

22. Article 3.3.1

Add the following to the end of the first sentence in subparagraph 3.3.1:

"which shall not be less than such state of skill and attention generally rendered by the contracting profession for projects similar to the Project in scope, difficulty and location."

Delete the last sentence.

23. Article 3.3.2

Add the following to the end of subparagraph 3.3.2:

"This obligation shall also extend to the presence on the Site of suppliers of materials or equipment, their employees, contractors, and agents engaged in the Work."

24. Articles 3.5.2 - 3.5.9

Add new subparagraphs 3.5.2 through 3.5.9, as follows:

Article 3.5.2

The Contractor shall be responsible for determining that all materials furnished for the Work meet all requirements of the Contract Documents. The Architect may require the Contractor to produce reasonable evidence that a material meets such requirements, such as certified reports of past tests by qualified testing laboratories, reports of studies by qualified experts, or other evidence which, in the opinion of the Architect, would lead to a reasonable certainty that any material used, or proposed to be used, in the Work meets the requirements of the Contract Documents. All such data shall be furnished at the Contractor's expense. This provision shall not require the Contractor to pay for periodic testing of different batches of the same material, unless such testing is specifically required by the Contract Documents to be performed at the Contractor's expense.

Article 3.5.3

In all cases in which a manufacturer's name, trade name or other proprietary designation is used in connection with materials or articles to be furnished under this Contract, whether or not the phrase "or equal" is used after such name, the Contractor shall furnish the product of the named manufacturer(s) without substitution, unless a written request for a substitute has been submitted by the Contractor and approved in writing by the Architect as provided in subparagraph 3.5.4.

Article 3.5.4

If the Contractor proposes to use a material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the Contractor shall inform the Architect in writing of the nature of such deviations at the time the material is submitted for approval, and shall request written approval of the deviation from the requirements of the Contract Documents.

Article 3.5.5

In requesting approval of deviations or substitutions, the Contractor shall provide, upon request, evidence leading to a reasonable certainty that the proposed substitution or deviation will provide a quality of result at least equal to that otherwise attainable. If, in the opinion of the Architect, the evidence presented by the Contractor does not provide as sufficient basis for such reasonable certainty, the Architect may reject such substitution or deviation without further investigation.

Article 3.5.6

The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect shall judge the design and appearance of proposed substitutes on the basis of their suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Architect will not approve as equal to materials specified proposed substitutes which, in the Architect's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the Project. In order to permit coordinated design of color and finishes the Contractor shall, if required by the Architect, furnish the substituted material in any color, finish, texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the Owner.

Article 3.5.7

Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the Contractor, notwithstanding approval or acceptance of such substitution by the Owner or the Architect, unless such substitution was made at the written request or direction of the Owner or the Architect.

Article 3.5.8

The Contractor shall guarantee all Work for a period of one year after Date of Substantial Completion, or by the terms of any special guarantee required by the Contract Documents. The Contractor shall, upon written notice from the Owner, promptly correct defective Work or Work not in accordance with the Contract Documents.

The warranty provided in this paragraph 3.5 shall be in addition to and not in limitation of any other warranty required by the Contract Documents or otherwise prescribed by law.

Article 3.5.9

The Contractor shall procure and deliver to the Architect, no later than the date claimed by the Contractor as the date of Substantial Completion, all special warranties required by the Contract Documents. Delivery by the Contractor shall constitute the Contractor's guarantee to the Owner that the warranty will be performed in accordance with its terms and conditions."

25. Article 3.6.1

Add the following:

"The project is exempt from the Massachusetts Sales Tax to the extent permitted by G.L. c.64H, §6(f). The exemption number can be obtained from the Awarding Authority upon request by the successful bidder."

26. Article 3.7.3

Delete the first sentence of subparagraph 3.7.3 and delete the word "However" from the second sentence.

27. Article 3.7.4

In the first sentence of subparagraph 3.7.4 delete the word "knowing" and insert the following after the word "it":

"knows or should know".

28. Article 3.8

Delete Paragraph 3.8 in its entirety.

29. Article 3.9.1

In the second line after the word "site" add "full time". Also, in the second line after the word "Work" add the following:

"until the date of substantial completion, and for such time thereafter as the Architect may determine to be necessary for the expeditious completion of the Work. The Contractor shall remove the superintendent if requested in writing by the Owner, and shall replace him with a competent person reasonably acceptable to Owner."

30. Article 3.9.2

Add new subparagraph 3.9.2 as follows:

Article 3.9.2

The Contractor shall coordinate and supervise the Work performed by Subcontractors to the end that the Work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the Work. The Contractor and all Subcontractors shall at all times afford each trade, any separate contractor, or the Owner, every reasonable opportunity for the installation of Work and the storage of materials."

31. Article 3.9.3

Add new subparagraph 3.9.3 as follows:

"Article 3.9.3

The Contractor shall arrange for and attend job meetings with the Architect and such other persons as the Architect may from time to time wish to have present. The Contractor shall be represented by a principal, project manager, general superintendent or other authorized main office representative, as well as by the Contractor's own superintendent. An authorized representative of any Subcontractor or Sub-subcontractor shall attend such meetings if the representative's presence is requested by the Architect. Such representatives shall be empowered to make binding commitments on all matters to be discussed at such meetings, including costs, payments, change orders, time schedules and manpower. Any notices required under the Contract may be served on such representatives."

32. Article 3.12.6

Add the following at the end of subparagraph 3.12.6:

"By approving and submitting Shop Drawings, Product Data, Samples, and similar submittals the Contractor thereby represents that the Contractor has determined and verified all dimensions, quantities, field dimensions, relations to existing work, coordination with work to be installed later, coordination with information on previously accepted Shop Drawings, Product Data, Samples, or similar submittals and verification of compliance with all the requirements of the Contract Documents. The accuracy of all such information is the responsibility of the Contractor. In reviewing Shop Drawings, Product Data, Samples, and similar submittals the Architect shall be entitled to rely upon the Contractor's representation that such information is correct and accurate."

33. Article 3.12.7

At the end of subparagraph 3.12.7, add the following:

"The accuracy of all such information is the responsibility of the Contractor. In reviewing Shop Drawings, Product Data, Samples, and similar submittals the Architect shall be entitled to rely upon the Contractor's representation that such information is correct and accurate."

34. Article 3.12.10

Under subparagraph 3.12.10, modify as follows:

In the seventh line from the bottom of the subparagraph starting with the word "provided," delete the rest of the sentence. Delete the last sentence of the subparagraph.

35. Article 3.18

Change the title of paragraph 3.18 to "INDEMNIFICATION AND COVENANT NOT TO SUE."

36. Article 3.18.1

Delete the text following the word "and" in line 1 through the words "Paragraph 11.3" in line 3.

Delete the phrase "(other than the Work itself)" in line 8.

Delete the word "negligent" in line 8.

Delete the words "but only to the extent" in the eighth line of subparagraph 3.18.1.

37. Add new subparagraphs 3.18.3 and 3.18.4 as follows:

"Article 3.18.3

The obligations of the Contractor under this paragraph 3.18 shall not extend to the liability of the Architect, the Architect's consultants, and agents or employees of any of them arising out of (1) the preparation of maps, Drawings, opinions, reports, surveys, Change Orders, designs or Specifications, or (2) directions or instructions given by the Architect, the Architect's consultants and agents or employees of any of them, provided such instructions or directions are the primary cause of the injury or damage.

Article 3.18.4

The Owner and the Architect have acknowledged that nothing in the Architect's engagement implies any undertaking by the Architect for the benefit of or which may be enforced by the Contractor, its Subcontractors, or the surety of any of them; it being understood that the Architect's obligations are to the Owner and that, in performing such obligations, the Architect may increase the burdens and expense of the Contractor, its Subcontractors or the surety of any of them."

38. Article 4.1.2

In the first sentence of subparagraph 4.1.2 delete the word "Contractor".

39. Article 4.1.3

Delete subparagraph 4.1.3 in its entirety.

40. Article 4.2.7

In the third line from the bottom delete the words "unless otherwise specifically stated by the Architect".

41. Article 4.2.12

In the second sentence, delete "will not show partiality to either."

42. Article 4.3.2

Delete all but the second sentence of subparagraph 4.3.2.

43. Article 4.3.7.1

Delete the second sentence of subparagraph 4.3.7.1 and substitute the following:

"The Contractor shall have the burden of demonstrating the effect of the claimed delay on the Contract Time, and shall furnish the Architect with such documentation relating thereto as the Architect may reasonably require."

44. Article 4.3.10

Delete this subparagraph in its entirety.

45. Article 4.4.5

Revise the second sentence of subparagraph 4.4.5 to read:

"The approval or rejection of a Claim by the Architect shall be final and binding on the parties but subject to final dispute resolution in accordance with the terms of this Contract."

Add the following sentence to the end of subparagraph 4.4.5:

"The provisions of this paragraph 4.4 shall not prevent the parties from pursuing such other remedies as may be available at law if they are not satisfied with the Architect's decision."

46. Article 4.4.6

Delete this subparagraph in its entirety.

47. Article 4.4.8

Delete the text after the word "Architect" in line 3.

48. Article 4.6

Delete Section 4.6.1 of the General Conditions and replace with the following:

"Any claim arising out of or related to the contract, except claims relating to aesthetic effect and except those waived as provided for in subparagraphs 4.3.10, 9.10.4 and 9.10.5 may, after a decision by the architect or 30 days after submission of the claim to the architect, at the sole option of the owner, be subject to arbitration. Prior to arbitration, the parties shall endeavor to resolve disputes not resolved by the architect by mediation in accordance with the provisions of paragraph 4.5."

Delete the first ten words of the first sentence in Section 4.6.2 and replace with the following:

"Claims not resolved by mediation, shall, at the Owners option, be decided by arbitration,..."

49. Article 5.2.1

Delete the last sentence of subparagraph 5.2.1.

50. Article 5.2.2

Insert the following after the words "made reasonable" in the second sentence: "and legally permissible".

51. Article 5.2.3

Delete sentence two and three of subparagraph 5.2.3.

52. Article 5.2.5

Add new subparagraph 5.2.5 as follows:

"Article 5.2.5

The form of each subcontract shall be submitted to the Owner for its approval, which shall not be unreasonably withheld or delayed. Each subcontract shall expressly provide for the contingent assignment referred to in subparagraph 5.4.1."

53. Article 5.4.2

Delete subparagraph 5.4.2.

54. Article 6.1.1

In sentence one of subparagraph 6.1.1 delete the following: "including those portions related to insurance and waiver of subrogation".

55. Article 6.1.4

Delete subparagraph 6.1.4.

56. Article 6.2.3

Delete the second sentence.

57. Article 6.2.5

Delete subparagraph 6.2.5 in its entirety.

58. Article 7.3.3

Renumber subparagraph 7.3.3 as 7.3.4.

Insert prior to 7.3.4 the following and renumber it 7.3.3:

"Upon request of the Owner or the Architect, the Contractor shall without cost to the Owner submit to the Architect, in such form as the Architect may require, an accurate written estimate of the cost of any proposed extra Work or change. The estimate shall indicate the quantity and unit cost of each item of materials, and the number of hours of work and hourly rate for each class of labor, as well as the description and amounts of all other costs chargeable under the terms of this Article. Unit labor costs for the installation of each item of materials shall be shown if required by the Architect. The Contractor shall promptly revise and resubmit such estimate if the Architect determines that it is not in compliance with the requirements of this Article, or that it contains errors of fact or mathematical errors. If required by the Architect, in order to establish the exact cost of new Work added or of previously required Work omitted, the Contractor shall obtain and furnish to the Architect bona fide proposals from recognized suppliers for furnishing any material included in such Work. Such estimates shall be furnished promptly so as to occasion no delay in the Work, and shall be furnished at the Contractor's expense. The Contractor shall state in the estimate any extension of time required for the completion of the Work if the change or extra work is ordered."

59. Articles 7.3.4.1 - 7.3.4.3

Insert the following new subparagraphs as 7.3.4.1, 7.3.4.2, and 7.3.4.3:

"Article 7.3.4.1

If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods, as selected by the Owner.

By unit prices stated in the Contract Documents or otherwise mutually agreed upon.

By Cost and Percentages estimated by the Contractor as provided in subparagraph 7.3.3 and accepted by the Owner; the Contractor's estimate shall become a fixed price which shall not be changed by any variation in the actual cost of executing the Work covered by the change.

By actual Cost determined after the Work covered by the change is completed, plus Percentage.

By submission to mediation, arbitration or a court, which shall determine the fair value of the Work covered by the change.

As used in this paragraph, "Cost" shall mean the estimated or actual net increase or decrease in cost to the Contract, Subcontractor, or Sub-subcontractor for performing the work covered by the change, including actual payments for materials, equipment rentals, expendable items, wages and associated benefits to workmen and to supervisors employed full time at the site, insurance, bonds and other provable direct costs, but not including any administrative, accounting or expediting costs, or other indirect or overhead costs, or any wages or benefits or supervisory personnel not assigned full time to the site, or any amount for profit or fee to the Contract, Subcontractor or Sub-subcontractor.

"Percentage" shall mean an allowance to be added to or subtracted from the cost in lieu of overhead and profit and of any other expense which is not included in the Cost of the Work covered by the change, as defined above. Percentage for a Sub-subcontractor shall be 15% of any net increase or decrease of Cost of any Work performed by the Sub-subcontractor's own forces plus 7 1/2% of any aggregate net increase in Cost of any Work performed for the Sub-subcontractor by other contractors. Percentage for a Subcontractor shall be such percentage allowances for overhead and profit as are set forth in the Subcontract between such Subcontractor and the Contractor. If; the Agreement is based on AIA Document A101 then the Percentage for the Contractor shall be 10% of any net increase or decrease of Cost of any Work performed by the Contractor's own forces plus 5% of any net increase or decrease in the cost for all other Work covered by the change.

When in the reasonable judgment of the Architect a series of Construction Change Directives or Change Orders effect a single change, Percentage shall be calculated on the cumulative net increase or decrease in cost, if any.

Article 7.3.4.2

If the Owner elects to determine the Cost of the Work as provided in method (a) using unit prices stated in the Contract Documents or subsequently agreed upon, the unit prices shall be subject to subparagraph 7.1.4. Notwithstanding the inclusion of unit prices in the Contract Documents, it shall be the Owner's option to require the Cost of any given change to be determined by one of the other methods stated in 7.3.4.1. If the Owner elects to determine the cost of the change by unit prices and the nature of the work is such that its extent cannot readily be measured after the completion of such work or any subsequent work, the Contractor shall keep daily records, available at all times to the Architect for inspection, of the actual quantities of such work put in place, and delivery receipts or other adequate evidence, acceptable to the Architect, indicating the quantities of materials delivered to the site for use in such unit price work, and distinguishing such from other similar material delivered for use in work included in the base Contract Sum. If so required by the Architect, materials for use in unit price work shall be stored apart from all other materials on the Project.

Article 7.3.4.3

If the Owner elects to determine the Cost of the Work as provided in methods (c) or (d) of subparagraph 7.3.4.2 or if the method of determining the cost has not been established before the work is begun, the Contractor shall keep detailed daily records of labor and materials costs applicable to the work."

60. Article 7.3.4

Renumber former subparagraph 7.3.4 as 7.3.5. In the last line, delete the words "Contract Sum or".

61. Article 7.3.5

Renumber former subparagraph 7.3.5 as 7.3.6.

62. Articles 7.3.6, 7.3.7 and 7.3.9

Delete former subparagraphs 7.3.6, 7.3.7, and 7.3.9.

63. Article 7.3.8:

Delete the second and third sentences.

64. Article 8.2.2

Delete subparagraph 8.2.2

65. Articles 8.2.4 - 8.2.10

Add new subparagraphs 8.2.4 through 8.2.10 as follows:

"Article 8.2.4

Within two weeks after award of the Contract, the Contractor shall submit to the Architect a Progress Schedule showing for each class of work included in the Schedule of Values, the percentage completion to be obtained and the total dollar value of work to be completed as of the first of each month until Substantial Completion. All calculations shall be on the basis of work in place, but not including the value of materials delivered but not in place.

Article 8.2.5

The Progress Schedule shall be based on an orderly progression of the Work, allowing adequate time for each operation (including adequate time for submission and review of submittals), and leading to a reasonable certainty of Substantial Completion by the date established in the Agreement. The Progress Schedule will be reviewed by the Architect for compliance with the requirements of this Article and will be accepted by the Architect or returned to the Contractor for revision and resubmittal. Unless specifically required by law, no payment under this Contract shall be due until the Progress Schedule has been approved by the Architect.

Article 8.2.6

If in any Application for Payment, the total value of the completed Work in place, as certified by the Architect, is less than 90% of the total value of the Work in place estimated in the Progress Schedule, the Owner may, at the Owner's option, require the Contractor to accelerate the progress of the Work without cost to the Owner by increasing the work force or hours of work, or by other reasonable means approved by the Architect.

Article 8.2.7

If each of three successive applications, as certified by the Architect, indicate that the actual Work completed is less than 90% of the values estimated in the Progress Schedule to be completed by the respective dates, the Owner may at the Owner's option, treat the Contractor's delinquency as a default justifying the action permitted under paragraph 14.2.

Article 8.2.8

If the Architect has determined that the Contractor should be permitted to extend the time for completion as provided in paragraph 8.3, the calendar dates in the Progress Schedule shall be adjusted accordingly to retain their same relationship to the adjusted date of Substantial Completion, and the dollar value of Work to be completed as of the first of each month shall be adjusted prorata.

Article 8.2.9

If the Contractor fails to submit any Application for Payment in any month, the Architect shall, for the purpose of this evaluation of progress, certify separately to the actual value of the Work in place completed as of the first of the month to the best of the Architect's knowledge.

Article 8.2.10

Nothing herein shall limit the Owner's right to liquidated or other damages for delays by the Contractor or to any other remedy which the Owner may possess under other provisions of the Contract Documents or by law."

66. Article 8.3.1

In the fourth line of subparagraph 8.3.1, change "other causes beyond the Contractor's control" to read "other causes (except weather) beyond the Contractor's control". Delete the words "Change Order" in line six and substitute "Construction Change Directive." Delete the words "pending mediation and arbitration" in line five.

Add at the end: ", and this shall be the Contractor's sole remedy for such delay."

67. Article 8.3.3

Delete subparagraph 8.3.3 and add the following:

No claim for delay shall be allowed on account of failure of the Architect to furnish Drawings, Specifications or instructions or to return Shop Drawings or Samples until 15 days after receipt by the Architect by registered or certified mail of written demand for such instructions, Drawings, or Samples, and not then unless such claim be reasonable.

68. Articles 8.3.4 - 8.3.5

Add new subparagraphs 8.3.4 and 8.3.5 as follows:

"Article 8.3.4

No extension of time shall be granted because of seasonal or abnormal variations in temperature, humidity or precipitation, which conditions shall be wholly at the risk of the Contractor, whether occurring within the time originally scheduled for completion or within the period of any extension granted. There shall be no increase in the Contract Sum on account of any additional costs of operations or conditions resulting therefrom.

Article 8.3.5

The Contractor hereby agrees that the Contractor shall have no claim for damages of any kind against the Owner or the Architect on account of any delay in the commencement of the Work and/or any delay or suspension of any portion of the Work, whether such delay is caused by the Owner, the Architect, or otherwise. The Contractor acknowledges that the Contractor's sole remedy for any such delay and/or suspension will be an extension of time as provided in this Article."

69. Article 9.1.1

In subparagraph 9.1.1, change "total" in line two to "maximum".

70. Article 9.2.1

Add at the end of the first sentence of subparagraph 9.2.1:

"and shall be revised if later found by the Architect to be inaccurate."

71. Article 9.3.1

Delete the first twelve words of the first sentence of subparagraph 9.3.1 and substitute the following:

"At the time or times established in the Agreement . . ."

After the first sentence of subparagraph 9.3.1, add: "The format and number of copies of such Applications for Payment shall be as directed by the Architect."

72. Article 9.3.1.1

Add to the end of subparagraph 9.3.1.1:

"when such Construction Change Directives have set forth an adjustment to the Contract Sum."

73. Article 9.3.3

Delete subparagraph 9.3.3 and replace with the following:

"The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interest or encumbrances, hereinafter referred to in this Article 9 as "liens". The Contractor further agrees that the submission of any Application for Payment shall conclusively be deemed to waive all liens with respect to said Work to which the Contractor may then be entitled, provided that such waiver of the lien rights shall not waive the Contractor's right to payment for such Work."

74. Article 9.3.4

Add new paragraph 9.3.4 as follows:

"Each application for payment or periodic estimate requesting payment shall be accompanied by a waiver of lien, in form and substance satisfactory to the owner, from each Subcontractor for all amounts due to the Subcontractor on the basis of the previous periodic payment to the Contractor. In the event that no such waiver is provided for any Subcontractor, the Contractor shall furnish the Owner, through the Architect, with a written explanation of the reason a waiver of lien was not included."

75. Article 9.5.1

In subparagraph 9.5.1 change the following:

.6 Delete the words "unpaid balance" in the second line and insert "retainage currently held by the Owner"

Add new subparagraphs 9.5.1.8 and 9.5.1.9:

.8 a lien or attachment is filed contrary to subparagraph 4.5.9; or

.9 failure of mechanical trade or electrical trade subcontractors to comply with mandatory requirements for maintaining record drawings. The Contractor shall check record drawings each month. Written confirmation that the record drawings are current will be required by the Architect before approval of the Contractor's monthly payment requisition.

76. Article 9.6.3

Delete subparagraph 9.6.3.

77. Article 9.6.4

Modify subparagraph 9.6.4 to read as follows:

"Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, Sub-subcontractor or material supplier, except as required by law."

78. Article 9.6.5

Delete subparagraph 9.6.5.

79. Article 9.6.7

Delete subparagraph 9.6.7.

80. Article 9.6.8

Add the following subparagraph 9.6.8 as follows:

"Article 9.6.8

Notwithstanding the provisions of paragraph 9.6 all progress payments shall be made in accordance with Chapter 30, Sections 39F and 39K of the General Laws of the Commonwealth of Massachusetts, as amended."

81. Article 9.7

Delete paragraph 9.7.

82. Article 9.8.5

Delete this subparagraph and substitute the following:

"The Certificate of Substantial Completion shall be submitted to the Owner and Contractor by the Architect. The certificate shall state the date of substantial completion, shall state any consequent responsibilities of the Contractor and the Owner in accordance with the Contract Documents and shall fix the time within which the Contractor shall complete or correct any incomplete or defective work."

83. Article 9.8.1

Add at the end of subparagraph 9.8.1:

". . . and when only minor items remain to be corrected or completed and which can be corrected or completed without any material interference with the Owner's use of the Work".

84. Article 9.8.2

Replace subparagraph 9.8.2 with the following:

"When the Contractor considers that the Work, or a portion thereof designated in the Contract Documents for separate completion, is substantially complete and the premises comply with subparagraph 3.15.1, the Contractor shall prepare and submit to the Architect (1) a list of items to be completed or corrected prior to final payment; (2) all special warranties required by the Contract Documents, endorsed by the Contractor and in a form reasonably acceptable to the Architect and (3) the permits and certificates referred to in subparagraph 13.5.4. The failure to include any items on the list mentioned in the preceding sentence does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents."

85. Article 9.9.1

In the first sentence of subparagraph 9.9.1 delete the words "when such portion is designated by separate agreement with the Contractor" and "consented to by the insurer as required under Clause 11.4.1.5. and".

86. Article 9.10.2

Delete the last two sentences and insert the following:

"If the Contractor fails to furnish such releases or waivers as the Owner reasonably requires to satisfy the Owner that there are no outstanding liens, the Owner may require the Contractor, as a condition of final payment and at the Contractor's expense to take such further action, as deemed necessary and expedient by the Owner so as to obtain the release or waiver and/or to furnish a bond satisfactory to the Owner to indemnify the Owner against any such liens".

87. Article 9.10.4

Delete this subparagraph.

88. Article 10.1.1

At the end of the subparagraph, add “, including but not limited to compliance with 29 CFR 1910.132, 1910.133, and 1910.134, and for providing a safe workplace and complying with all codes, by-laws, rules and regulations applicable to the construction site.”

89. Article 10.2.1.2

In subparagraph 10.2.1.2, delete the word “and” at the end of the subparagraph.

90. Article 10.2.1.3

In subparagraph 10.2.1.3, add the word “and” to the end of the subparagraph.

91. Article 10.2.1.4

Add new subparagraph 10.2.1.4 as follows:

92. Article 10.2.1.4

“.4 any other property of the Owner, whether or not forming part of the Work, located at the site or adjacent thereto in areas to which the Contractor has access.”

93. Article 10.2.5

Replace subparagraph 10.2.5 with the following:

“The Contractor shall promptly remedy damage and loss to property referred to in subparagraphs 10.2.1.2, 10.2.1.3 and 10.2.1.4. If the damage or loss is due in whole or in part to the Contractor’s failure to take the precautions required by this paragraph 10.2, the Contractor shall, subject to any reimbursement to which the Contractor is entitled under property insurance required by the Contract Documents, bear the cost.”

94. Articles 10.2.8 - 10.2.11

Add new subparagraphs 10.2.8 through 10.2.11 as follows:

Article 10.2.8

The Contractor shall provide and maintain in good operating condition suitable and adequate fire protection equipment and services, and shall comply with all reasonable recommendations regarding fire protection made by the representatives of the fire insurance company carrying insurance on the Work or by the local fire chief or fire marshal. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.

Article 10.2.9

The Contractor shall at all times protect excavations, trenches, buildings and materials, from rain water, ground water, backup or leakage of sewers, drains and other piping, and from water of any other origin and shall remove promptly any accumulation of water. The Contractor shall provide and operate all pumps, piping and other equipment necessary to this end.

Article 10.2.10

The Contractor shall remove snow and ice which might result in damage or delay.

Article 10.2.11

During the progress of the Work and at all times prior to the date of Substantial Completion or occupancy of the Work by the Owner, whichever is earlier, the Contractor shall provide temporary heat, ventilation, and enclosure, adequate to permit the Work to proceed in a timely fashion, and to prevent damage to completed Work or Work in progress, or to materials stored on the premises. The permanent heating and ventilation systems may be used for these purposes when available unless otherwise provided in the Contract Documents."

95. Article 10.3.1

Delete this subparagraph in its entirety and substitute the following:

"If the Contractor encounters or recognizes on the site any material known or reasonably believed to be hazardous, including but not limited to asbestos or polychlorinated biphenyl (PCB), the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Architect in writing. The Contractor and the Owner shall cooperate in implementing measures to remove or contain said material and the Contractor shall comply with all directions of the Architect in the implementation of such removal or containment."

96. Article 10.3.2

Delete this subparagraph in its entirety.

97. Article 10.3.3

Delete this subparagraph in its entirety.

98. Article 10.4 -10.5

Delete these paragraphs in their entirety.

99. Article 11.1.1

In the second line of subparagraph 11.1.1 following the word "located" insert the words "and to which the Owner has no reasonable objection."

Add new Sub-subparagraph 11.1.1.1 to read as follows:

"11.1.1.1* (Statutory reference: M.G.L. c.149, §34A)

The Contractor shall, before commencing performance of the contract, provide by insurance for the payment of compensation and the furnishing of other benefits under M.G.L. c.152 to all persons to be employed under the contract, and the Contractor shall continue such insurance in full force and effect during the term of the contract. Sufficient proof of compliance with this Sub-subparagraph 11.1.1.1 must be furnished at the time of execution of this contract. Failure to provide and continue in force such insurance as aforesaid shall be deemed a material breach of the contract and shall operate as an immediate termination thereof. No cancellation of such insurance, whether by the insurer or by the insured, shall be valid unless written notice thereof is given by the party proposing cancellation to the other party and to the awarding authority at least fifteen days prior to the intended effective date thereof, which date shall be expressed in said notice."

100. Article 11.1.2

Change subparagraph 11.1.2 to read as follows:

"The insurance required by subparagraph 11.1.1 shall include all major divisions of coverage, and shall be on a comprehensive general basis including Premises and Operations (including X-C-U), Owner's and Contractor's Protective, Products and Completed Operations, and Owned, Non-owned, and Hired Motor Vehicles. Such insurance shall be written for not less than any limits of liability required by law or the following limits, whichever are greater:

Commonwealth of Massachusetts Statutory Worker's Compensation and other benefits as required under the General Laws of Massachusetts, including Employer's Liability Part B: \$500,000 / \$500,000 / \$500,000.

Broad form Commercial General Liability, written on a "per occurrence" basis with an aggregate cap no less than three (3) times the required limit: \$1,000,000 C.S.L.

Property Damage Liability shall include coverage for X-C-U hazard of explosion, collapse, and damage to underground property.

Umbrella or Excess Liability coverage following form of underlying General, Automobile and Employers' Liability Coverage: Minimum of \$2,000,000 C.S.L. over primary insurance with no more than \$10,000 Retention.

Comprehensive Automobile Liability covering owned, non-owned, and hired or borrowed vehicles: \$1,000,000 C.S.L.

All insurance shall be written on an occurrence basis, unless the Owner approves in writing coverage on a claims-made basis. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment. The Owner and the Architect shall be added as an Additional Insured on all policies."

101. Article 11.1.3

Add the following at the end of the second sentence of subparagraph 11.1.3:

"These certificates shall set forth evidence of all coverage required by 11.1.1 and 11.1.2. The form of certificate shall be AIA Document G705. The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending limits of coverage."

102. Article 11.2.1

Delete this subparagraph and substitute the following:

The Contractor shall procure and pay for an Owner's policy of Owner's protective liability insurance insuring the Owner and its officers, employees and agents against claims which may arise from operations under the Contract or relating thereto.

103. Article 11.3

Delete this paragraph in its entirety.

104. Article 11.4.1 – 1.4.4

Delete subparagraphs 11.4.1 through 11.4.4 and insert the following subparagraph 11.4.1:

"The Contractor shall purchase and maintain property insurance upon the entire Work at the site to the full insurable value thereof. Coverage for such liability insurance shall be provided by a company or companies reasonably acceptable to the Owner and which have, and shall maintain throughout the pendency of this contract, a minimum financial rating of not less than A+ according to A.M. Best or AAA according to Moody's. Contractor shall furnish to Owner written confirmation as to the insurance carrier's most current financial ratings prior to commencing work. Such insurance shall include the interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the work and shall insure against the perils of fire and extended coverage and shall include "all risks" insurance for physical loss or damage including without duplication, theft, vandalism and malicious mischief. This insurance shall also cover portions of the Work stored off the site or in transit. If this insurance is written with stipulated amounts deductible, the Owner shall not be responsible for any difference between the payments made by the insurance carrier and the claim. The policy shall contain a provision that coverages afforded under policies will not be canceled or allowed to expire until at least 30 days' written notice has been given to the Owner. The Owner shall be named insured within the policy."

105. Article 11.4.5-11.4.7

Delete subparagraphs 11.4.5 through 11.4.7 in their entirety.

106. Article 11.4.8

Delete the first sentence of subparagraph 11.4.8.

107. Article 11.4.9-11.4.10

Delete subparagraphs 11.4.9 and 11.4.10 in their entirety and substitute the following:

"The Owner shall have the power to adjust and settle with its insurers any loss for which it has obtained insurance.

Upon the occurrence of an insured loss, the Owner and the Contractor shall cooperate with each other and with each other's insurer in the submission of claims and related information and the distribution of any insurance proceeds. If after such a loss no other special agreement is made, replacement of damaged work shall be covered by an appropriate change order."

108. Article 12.2.1.1

In the last line, insert prior to the word "shall" the following: "and any cost, loss or damages to the Owner resulting from such failure or defect,"

109. Article 12.2.2.1

Add to the end of the provision "The Contractor shall advise the Owner, 60 days prior to the end of the one year period for correction of work, that sixty (60) days remain in the applicable warranty period.

110. Article 13.2.2

Delete subparagraph 13.2.2.

111. Article 13.2.3

Add new subparagraph 13.2.3 as follows:

"If the Owner conveys its interest in the Project to a third party, any rights which the Owner may have against the Contractor arising from this Agreement including without limitation Claims under Article 12 or Claims which, under the terms of subparagraph 9.10.4, are reserved to the Owner after the making and acceptance of final payment, shall automatically transfer to such third party."

112. Article 13.5.4

Change subparagraph 13.5.4 to read as follows:

"The Contractor shall obtain and deliver promptly to the Architect any occupancy permit and any certificates of final inspection of any part of the Contractor's work and operating permits for any mechanical apparatus, such as elevators, escalators, boilers, air compressors, etc., which may be required by law to permit full use and occupancy of the premises by the Owner. Receipt of such permits or certificates by the Architect shall be a condition precedent to Substantial Completion of the Work."

113. Article 13.5.5

Delete subparagraph 13.5.5 in its entirety.

114. Article 13.6

Delete Article 13.6 in its entirety.

115. Article 13.9

Add new Paragraph 13.9

"13.9 - DEFENSE OF SUITS

Article 13.9.1

The Contractor shall be responsible for, shall defend and pay all costs, attorneys' fees and liabilities both direct and indirect as a result of suits arising out of this Contract.

Article 13.9.2

Neither final acceptance nor occupation of the premises by the Owner shall relieve the Contractor of responsibility for all claims for labor, materials, and equipment arising out of this contract.

Article 13.9.3

The Contractor shall indemnify and hold harmless the Owner and the Architect and their agents and employees from and against all claims, damages, losses, and expenses including attorneys' fees arising out of or resulting from the performance of the work."

116. Article 14.1.1.4

Delete subparagraph 14.1.1.4.

117. Article 14.1.2

Delete this subparagraph in its entirety.

118. Article 14.1.3

Revise subparagraph 14.1.3 as follows:

"If one of the above reasons exists, the Contractor may, upon seven additional days written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for the Work executed and for all materials or equipment not incorporated in the Work, but delivered and suitably stored at the site. The payment for materials or equipment stored at the site shall be conditioned upon submission by the Contractor of bills of sale or such other evidence as is satisfactory to the Owner to establish the Owner's title to such material or equipment or otherwise protect the Owner's interest."

119. Article 14.2

Change paragraph 14.2 to read as follows:

"TERMINATION BY THE OWNER FOR CAUSE

If the Contractor is adjudged a bankrupt, or if the Contractor makes a general assignment for the benefit of the Contractor's creditors, or if a receiver is appointed on account of the Contractor's insolvency, or if the Contractor persistently or repeatedly refuses or fails, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or if the Contractor fails to make prompt payment to Subcontractors or for materials or labor, or persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction or disregards an instruction, order or decision of the Architect, or otherwise is guilty of a substantial violation of any provision of the Contract, then the Contractor shall be in default, and the Owner may, without prejudice to any other right or remedy and upon written notice to the Contractor, take possession of all materials, tools, appliances, equipment, construction equipment and machinery and vehicles, offices and other facilities on the Project site, and all materials intended for the Work, wherever stored, and, seven (7) days after such notice, may terminate the employment of the Contractor, accept assignment of any or all subcontracts pursuant to paragraph 5.4, and finish the Work by whatever method the Owner may deem expedient. The Owner shall be entitled to collect from the Contractor all direct, indirect, and consequential damages suffered by the Owner on account of the Contractor's default, including without limitation additional services and expenses of the Architect made necessary thereby. The Owner shall be entitled to hold all amounts due the Contractor at the date of termination until all of the Owner's damages have been established, and to apply such amounts to such damages."

120. Article 14.3

Delete Paragraph 14.3.

121. Article 14.4.3

Delete subparagraph 14.4.3 and substitute the following:

"In the event that the Contract is terminated pursuant to paragraph 14.1, the Contractor shall be reimbursed in accordance with the Contract Documents for all Work performed up to the termination date, and for all materials or equipment not incorporated in the Work, but delivered and suitably stored at the site. Payment for materials or equipment stored at the site shall be conditioned upon submission by the Contractor of bills of sale or such other evidence as is satisfactory to the Owner to establish the Owner's title to such material or equipment or otherwise protect the Owner's interest."

122. Article 15 – CORI REQUIREMENTS AND COVID-19 PROTOCOLS

New Article 15 - CORI REQUIREMENTS AND COVID-19 PROTOCOLS is added, as follows:

"ARTICLE 15 - CORI REQUIREMENTS AND COVID-19 PROTOCOLS

15.1 CORI Background Checks: As a condition of this Contract any Contractor working on the project site must perform a background check

- .1 Type of Background Checks: The Prime Contractor/General Contractor shall be responsible for performing background checks including federal and state criminal and sex offender (CORI) checks on all employees and subcontractors proposed for work on this project site.
- .2 All background checks shall be conducted in accordance with applicable federal and state laws.

15.2 COVID-19 Protocols: Guidelines and Procedures have been established in response to COVID-19 Coronavirus Pandemic. Refer to the requirements of the Contract Documents including provisions stated in Document 00 8050 COVID-19 GUIDELINES AND PROCEDURES DURING CONSTRUCTION."

END OF DOCUMENT

DOCUMENT 00 80 10

EXCERPTS FROM MASSACHUSETTS GENERAL LAWS (MGL) CHAPTERS 30, 82, and 149

Excerpts from Chapters 30, 82 and 149 of the Massachusetts General Laws

NOTICE - These are **NOT** the official versions of the Massachusetts General Laws (MGL). While reasonable efforts have been made to assure the accuracy of the excerpts provided, do not rely on this information without first checking an official edition of the MGL. If you are in need of legal advice or counsel, consult a lawyer. These excerpts include amendments to the General Laws passed through February 28, 2014. For laws enacted since that time, see the 2014 Session Laws.

Certain excerpts from the Massachusetts General Laws are applicable to Construction contracts. Attention is directed to the following Sections of Chapter 149 as amended.

Section 25. Lodging, board and trade of public employees; statute part of employment contract.

"Every employee in public work shall lodge, board, and trade where and with whom he elects; and no person or his agents or employees under contract with the commonwealth, a county, city or town, or with a department, board, commission or officer acting therefor, for the doing of public work shall directly or indirectly require, as a condition of employment therein, that the employee shall lodge, board or trade at a particular place or with a particular person. This section shall be made a part of the contract for such employment."

Section 26. Public works; preference to veterans and citizens; wages.

"In the employment of mechanics and apprentices, teamsters, chauffeurs and laborers in the construction of public works by the commonwealth, or by a county, town, authority or district, or by persons contracting or subcontracting for such works, preference shall first be given to citizens of the commonwealth who have been residents of the commonwealth for at least six months at the commencement of their employment who are veterans as defined in clause Forty-third of section 7 of chapter 4, and who are qualified to perform the work to which the employment relates; and, within such preference, preference shall be given to service-disabled veterans; and secondly, to citizens of the commonwealth generally who have been residents of the commonwealth for at least six months at the commencement of their employment, and if they cannot be obtained in sufficient numbers, then to citizens of the United States, and every contract for such work shall contain a provision to this effect..."

Section 34. Public contracts; stipulation as to hours and days of work; void contracts.

"Every contract, except for the purchase of material or supplies, involving the employment of laborers, workmen, mechanics, foremen or inspectors, to which the commonwealth or any county or any town, subject to section thirty, is a party, shall contain a stipulation that no laborer, workman, mechanic, foreman or inspector working within the commonwealth, in the employ of the contractor, subcontractor or other person doing or contracting to do the whole or a part of the work contemplated by the contract, shall be required or permitted to work more than eight hours in any one-day or more than forty-eight hours in any one week, or more than six days in any one week, except in cases of emergency, or, in case any town subject to section thirty-one is a party to such a contract, more than eight hours in any one-day, except as aforesaid..."

Section 34A. Contracts for public works; workers' compensation insurance; breach of contract; enforcement and violation of statute.

"Every contract for the construction, alteration, maintenance, repair or demolition of, or addition to, any public building or other public works for the commonwealth or any political subdivision thereof shall contain stipulations requiring that the contractor shall, before commencing performance of such contract, provide by insurance for the payment of compensation and the furnishing of other benefits under chapter one hundred and fifty-two to all persons to be employed under the contract, and that the

contractor shall continue such insurance in full force and effect during the term of the contract. No officer or agent contracting in behalf of the commonwealth or any political subdivision thereof shall award such a contract until he has been furnished with sufficient proof of compliance with the aforesaid stipulations. Failure to provide and continue in force such insurance as aforesaid shall be deemed a material breach of the contract and shall operate as an immediate termination thereof. No cancellation of such insurance, whether by the insurer or by the insured, shall be valid unless written notice thereof is given by the party proposing cancellation to the other party and to the officer or agent who awarded the contract at least fifteen days prior to the intended effective date thereof, which date shall be expressed in said notice. Notice of cancellation sent by the party proposing cancellation by registered mail, postage prepaid, with a return receipt of the addressee requested, shall be a sufficient notice..."

Section 34B. Contracts for public works; wages for reserve police officer.

"Every contract for the construction, alteration, maintenance, repair or demolition of, or addition to, any public works for the commonwealth or any political subdivision thereof shall contain stipulations requiring that the contractor shall pay to any reserve police officer employed by him in any city or town the prevailing rate of wage paid to regular police officers in such city or town."

Whenever general bids are invited for a contract subject to Section 44A, the following provision applies:

Section 44E. Filing of bids; forms; modular buildings.

Second paragraph of subdivision (2), clause E.

"The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that he will comply fully with all laws and regulations applicable to awards made subject to section 44A."

For projects estimated to cost more than \$20,000, the following provision applies to sub-bidders:

Section 44F. Plans and specifications; sub-bids; form; contents.

First paragraph of clause I of subdivision (2) of section 44F.

"The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that he will comply fully with all laws and regulations applicable to awards of subcontracts subject to section 44F."

Section 44G. Allowances; alternates; weather protection devices.

"(A) "Allowance" as used herein means a sum of money covering one or more items of labor or labor and materials which is designated in bid documents and which general bidders are required to use in computing their bids. The use of such allowances shall be prohibited in the award of any contract subject to the provisions of section forty-four A. Whenever the designer is unable to supply specifications for any item prior to the solicitation of bids, such item shall not be included in any contract subject to the provisions of section forty-four A. The awarding authority shall solicit bids for every such item separately pursuant to the provisions of section forty-four A after specifications for that item are prepared.

Every alternate contained in the form for general bids shall be listed in a numerical sequence in order of priority. When the awarding authority decides to consider alternates in determining the lowest eligible and responsible bidder, the awarding authority shall consider the alternates in descending numerical sequence, such that no single alternate shall be considered unless every alternate preceding it on the list has been added to or subtracted from the base bid price.

The use of options other than alternates in bid documents or bid forms subject to section forty- four A shall be prohibited under all circumstances.

Every contract subject to section forty-four A shall include specifications for the installation of weather protection and shall require that the contractor shall install the same and that he shall furnish adequate heat in the area so protected during the months of November through March. Standards for such specifications shall be established by the commissioner or his designee."

Section 44J. Invitations to bid; notice; contents; violations; penalty.

"(1) No public agency or authority of the commonwealth or any political subdivision thereof shall award any contract for which competitive bids are required pursuant to section forty-four A of this chapter or section thirty-nine M of chapter thirty, or for which competitive proposals are required pursuant to subsection (4) of section forty-four E of this chapter or section eleven C of chapter twenty-five A, unless a notice inviting bids or proposals therefor shall have been posted no less than one week prior to the time specified in such notice for the receipt of said bids or proposals in a conspicuous place in or near the offices of the awarding authority, and shall have remained posted until the time so specified, and unless such notice shall also have been published at least once not less than two weeks prior to the time so specified in the central register published by the secretary of state pursuant to section twenty A of chapter nine and in a newspaper of general circulation in the locality of the proposed project. Said notice shall also be published at such other times and in such other newspapers or trade periodicals as the commissioner of capital asset management and maintenance may require, having regard to the locality of the work involved.

Said notice shall specify the time and place where plans and specification of the proposed work may be had; the time and place of submission of general bids; and the time and place for opening of the general bids. For contracts subject to the provisions of section forty-four A to H, inclusive, of this chapter, said notice shall also specify the time and place for submission of filed sub-bids, where required pursuant to section forty-four F; and the time and place for opening of said filed sub-bids.

Said notice shall also provide sufficient facts concerning the nature and scope of such project, the type and elements of construction, and such other information as will assist applicants in deciding to bid on such contract.

No contract or preliminary plans and specifications shall be split or divided for the purpose of evading the provisions of this section.

General bids and filed sub-bids for any contract subject to this section shall be in writing and shall be opened in public at the time and place specified in the posted or published notice, and after being so opened shall be open to public inspection.

The provisions of this section shall not apply to any transaction between the commonwealth and any public service corporation.

The provisions of this section may be waived in cases of extreme emergency involving the health and safety of the people and their property, upon the written approval of said commissioner. The written approval shall contain a description of the circumstances and the reasons for the commissioner's determination.

Whoever violates any provision of this section shall be punished by a fine of not more than ten thousand dollars or by imprisonment in the state prison for not more than three years or in a jail or house of correction for not more than two and one-half years, or by both said fine and imprisonment; and in the event of final conviction, said person shall be incapable of holding any office of honor, trust or profit under the commonwealth or under any county, district or municipal agency.

Each and every person who shall cause or conspire to cause any contract or preliminary plans and specifications to be split or divided for the purpose of evading the provisions of this section shall forfeit and pay to the commonwealth, a political subdivision thereof or other awarding authority subject to this section, the sum of not more than five thousand dollars and, in addition, such person or persons shall pay, apportioned among them, double the amount of damages which the commonwealth or political subdivision thereof or other awarding authority may have sustained by reason of the doing of such act, together with the costs of the action.

If an awarding authority rejects all general bids or does not receive any general bids, and advertises for a second opening of general bids with the original filed sub-bids as set forth in subsection (1) of section forty-four E the notice for receipt of such general bids may be published in the central register and elsewhere as required not less than one week prior to the time specified for such second opening of general bids.

No request for proposals or invitation for bids issued under sections 38A ½ to 38O, inclusive, of chapter 7, section 11C of chapter 25A, section 39M of chapter 30, this section and sections 44A to 44H, inclusive, shall be advertised if the awarding authority's cost estimate is greater than one (1) year old."

Attention is directed to the following sections of Chapter 30 of the General Laws of Massachusetts as amended to date.

Section 38A. Price adjustment clause in contracts for road, bridge, water and sewer projects awarded under Sec. 39M

"Contracts for road and bridge projects awarded as a result of a proposal or invitation for bids under section 39M shall include a price adjustment clause for each of the following materials: fuel, both diesel and gasoline; asphalt; concrete; and steel. Contracts for water and sewer projects awarded as a result of a proposal or invitation for bids under said section 39M shall include a price adjustment clause for fuel, both diesel and gasoline; liquid asphalt; and Portland cement contained in cast-in-place concrete. A base price for each material shall be set by the awarding authority or agency and shall be included in the bid documents at the time the project is advertised. The awarding authority or agency shall also identify in the bid documents the price index to be used for each material. The price adjustment clause shall provide for a contract adjustment to be made on a monthly basis when the monthly cost change exceeds plus or minus 5 per cent."

Section 39F. Construction contracts; assignment and subrogation; subcontractor defined; enforcement of claim for direct payment; deposit; reduction of disputed amounts.

"(1) Every contract awarded pursuant to sections forty-four A to L inclusive, of chapter one hundred and forty-nine shall contain the following subparagraphs (a) through (i) and every contract awarded pursuant to section thirty-nine M of chapter thirty shall contain the following subparagraphs (a) through (h) and in each case those subparagraphs shall be binding between the general contractor and each subcontractor.

(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

Not later than the sixty-fifth-day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

Each payment made by the awarding authority to the general contractor pursuant to subparagraphs (a) and (b) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor; and the awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (a) and (b), the awarding authority shall act upon the demand as provided in this section.

If, within seventy days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the seventieth day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the awarding authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided, that the awarding authority shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (d). The awarding authority shall make further direct payments to the subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this subparagraph.

The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the general contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (f) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the general contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of such payment.

The awarding authority shall deduct from payments to a general contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f), are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor.

If the subcontractor does not receive payment as provided in subparagraph (a) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (a), the subcontractor may demand direct payment by following the procedure in subparagraph (d) and the general contractor may file a sworn reply as provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the awarding authority shall proceed as provided in subparagraph (e), (f), (g), and (h).

(2) Any assignment by a subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of section twenty-nine of chapter one hundred forty-nine shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the awarding authority or which are on deposit pursuant to subparagraph (f) of paragraph (1) shall be subordinate to the rights of all subcontractors who are entitled to be paid under this section and who have not been paid in full.

"Subcontractor" as used in this section (i) for contracts awarded as provided in sections forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall mean a person who files a sub-bid and receives a subcontract as a result of that filed sub-bid or who is approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, (ii) for contracts awarded as provided in paragraph (a) of section thirty-nine M of chapter thirty shall mean a person approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, and (iii) for contracts with the commonwealth not awarded as provided in forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall also mean a person contracting with the general contractor to supply materials used or employed in a public works project for a price in excess of five thousand dollars.

A general contractor or a subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposited as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the awarding authority and the general contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. Sections fifty-nine and fifty-nine B of chapter two hundred thirty-one shall apply to such petitions. The court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to sections fifty-nine and fifty-nine B and, upon motion of any party, shall advance for speedy trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any subcontractor with the petition of one or more subcontractors or the same general contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the

fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited in excess of the interest earned for the period of any such deposit. No person except a subcontractor filing a demand for direct payment for which no funds due the general contractor are available for direct payment shall have a right to file a petition in court of equity against the awarding authority claiming a demand for direct payment is premature and such subcontractor must file the petition before the awarding authority has made a direct payment to the subcontractor and has made a deposit of the disputed portion as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1).

In any petition to collect any claim for which a subcontractor has filed a demand for direct payment the court shall, upon motion of the general contractor, reduce by the amount of any deposit of a disputed amount by the awarding authority as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1) any amount held under a trustee writ or pursuant to a restraining order or injunction."

Section 39G. Completion of public works; semi-final and final estimates; payments; extra work; disputed items.

"Upon substantial completion of the work required by a contract with the commonwealth, or any agency or political subdivision thereof, for the construction, reconstruction, alteration, remodeling, repair or improvement of public ways, including bridges and other highway structures, sewers and water mains, airports and other public works, the contractor shall present in writing to the awarding authority its certification that the work has been substantially completed. Within twenty-one days thereafter, the awarding authority shall present to the contractor either a written declaration that the work has been substantially completed or an itemized list of incomplete or unsatisfactory work items required by the contract sufficient to demonstrate that the work has not been substantially completed. The awarding authority may include with such list a notice setting forth a reasonable time, which shall not in any event be prior to the contract completion date, within which the contractor must achieve substantial completion of the work. In the event that the awarding authority fails to respond, by presentation of a written declaration or itemized list as aforesaid, to the contractor's certification within the twenty-one-day period, the contractor's certification shall take effect as the awarding authority's declaration that the work has been substantially completed.

Within sixty-five days after the effective date of a declaration of substantial completion, the awarding authority shall prepare and forthwith send to the contractor for acceptance a substantial completion estimate for the quantity and price of the work done and all but one percent retainage on that work, including the quantity, price and all but one percent retainage for the undisputed part of each work item and extra work item in dispute but excluding the disputed part thereof, less the estimated cost of completing all incomplete and unsatisfactory work items and less the total periodic payments made to date for the work. The awarding authority also shall deduct from the substantial completion estimate an amount equal to the sum of all demands for direct payment filed by subcontractors and not yet paid to subcontractors or deposited in joint accounts pursuant to section thirty-nine F, but no contract subject to said section thirty-nine F shall contain any other provision authorizing the awarding authority to deduct any amount by virtue of claims asserted against the contract by subcontractors, material suppliers or others.

If the awarding authority fails to prepare and send to the contractor any substantial completion estimate required by this section on or before the date herein above set forth, the awarding authority shall pay to the contractor interest on the amount which would have been due to the contractor pursuant to such substantial completion estimate at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston from such date to the date on which the awarding authority sends that substantial completion estimate to the contractor for acceptance or to the date of payment therefor, whichever occurs first. The awarding authority shall include the amount of such interest in the substantial completion estimate.

Within fifteen-days after the effective date of the declaration of substantial completion, the awarding authority shall send to the contractor by certified mail, return receipt requested, a complete list of all incomplete or unsatisfactory work items, and, unless delayed by causes beyond his control, the contractor shall complete all such work items within forty-five-days after the receipt of such list or before the then contract completion date, whichever is later. If the contractor fails to complete such work within such time, the awarding authority may, subsequent to seven-days' written notice to the contractor by certified mail, return receipt requested, terminate the contract and complete the incomplete or unsatisfactory work items and charge the cost of same to the contractor.

Within thirty days after receipt by the awarding authority of a notice from the contractor stating that all of the work required by the contract has been completed, the awarding authority shall prepare and forthwith send to the contractor for acceptance a final estimate for the quantity and price of the work done and all retainage on that work less all payments made to date, unless the awarding authority's inspection shows that work items required by the contract remain incomplete or unsatisfactory, or that documentation required by the contract has not been completed. If the awarding authority fails to prepare and send to the contractor the final estimate within thirty days after receipt of notice of completion, the awarding authority shall pay to the contractor interest on the amount which would have been due to the contractor pursuant to such final estimate at the rate hereinabove provided from the thirtieth day after such completion until the date on which the awarding authority sends the final estimate to the contractor for acceptance or the date of payment therefor, whichever occurs first, provided that the awarding authority's inspection shows that no work items required by the contract remain incomplete or unsatisfactory. Interest shall not be paid hereunder on amounts for which interest is required to be paid in connection with the substantial completion estimate as hereinabove provided. The awarding authority shall include the amount of the interest required to be paid hereunder in the final estimate.

The awarding authority shall pay the amount due pursuant to any substantial completion or final estimate within thirty-five days after receipt of written acceptance for such estimate from the contractor and shall pay interest on the amount due pursuant to such estimate at the rate hereinabove provided from that thirty-fifth day to the date of payment. Within 15 days, 30 days in the case of the commonwealth, after receipt from the contractor, at the place designated by the awarding authority, if such place is so designated, of a periodic estimate requesting payment of the amount due for the preceding periodic estimate period, the awarding authority shall make a periodic payment to the contractor for the work performed during the preceding periodic estimate period and for the materials not incorporated in the work but delivered and suitably stored at the site, or at some location agreed upon in writing, to which the contractor has title or to which a subcontractor has title and has authorized the contractor to transfer title to the awarding authority, upon certification by the contractor that he is the lawful owner and that the materials are free from all encumbrances. The awarding authority shall include with each such payment interest on the amount due pursuant to such periodic estimate at the rate herein above provided from the due date. In the case of periodic payments, the contracting authority may deduct from its payment a retention based on its estimate of the fair value of its claims against the contractor, a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, and a retention to secure satisfactory performance of the contractual work not exceeding five per cent of the approved amount of any periodic payment, and the same right to retention shall apply to bonded subcontractors entitled to direct payment under section thirty- nine F of chapter thirty; provided, that a five per cent value of all items that are planted in the ground shall be deducted from the periodic payments until final acceptance.

No periodic, substantial completion or final estimate or acceptance or payment thereof shall bar a contractor from reserving all rights to dispute the quantity and amount of, or the failure of the awarding authority to approve a quantity and amount of, all or part of any work item or extra work item.

Substantial completion, for the purposes of this section, shall mean either that the work required by the contract has been completed except for work having a contract price of less than one percent of the then adjusted total contract price, or substantially all of the work has been completed and opened to public use except for minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the work required by the contract."

Section 39I. Deviations from plans and specifications.

"Every contractor having a contract for the construction, alteration, maintenance, repair or demolition of, or addition to, any public building or public works for the commonwealth, or of any political subdivision thereof, shall perform all the work required by such contract in conformity with the plans and specifications contained therein. No willful and substantial deviation from said plans and specifications shall be made unless authorized in writing by the awarding authority or by the engineer or architect in charge of the work who is duly authorized by the awarding authority to approve such deviations. In order to avoid delays in the prosecution of the work required by such contract such deviation from the plans or specifications may be authorized by a written order of the awarding authority or such engineer or architect so authorized to approve such deviation. Within thirty days thereafter, such written order shall be confirmed by a certificate of the awarding authority stating: (1) if such deviation involves any substitution or elimination of materials, fixtures or equipment, the reasons why such materials, fixtures or equipment were included in the first instance and the reasons for substitution or elimination, and, if the deviation is of any other nature, the reasons for such deviation, giving justification therefor; (2) that the specified deviation does not materially injure the project as a whole; (3) that either the work substituted for the work specified is of the same cost and quality, or that an equitable adjustment has been agreed upon between the contracting agency and the contractor and the amount in dollars of said adjustment; and (4) that the deviation is in the best interest of the contracting authority.

Such certificate shall be signed under the penalties of perjury and shall be a permanent part of the file record of the work contracted for.

Whoever violates any provision of this section willfully and with intent to defraud shall be punished by a fine of not more than five thousand dollars or by imprisonment for not more than six months, or both."

Section 39J. Public construction contracts; effect of decisions of contracting body or administrative board.

"Notwithstanding any contrary provision of any contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building or public works by the commonwealth, or by any county, city, town, district, board, commission or other public body, when the amount of the contract is more than five thousand dollars in the case of the commonwealth and more than two thousand dollars in the case of any county, city, town, district, board, commission or other public body, a decision, by the contracting body or by any administrative board, official or agency, or by any architect or engineer, on a dispute, whether of fact or of law, arising under said contract shall not be final or conclusive if such decision is made in bad faith, fraudulently, capriciously, or arbitrarily is unsupported by substantial evidence, or is based upon error of law."

Section 39K. Public building construction contracts; payments.

"Every contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building by the commonwealth, or by any county, city, town, district, board, commission or other public body, when the amount is more than five thousand dollars in the case of the commonwealth and more than two thousand dollars in the case of any county, city, town, district, board, commission or other public body, shall contain the following paragraph: Within fifteen days (thirty days in the case of the commonwealth, including local housing authorities) after receipt from the contractor, at the place designated by the awarding authority if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the awarding authority will make a periodic payment to the contractor for the work performed during the preceding month and for the materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the contractor has title or to which a subcontractor has title and has authorized the contractor to transfer title to the awarding authority, upon certification by the contractor that he is the lawful owner and that the materials are free from all encumbrances, but less (1) a retention based on its estimate of the fair value of its claims against the contractor and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, and less (3) a retention not exceeding five percent of the approved amount of the periodic

payment. After the receipt of a periodic estimate requesting final payment and within sixty-five-days after (a) the contractor fully completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the awarding authority, less than one percent of the original contract price, or (b) the contractor substantially completes the work and the awarding authority takes possession for occupancy, whichever occurs first, the awarding authority shall pay the contractor the entire balance due on the contract less, (1) a retention based on its estimate of the fair value of its claims against the contractor and of the cost of completing the incomplete and unsatisfactory items of work and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, or based on the record of payments by the contractor to the subcontractors under this contract if such record of payment indicates that the contractor has not paid subcontractors as provided in section thirty-nine F. If the awarding authority fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the contractor; provided, that no interest shall be due, in any event, on the amount due on a periodic estimate for final payment until fifteen days (twenty-four days in the case of the commonwealth) after receipt of such a periodic estimate from the contractor, at the place designated by the awarding authority if such a place is so designated. The contractor agrees to pay to each subcontractor a portion of any such interest paid in accordance with the amount due each subcontractor.

The awarding authority may make changes in any periodic estimate submitted by the contractor and the payment due on said periodic estimate shall be computed in accordance with the changes so made, but such changes or any requirement for a corrected periodic estimate shall not affect the due date for the periodic payment or the date for the commencement of interest charges on the amount of the periodic payment computed in accordance with the changes made, as provided herein; provided, that the awarding authority may, within seven days after receipt, return to the contractor for correction, any periodic estimate which is not in the required form or which contains computations not arithmetically correct and, in that event, the date of receipt of such periodic estimate shall be the date of receipt of the corrected periodic estimate in proper form with arithmetically correct computations. The date of receipt of a periodic estimate received on a Saturday shall be the first working day thereafter. The provisions of section thirty-nine G shall not apply to any contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building to which this section applies.

All periodic estimates shall be submitted to the awarding authority, or to its designee as set forth in writing to the contractor, and the date of receipt by the awarding authority or its designee shall be marked on the estimate. All periodic estimates shall contain a separate item for each filed subtrade and each sub-subtrade listed in sub-bid form as required by specifications and a column listing the amount paid to each subcontractor and sub-subcontractor as of the date the periodic estimate is filed. The person making payment for the awarding authority shall add the daily interest provided for herein to each payment for each day beyond the due date based on the date of receipt marked on the estimate.

A certificate of the Engineer to the effect that the contractor has fully or substantially completed the work shall, subject to the provisions of section thirty-nine J, be conclusive for the purposes of this section.

Notwithstanding the provisions of this section, at any time after the value of the work remaining to be done is, in the estimation of the awarding authority, less than 1 per cent of the adjusted contract price, or the awarding authority has determined that the contractor has substantially completed the work and the awarding authority has taken possession for occupancy, the awarding authority may send to the general contractor by certified mail, return receipt requested, a complete and final list of all incomplete and unsatisfactory work items, including, for each item on the list, a good faith estimate of the fair and reasonable cost of completing such item. The general contractor shall then complete all such work items within 30 days of receipt of such list or before the contract completion date, whichever is later. If the general contractor fails to complete all incomplete and unsatisfactory work items within 45 days after receipt of such items furnished by the awarding authority or before the contract completion date, whichever is later, subsequent to an additional 14 days' written notice to the general contractor by certified mail, return receipt requested, the awarding authority may terminate the contract and complete

the incomplete and unsatisfactory work items and charge the cost of same to the general contractor and such terminations shall be without prejudice to any other rights or remedies the awarding authority may have under the contract. The awarding authority shall note any such termination in the evaluation form to be filed by the awarding authority pursuant to the provisions of section 44D of chapter 149."

Section 39L. Public construction work by foreign corporations; restrictions and reports.

"The commonwealth and every county, city, town, district, board, commission or other public body which, as the awarding authority, request proposals, bids or sub-bids for any work in the construction, reconstruction, alteration, remodeling, repair or demolition of any public building or other public works (1) shall not enter into a contract for such work with, and shall not approve as a subcontractor furnishing labor and materials for a part of the work, a foreign corporation which has not filed with such awarding authority a certificate of the state secretary stating that the corporation has complied with requirements of section 15.03 of subdivision A of Part 15 of chapter 156D and the date of compliance, and further has filed all annual reports required by section 16.22 of subdivision B of Part 16 of said chapter 156D, and (2) shall report to the state secretary and to the department of corporations and taxation any foreign corporation performing work under such contract or subcontract, and any person, other than a corporation, performing work under such contract or subcontract, and residing or having a principal place of business outside the commonwealth."

Section 39M. Contracts for construction and materials; manner of awarding.

"(b) Specifications for such contracts, and specifications for contracts awarded pursuant to the provisions of said sections forty-four A to forty-four L of said chapter one hundred and forty-nine, shall be written to provide for full competition for each item of material to be furnished under the contract; except, however, that said specifications may be otherwise written for sound reasons in the public interest stated in writing in the public records of the awarding authority or promptly given in writing by the awarding authority to anyone making a written request therefor, in either instance such writing to be prepared after reasonable investigation. Every such contract shall provide that an item equal to that named or described in the said specifications may be furnished; and an item shall be considered equal to the item so named or described if, in the opinion of the awarding authority: (1) it is at least equal in quality, durability, appearance, strength and design, (2) it will perform at least equally the function imposed by the general design for the public work being contracted for or the material being purchased, and (3) it conforms substantially, even with deviations, to the detailed requirements for the item in the said specifications.

For each item of material, the specifications shall provide for either a minimum of three named brands of material or a description of material which can be met by a minimum of three manufacturers or producers, and for the equal of any one of said named or described materials."

For projects estimated to cost more than \$10,000, the following provision, section 39M subsection c, applies:

"(c) The term "lowest responsible and eligible bidder" shall mean the bidder: (1) whose bid is the lowest of those bidders possessing the skill, ability and integrity necessary for the faithful performance of the work; (2) who shall certify, that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work; (3) who shall certify that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; (4) who, where the provisions of section 8B of chapter 29 apply, shall have been determined to be qualified thereunder; and (5) who obtains within 10 days of the notification of contract award the security by bond required under section 29 of chapter 149; provided that for the purposes of this section the term "security by bond" shall mean the bond of a surety company qualified to do business under the laws of the commonwealth and satisfactory to the awarding authority; provided further, that if there is more than 1 surety company, the surety companies shall be jointly and severally liable."

Section 39N. Construction contracts; equitable adjustment in contract price for differing subsurface or latent physical conditions.

"Every contract subject to section forty-four A of chapter one hundred and forty-nine or subject to section thirty-nine M of chapter thirty shall contain the following paragraph in its entirety and an awarding authority may adopt reasonable rules or regulations in conformity with that paragraph concerning the filing, investigation and settlement of such claims:

If, during the progress of the work, the contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the contract documents either the contractor or the contracting authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a contractor, or upon its own initiative, the contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents and are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly."

Section 39O. Contracts for construction and materials; suspension, delay or interruption due to order of awarding authority; adjustment in contract price; written claim.

"Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim."

Section 39P. Contracts for construction and materials; awarding authority's decisions on interpretation of specifications, etc.; time limit; notice.

"Every contract subject to section thirty-nine M of this chapter or section forty-four A of chapter one hundred forty-nine which requires the awarding authority, any official, its architect or engineer to make a decision on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, shall require that the decision be made promptly and, in any event, no later than thirty days after the written submission for decision; but if such decision requires extended investigation and study, the awarding authority, the official, architect or engineer shall, within thirty days after the receipt of the submission, give the party making the submission written notice of the reasons why the decision cannot be made within the thirty day period and the date by which the decision will be made."

Section 39Q. Contracts for capital facility construction; contents; annual claims report.

"(1) Every contract awarded by any state agency as defined by section thirty-nine A of chapter seven for the construction, reconstruction, alteration, remodeling, repair or demolition of any capital facility as defined by the aforesaid section thirty-nine A shall contain the following subparagraphs (a) through (d) in their entirety:

(a) Disputes regarding changes in and interpretations of the terms or scope of the contract and denials of or failures to act upon claims for payment for extra work or materials shall be resolved according to the following procedures, which shall constitute the exclusive method for resolving such disputes. Written notice of the matter in dispute shall be submitted promptly by the claimant to the chief executive official of the state agency which awarded the contract or his designee. No person or business entity having a contract with a state agency shall delay, suspend, or curtail performance under that contract as a result of any dispute subject to this section. Any disputed order, decision or action by the agency or its authorized representative shall be fully performed or complied with pending resolution of the dispute.

Within thirty days of submission of the dispute to the chief executive official of the state agency or his designee, he shall issue a written decision stating the reasons therefor, and shall notify the parties of their right of appeal under this section. If the official or his designee is unable to issue a decision within thirty days, he shall notify the parties to the dispute in writing of the reasons why a decision cannot be issued within thirty days and of the date by which the decision shall issue. Failure to issue a decision within the thirty-day period or within the additional time period specified in such written notice shall be deemed to constitute a denial of the claim and shall authorize resort to the appeal procedure described below. The decision of the chief executive official or his designee shall be final and conclusive unless an appeal is taken as provided below.

Within twenty-one calendar days of the receipt of a written decision or of the failure to issue a decision as stated in the preceding subparagraph, any aggrieved party may file a notice of claim for an adjudicatory hearing with the division of hearing officers or the aggrieved party may file an action directly in a court of competent jurisdiction and shall serve copies thereof upon all other parties in the form and manner prescribed by the rules governing the conduct of adjudicatory proceedings of the division of hearing officers. In the event an aggrieved party exercises his option to file an action directly in court as provided in the previous sentence, the twenty-one day period shall not apply to such filing and the period of filing such action shall be the same period otherwise applicable for filing a civil action in superior court. The appeal shall be referred to a hearing officer experienced in construction law and shall be prosecuted in accordance with the formal rules of procedure for the conduct of adjudicatory hearings of the division of hearing officers, except as provided below. The hearing officer shall issue a final decision as expeditiously as possible, but in no event more than one hundred and twenty calendar days after conclusion of the adjudicatory hearing, unless the decision is delayed by a request for extension of time for filing post-hearing briefs or other submissions assented to by all parties. Whenever, because an extension of time has been granted, the hearing officer is unable to issue a decision within one hundred and twenty days, he shall notify all parties of the reasons for the delay and the date when the decision will issue. Failure to issue a decision within the one hundred and twenty-day period or within the additional period specified in such written notice shall give the petitioner the right to pursue any legal remedies available to him without further delay.

When the amount in dispute is less than ten thousand dollars, a contractor who is party to the dispute may elect to submit the appeal to a hearing officer experienced in construction law for expedited hearing in accordance with the informal rules of practice and procedure of the division of hearing officers. An expedited hearing under this subparagraph shall be available at the sole option of the contractor. The hearing officer shall issue a decision no later than sixty days following the conclusion of any hearing conducted pursuant to this subparagraph. The hearing officer's decision shall be final and conclusive, and shall not be set aside except in cases of fraud.

(2) The commissioner of administration shall require the division of hearings officers to prepare annually a report concerning the construction contract claims submitted to the division during the preceding twelve months, in such form as the commissioner shall prescribe. The report shall contain, at a minimum, the following information: the number of claims submitted; the names of all parties to each such claim; a brief description of the claim; the date of submission and of disposition of the claim; its disposition, whether by settlement, withdrawal, default or written decision; and the number of claims currently pending. The original of the report shall be submitted to the commissioner of administration by January fifteenth, and a copy shall be filed with the state librarian and shall be a public document."

Section 39R. Definitions; contract provisions; management and financial statements; enforcement.

"(a) The words defined herein shall have the meaning stated below whenever they appear in this section:

"Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to sections thirty-eight A 1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A to forty-four H, inclusive, of chapter one hundred and forty-nine, which is for an amount or estimated amount greater than one hundred thousand dollars.

"Contract" means any contract awarded or executed pursuant to sections thirty-eight A 1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A through forty-four H, inclusive, of chapter one hundred and forty-nine, which is for amount or estimated amount greater than one hundred thousand dollars.

"Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

"Independent Certified Public Accountant" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his residence or principal office and who is in fact independent. In determining whether an accountant is independent with respect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with the awarding authority.

"Audit," when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

"Accountant's Report," when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he has made and sets forth his opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefor shall be stated. An accountant's report shall include as a part thereof a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of the financial condition of the contractor.

"Management," when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the contractor.

Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

Subsection (a)(2) hereof notwithstanding, every agreement or contract awarded or executed pursuant to sections thirty-eight A 1/2 to thirty-eight O, inclusive, of chapter seven, or eleven C of chapter twenty-five A, and pursuant to section thirty-nine M of chapter thirty or to section forty-four A through H, inclusive, of chapter one hundred and forty-nine, shall provide that:

The contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the contractor, and

Until the expiration of six years after final payment, the office of inspector general, and the commissioner of capital asset management and maintenance shall have the right to examine any books, documents, papers or records of the contractor or of his subcontractors that directly pertain to, and involve transactions relating to, the contractor or his subcontractors, and

If the agreement is a contract as defined herein, the contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the awarding authority, including in his description the date of the change and reasons therefor, and shall accompany said description with a letter from the contractor's independent certified public accountant approving or otherwise commenting on the changes, and If the agreement is a contract as defined herein, the contractor has filed a statement of management on internal accounting controls as set forth in paragraph (c) below prior to the execution of the contract, and If the agreement is a contract as defined herein, the contractor has filed prior to the execution of the contracts and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth in paragraph (d) below.

(c) Every contractor awarded a contract shall file with the awarding authority a statement of management as to whether the system of internal accounting controls of the contractor and subsidiaries reasonably assures that:

Transactions are executed in accordance with management's general and specific authorization;

Transactions are recorded as necessary:

To permit preparation of financial statements in conformity with generally accepted accounting principles, and

To maintain accountability for assets;

Access to assets is permitted only in accordance with management's general or specific authorization; and

The recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

Every contractor awarded a contract shall also file with the awarding authority a statement prepared and signed by an independent certified public accountant, stating that he/she has examined the statement of management on internal accounting controls, and expressing an opinion as to:

Whether the representations of management in response to this paragraph, and paragraph (b) above are consistent with the result of management's evaluation of the system of internal accounting controls; and

Whether such representations of management are, in addition, reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statements.

Every contractor awarded a contract by the commonwealth or by any political subdivision thereof shall annually file with the commissioner of capital asset management and maintenance during the term of the contract a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report. Such statements shall be made available to the awarding authority upon request.

The office of inspector general, the commissioner for capital asset management and maintenance and any other awarding authority shall enforce the provisions of this section. The commissioner of capital asset management and maintenance may after providing an opportunity for the inspector general and other interested parties to comment, promulgate pursuant to the provisions of chapter thirty A such rules, regulations and guidelines as are necessary to effectuate the purposes of this section. Such rules, regulations and guidelines may be applicable to all awarding authorities. A contractor's failure to satisfy any of the requirements of this section may be grounds for debarment pursuant to section forty-four C of chapter one hundred and forty-nine.

Records and statements required to be made, kept or filed under the provisions of this section shall not be public records as defined in section seven of chapter four and shall not be open to public inspection; provided, however, that such records and statements shall be made available pursuant to the provisions of clause (2) of paragraph (b)."

Section 39S. Contracts for construction; requirements.

"(a) As used in this section the word "person" shall mean any natural person, joint venture, partnership corporation or other business or legal entity. Any person submitting a bid for, or signing a contract to work on, the construction, reconstruction, alteration, remodeling or repair of any public work by the commonwealth, or political subdivision thereof, or by any county, city, town, district, or housing authority, and estimated by the awarding authority to cost more than \$10,000, and any person submitting a bid for, or signing a contract to work on, the construction, reconstruction, installation, demolition, maintenance or repair of any building by a public agency, estimated to cost more than \$10,000, shall certify on the bid, or contract, under penalties of perjury, as follows:

(1) That he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work; (2) that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and (3) that all employees to be employed in the work subject to this bid have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration.

Any employee found on a worksite subject to this section without documentation of successful completion of a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration shall be subject to immediate removal.

The attorney general, or his designee, shall have the power to enforce this section including the power to institute and prosecute proceedings in the superior court to restrain the award of contracts and the performance of contracts in all cases where, after investigation of the facts, he has made a finding that the award or performance has resulted in violation, directly or indirectly, of subsection (b), and he shall not be required to pay to the clerk of the court an entry fee in connection with the institution of the proceeding."

Section 40. Discharge or release of bonds.

"Bonds given to the commonwealth, any county, city, town or political subdivision to secure the performance of contracts for the construction or repair of public buildings or other public works may be discharged or released by the awarding authority, upon such terms as it deems expedient, after the expiration of one year from the time of completion, subject to section thirty-nine K, of the work contracted to be done; provided that no claim filed under said bond is pending, and provided further, that no such bonds shall be discharged or released prior to the expiration of all special guarantees provided for in the contract unless new bonds in substitution therefor specifically relating to the unexpired guarantees shall be taken."

Attention is directed to the following sections of Chapter 82 of the General Laws of Massachusetts as amended to date.

Section 40. Definitions.

"The following words, as used in this section and sections 40A to 40E, inclusive, shall have the following meanings:

"Company", natural gas pipeline company, petroleum or petroleum products pipeline company, public utility company, cable television company, and municipal utility company or department that supply gas, electricity, telephone, communication or cable television services or private water companies within the city or town where such excavation is to be made.

"Description of excavation location", such description shall include the name of the city or town, street, way, or route number where appropriate, the name of the streets at the nearest intersection to the excavation, the number of the buildings closest to the excavation or any other description, including landmarks, utility pole numbers or other information which will accurately define the location of the excavation.

"Emergency", a condition in which the safety of the public is in imminent danger, such as a threat to life or health or where immediate correction is required to maintain or restore essential public utility service.

"Excavation", an operation for the purpose of movement or removal of earth, rock or the materials in the ground including, but not limited to, digging, blasting, augering, backfilling, test boring, drilling, pile driving, grading, plowing in, hammering, pulling in, jacking in, trenching, tunneling and demolition of structures, excluding excavation by tools manipulated only by human power for gardening purposes and use of blasting for quarrying purposes.

"Excavator", any entity including, but not limited to, a person, partnership, joint venture, trust, corporation, association, public utility, company or state or local government body which performs excavation operations.

"Premark", to delineate the general scope of the excavation or boring on the paved surface of the ground using white paint, or stakes or other suitable white markings on nonpaved surfaces. No pre-marking shall be acceptable if such marks can reasonably interfere with traffic or pedestrian control or are misleading to the general public. Pre-marking shall not be required of any continuous excavation that is over 500 feet in length.

"Safety zone", a zone designated on the surface by the use of standard color-coded markings which contains the width of the facilities plus not more than 18 inches on each side.

"Standard color-coded markings", red - electric power lines, cables, conduit or light cables; yellow - gas, oil, street petroleum, or other gaseous materials; orange - communications cables or conduit, alarm or signal lines; blue - water, irrigation and slurry lines; green - sewer and drain lines; white - pre-mark of proposed excavation.

"System", the underground plant damage prevention system as defined in section 76D of chapter 164."

Section 40A. Excavations; notice.

"No excavator installing a new facility or an addition to an existing facility or the relay or repair of an existing facility shall, except in an emergency, make an excavation, in any public or private way, any company right-of-way or easement or any public or privately owned land or way, unless at least 72 hours, exclusive of Saturdays, Sundays and legal holidays but not more than 30 days before the proposed excavation is to be made, such excavator has pre-marked not more than 500 feet of the proposed excavation and given an initial notice to the system. Such initial notice shall set forth a description of the excavation location in the manner as herein defined. In addition, such initial notice shall indicate whether any such excavation will involve blasting and, if so, the date and the location at which such blasting is to occur.

The notice requirements shall be waived in an emergency as defined herein; provided, however, that before such excavation begins or during a life-threatening emergency, notification shall be given to the system and the initial point of boring or excavation shall be pre-marked. The excavator shall ensure that the underground facilities of the utilities in the area of such excavation shall not be damaged or jeopardized.

In no event shall any excavation by blasting take place unless notice thereof, either in the initial notice or a subsequent notice accurately specifying the date and location of such blasting shall have been given and received at least 72 hours in advance, except in the case of an unanticipated obstruction requiring blasting when such notice shall be not less than four hours prior to such blasting. If any such notice cannot be given as aforesaid because of an emergency requiring blasting, it shall be given as soon as may be practicable but before any explosives are discharged."

Section 40B. Designation of location of underground facilities.

"Within 72 hours, exclusive of Saturdays, Sundays and legal holidays, from the time the initial notice is received by the system or at such time as the company and the excavator agree, such company shall respond to the initial notice or subsequent notice by designating the location of the underground facilities within 15 feet in any direction of the pre-marking so that the existing facilities are to be found within a safety zone. Such safety zone shall be so designated by the use of standard color-coded markings. The providing of such designation by the company shall constitute prima facie evidence of an exercise of reasonable precaution by the company as required by this section; provided, however, that in the event that the excavator has given notice as aforesaid at a location at which because of the length of excavation the company cannot reasonably designate the entire location of its facilities within such 72 hour period, then such excavator shall identify for the company that portion of the excavation which is to be first made and the company shall designate the location of its facilities in such portion within 72 hours and shall designate the location of its facilities in the remaining portion of the location within a reasonable time thereafter. When an emergency notification has been given to the system, the company shall make every attempt to designate its facilities as promptly as possible."

Section 40C. Excavator's responsibility to maintain designation markings; damage caused by excavator.

"After a company has designated the location of its facilities at the location in accordance with section 40B, the excavator shall be responsible for maintaining the designation markings at such locations, unless such excavator requests remarking at the location due to the obliteration, destruction or other removal of such markings. The company shall then remark such location within 24 hours following receipt of such request.

When excavating in close proximity to the underground facilities of any company when such facilities are to be exposed, non-mechanical means shall be employed, as necessary, to avoid damage in locating such facility and any further excavation shall be performed employing reasonable precautions to avoid damage to any underground facilities including, but not limited to, any substantial weakening of structural or lateral support of such facilities, penetration or destruction of any pipe, main, wire or conduit or the protective coating thereof, or damage to any pipe, main, wire or conduit.

If any damage to such pipe, main, wire or conduit or its protective coating occurs, the company shall be notified immediately by the excavator responsible for causing such damage.

The making of an excavation without providing the notice required by section 40A with respect to any proposed excavation which results in any damage to a pipe, main, wire or conduit, or its protective coating, shall be prima facie evidence in any legal or administrative proceeding that such damage was caused by the negligence of such person."

Section 40D. Local laws requiring excavation permits; public ways.

"Nothing in this section shall affect or impair local ordinances or by-laws requiring a permit to be obtained before excavation in a public way or on private property; but notwithstanding any general or special law, ordinance or by-law to the contrary, to the extent that any permit issued under the provisions of the state building code or state fire code requires excavation by an excavator on a public way or on private property, the permit shall not be valid unless the excavator notifies the system as required pursuant to sections 40 and 40A, before the commencement of the excavation, and has complied with the permitting requirements of chapter 82A."

Section 40E. Violations of Secs. 40A to 40E; punishment.

"Any person or company found by the department of telecommunications and energy, after a hearing, to have violated any provision of sections 40A to 40E, inclusive, shall be fined \$1000 for the first offense and not less than \$5,000 nor more than \$10,000 for any subsequent offense within 12 consecutive months as set forth by the rules of said department; provided, however, that nothing herein shall be construed to require forfeiture of any penal sum by a state or local government body for violation of section 40A or 40C; and provided, further, that nothing herein shall be construed to require the forfeiture of any penal sum by a residential property owner for the failure to pre-mark for an excavation on such person's residential property."

Attention is directed to the following sections of Chapter 30 of the Acts of 2009. Section 33.

"(a) Notwithstanding any general or special law to the contrary, the following requirements shall apply to any public works project funded by the American Recovery and Reinvestment Act of 2009 where the amount of construction costs under any contract awarded is likely to exceed \$1,000,000. For the purposes of this section, "public works" shall mean building or work the construction of which is carried on by authority of the commonwealth, or by a county, town, authority or district, or with funds of a federal agency or the commonwealth or a county, city, town, authority or district to serve the interest of the general public, regardless of whether title thereof is in the commonwealth or in a county, city, town, authority or district; provided, however, that for the purposes of this definition, "construction" shall have the meaning provided in section 27D of chapter 149 of the General Laws.

For any public works project subject to subsection (a), the specifications set forth in any request for responses shall include a requirement that, on a per project basis, not less than 20 per cent of the total hours of employees receiving an hourly wage who are directly employed on the site of the project, employed by the contractor or a subcontractor and subject to the prevailing wage, shall be performed by apprentices in bona fide apprentice training programs as provided in sections 11H and 11I of chapter 23 of the General Laws which are approved by the division of apprentice training in the executive office of labor and workforce development.

During the performance of a public works project subject to subsections (a) and (b), the contractor shall submit periodic reports to the awarding authority with records indicating the total hours worked by all journeymen and apprentices in positions subject to the apprentice requirement. In any instance in which the apprentice hours do not constitute 5 per cent of the total hours of employees subject to the apprentice requirement, the contractor shall submit a plan to the awarding authority describing how the contractor shall comply with the apprentice requirement.

The attorney general shall have all the necessary powers to require compliance with the requirements of subsections (a), (b) and (c) therewith, including the power to institute and prosecute proceedings in the superior court to restrain the award of contracts and the performance of contracts. Prior to award of the contract, an awarding authority may petition the attorney general for approval to adjust the requirements set forth in said subsections (a), (b) and (c). The attorney general may adjust these requirements only if he determines that compliance with these requirements is not feasible or if application of the requirements would be preempted by federal law.

An awarding authority serving a low-income population may require additional specifications that address the needs of its clients including, but not limited to, preferential hiring for residents of public housing authorities for available apprenticeship positions.

Subject to appropriation, the division of apprentice training shall enhance its outreach efforts to underserved populations in order to increase and diversify the number of apprentices in the commonwealth."

Section 39.

"Any entity located in the commonwealth that receives federal funds through the American Recovery and Reinvestment Act of 2009 shall provide information as directed by the secretary of administration and finance regarding the use of the funds. The required information shall include, but not be limited to, the reporting information required by the federal government and any other information deemed necessary by the secretary to administer the American Recovery and Reinvestment Act of 2009 responsibly, efficiently and transparently. To the extent possible, the secretary shall work to streamline the reporting of this information, minimize duplication of data entry by recipients and ensure data consistency. The secretary may issue regulations to effectuate this reporting requirement."

Section 40.

"Employers and hiring agents on all projects funded in whole or in part by the American Recovery and Reinvestment Act of 2009 shall post notices of available employment opportunities to the commonwealth's job bank or the one-stop career centers closest to where the projects shall be located. The postings shall contain such information as directed by the secretary of labor and workforce development. The secretary may issue regulations to effectuate this job posting requirement."

END OF DOCUMENT

DOCUMENT 00 80 50

COVID-19 GUIDELINES AND PROCEDURES DURING CONSTRUCTION

The following Guidelines and Procedures have been established in response to COVID-19 Coronavirus Pandemic.

These Guidelines and Procedures are based on the current policy established by the Commonwealth of Massachusetts and other jurisdictions as applicable and shall apply to projects during construction.

Paragraphs 1.1, 1.2, and 1.3 have been established by the State of Massachusetts based on CDC Guidelines.

Additional guidelines are contained in the referenced document in Paragraph 2.1 as established by OSHA.

1.0 COMMONWEALTH OF MASSACHUSETTS (MA)

1.1 MA COVID-19 EMPLOYEE HEALTH, PROTECTION, GUIDANCE AND PREVENTION

The following applies to both State employees and contracted staff working on behalf of the State.

These Guidelines and Procedures MUST be implemented at all times on all construction sites. All construction sites MUST conduct a Safety Stand Down day to disseminate these Guidelines to all employees and workers.

Employee Health Protection – ZERO Tolerance

ZERO TOLERANCE FOR SICK WORKERS REPORTING TO WORK. IF YOU ARE SICK, STAY HOME! IF YOU FEEL SICK, GO HOME! IF YOU SEE SOMEONE SICK, SEND THEM HOME!

If you are exhibiting any of the symptoms below, you are to report this to your supervisor (via phone, text or email) right away, and head home from the job site or stay home if already there.

If you notice a co-worker showing signs or complaining about such symptoms, he or she should be directed to their supervisor (via phone, text or email) and asked to leave the project site immediately.

COVID-19 Typical Symptoms:

- Fever
- Cough
- Shortness of Breath
- Sore Throat

Self-certify prior to shift

Prior to starting a shift, each employee will self-certify to their supervisor that they:

- Have no signs of a fever or a measured temperature above 100.3 degrees or greater, a cough or trouble breathing within the past 24 hours.

- Have not had "close contact" with an individual diagnosed with COVID-19. "Close contact" means living in the same household as a person who has tested positive for COVID-19, caring for a person who has tested positive for COVID-19, being within 6 feet of a person who has tested positive for COVID-19 for about 15 minutes, or coming in direct contact with secretions (e.g., sharing utensils, being coughed on) from a person who has tested positive for COVID-19, while that person was symptomatic.
- Have not been asked to self-isolate or quarantine by their doctor or a local public health official.

Workers that are working in a confined space or inside a closed building envelope will have to be temperature screened by a Medical Professional or Trained Individual provided that such screening is out of public view to respect privacy and results are kept private.

Employees exhibiting symptoms or unable to self-certify should be directed to leave the work site and seek medical attention and applicable testing by their health care provider. They are not to return to the work site until cleared by a medical professional.

General On-the-Job Guidance to Prevent Exposure & Limit the Transmission of the Virus

- No handshaking.
- Wash hands often with soap for at least 20 seconds or use an alcohol-based hand sanitizer with at least 60% ethanol or 70% isopropanol.
- Contractor and State Agency Field Offices are locked down to all but authorized personnel.
- Each jobsite should develop cleaning and decontamination procedures that are posted and shared. These Procedures must cover all areas including trailers, gates, equipment, vehicles, etc. and shall be posted at all entry points to the sites, and throughout the project site.
- A "No Congregation" policy is in effect, individuals must implement social distancing by maintaining a minimum distance of 6-feet from other individuals.
- Avoid face to face meetings – critical situations requiring in-person discussion must follow social distancing.
- Conduct all meetings via conference calls, if possible. Do not convene meetings of more than 10 people. Recommend use of cell phones, texting, web meeting sites and conference calls for project discussion.
- All individual work crew meetings/tailgate talks should be held outside and follow social distancing.
- Please keep all crews a minimum of 6 ft. apart at all times to eliminate the potential of cross contamination.
- At each job briefing/toolbox talk, employees are asked if they are experiencing any symptoms, and are sent home if they are.
- Each jobsite should have laminated COVID-19 safety guidelines and handwashing instructions.
- All restroom facilities/porta-potties should be cleaned and handwashing stations must be provided with soap, hand sanitizer and paper towels.

- All surfaces should be regularly cleaned, including surfaces, door handles, laptops, etc.
- All common areas and meeting areas are to be regularly cleaned and disinfected at least once a day but preferably twice a day.
- Be sure to use your own water bottle, and do not share.
- To avoid external contamination, we recommend everyone bring food from home.
- Please maintain Social Distancing separation during breaks and lunch.
- Cover coughing or sneezing with a tissue, then throw the tissue in the trash and wash hands, if no tissue is available then cough into your elbow.
- Avoid touching eyes, nose, and mouth with your hands.
- To avoid sharing germs, please clean up after Yourself. DO NOT make others responsible for moving, unpacking and packing up your personal belongings.
- If you or a family member is feeling ill, stay home!

Work Site Risk Prevention Practices

- At the start of each shift, confirm with all employees that they are healthy.
- We will have a 100% glove policy from today going forward. All construction workers will be required to wear cut-resistant gloves or the equivalent.
- Use of eye protection (safety goggles/face shields) is recommended.
- In work conditions where required social distancing is impossible to achieve affected employees shall be supplied PPE including as appropriate a standard face mask, gloves, and eye protection.
- All employees shall drive to work site/parking area in a single occupant vehicle. Contractors / State staff shall not ride together in the same vehicle.
- When entering a machine or vehicle which you are not sure you were the last person to enter, make sure that you wipe down the interior and door handles with disinfectant prior to entry.
- In instances where it is possible, workers should maintain separation of 6 ft. from each other per CDC guidelines.
- Multi person activities will be limited where feasible (two person lifting activities).
- Large gathering places on the site such as shacks and break areas will be eliminated and instead small break areas will be used with seating limited to ensure social distancing.
- Contact the cleaning person for your office trailer or office space and ensure they have proper COVID- 19 sanitation processes. Increase their cleaning visits to daily.
- Clean all high contact surfaces a minimum of twice a day in order to minimize the spread of germs in areas that people touch frequently. This includes but is not limited to desks, laptops and vehicles.

Wash Stations

All site-specific projects with outside construction sites without ready access to an indoor bathroom MUST install Wash Stations.

- Install hand wash stations with hot water, if possible, and soap at fire hydrants or other water sources to be used for frequent handwashing for all onsite employees.
- All onsite workers must help to maintain and keep stations clean.
- If a worker notices soap or towels are running low or out, immediately notify supervisors.
- Garbage barrels will be placed next to the hand wash station for disposal of tissues/towels.

Do all you can to maintain your good health by: getting adequate sleep; eating a balanced, healthy diet, avoid alcohol; and consume plenty of fluids.

Please Note: This document is not intended to replace any formalized procedures currently in place with the General Contractor.

Where these guidance does not meet or exceed the standards put forth by the General Contractor, everyone shall abide by the most stringent procedure available.

A site-specific COVID-19 Officer (who may also be the Health and Safety Officer) shall be designated for every site.

The approved project Health and Safety Plan (HASP) shall be modified to require that the Contractor’s site specific project COVID-19 Officer submit a written daily report to the Owner’s Representative. The COVID-19 Officer shall certify that the contractor and all subcontractors are in full compliance with these guidelines.

Any issue of non-compliance with these guidelines shall be a basis for the suspension of work. The contractor will be required to submit a corrective action plan detailing each issue of non-conformance and a plan to rectify the issue(s). The Contractor will not be allowed to resume work until the plan is approved by the Owner. Any additional issues of non-conformance may be subject to action against the Contractor’s prequalification and certification status.



1.2 MA SUPPLEMENTAL GUIDELINES FOR CONSTRUCTION SITES

ADDENDUM 1 Limiting Exposures and Worker Infection Protocol

COVID-19 EMPLOYEE HEALTH, PROTECTION, GUIDANCE AND PREVENTION

LIMITING EXPOSURES

Workers should follow the General On-the-Job Guidance to Prevent Exposure & Limit the Transmission of the Virus of the COVID-19 Employee Health, protection, guidance and prevention guide.

In addition, Contractors should advise workers of best practice to limit exposures off the construction site.

When leaving a construction site for breaks, lunch, or other reasons are required to wash hands with soap for at least 20 seconds or use an alcohol-based hand sanitizer with at least 60% ethanol or 70% isopropanol before leaving the site and must maintain social distancing if traveling to other locations off the construction site. Frequent use of handwashing or alcohol-based hand sanitizers should be encouraged and handwashing facilities and/or alcohol-based hand sanitizers should be made readily available at work sites.

WORKER INFECTION PROTOCOL

As provided in the guidance document, there is a zero tolerance for sick workers reporting to work. Employees should be instructed that even those with mild symptoms of respiratory infection (cough, shortness of breath, sore throat) or fever should stay off work. Contractors shall take immediate steps to limit infections at the job site in the event that a worker discovered to have tested positive for COVID-19 or has COVID-19 related symptoms.

Although it is understood that contractors are enforcing Work Site Risk Prevention Practices including social distancing rules and use of PPE, consistent with guidelines it is also recognized that there may be occasions where someone who has tested positive for COVID-19 or who has COVID-19 symptoms has been present in a work area.

Prompt identification and isolation of potentially infectious individuals is a critical step in protecting workers, vendors, visitors, and others at a worksite.

IDENTIFICATION OF EXPOSURE

The Contractor shall direct workers with COVID-19 related symptoms to leave the jobsite immediately and contact their healthcare provider. The Massachusetts Department of Health (DPH) or a local board of health will make appropriate notifications to those who had direct prolonged contact with the COVID-19 positive workers.

The Contractor shall work with the local board of health to identify any potential jobsite exposures, including:

- Other workers, vendors, inspectors, or visitors to the work site with close contact to the individual.
- Work areas such as supply cabinets and designated work stations or rooms.
- Work tools and equipment.
- Common areas such as break rooms and tables, vending machines, and sanitary facilities.

NOTIFICATION AND QUARANTINE REQUIREMENTS

As provided by law, the identity of the worker must be kept confidential.

Upon learning of an infection, the contractor must immediately notify the designated COVID-19 safety officer, the site safety officer, and the owner.

SANITIZATION REQUIREMENTS

Contractor shall take immediate steps to sanitize common areas and direct work places. This includes all on-site bathroom facilities, any break facilities, and any other common areas on the job site that may have been in close contact with the infected worker.

Sanitation will be conducted with personnel, equipment, and material approved for COVID-19 sanitization.

Identified areas should remain isolated from workers until sanitation process has been completed and area is deemed safe for use.

RETURNING TO WORK

All impacted workers should follow CDC and DPH recommended steps concerning return to work. Workers who are considered close contacts to a COVID19 case by public health authorities should not return for 14 days and are subject quarantine by public health.

Workers who leave during the work day due to COVID-19 symptoms and develop COVID-19 as confirmed by laboratory testing or diagnosis by a healthcare provider shall not return to the site until either released from isolation by healthcare provider or public health.

IN ALL CASES

Keep all employee names confidential as required by law.

Other employees may be sent home while a workspace is being cleaned but will return to work after cleaning unless advised otherwise by a health care provider.

Other employees should be asked to contact their health provider if they have any questions Remind other employees to continue to practice proper sanitation and monitor for flu like symptoms.

1.3 MA ENFORCEMENT OF THE COVID-19 SAFETY GUIDELINES AND PROCEDURES FOR CONSTRUCTION SITES

COVID-19 Order No. 13, as revised and extended on March 31, 2020, requires the Massachusetts Department of Transportation and the Division of Capital Asset Management and Maintenance to "issue guidance and enforcement procedures for the safe operation of public works construction sites." The safety guidance is attached as "COVID-19 Guidelines and Procedures for All Construction Sites and Workers at All Public Works Sites" (hereinafter, the COVID-19 Construction Safety Guidance) and is posted online and may be revised from time to time. This document contains the required enforcement procedures, which shall be followed by all state agencies and authorities who undertake, manage or fund construction projects and may be used by each city or town for ensuring the safety of both publicly- and privately-owned construction projects.

- All Projects: Construction sites that cannot consistently comply with the COVID-19 Construction Safety Guidance, including ensuring that social distancing and safety requirements are being followed, must:

- Safely secure the site and pause construction activities until a corrective action plan is prepared, submitted and approved by both the Owner and the city or town; or
- Close down the site for the duration of the State of Emergency if repeatedly found by either the Owner's COVID-19 Officer or a state or local inspector (including a third-party private inspector accountable to a city or town) to be in violation of the social distancing and safety requirements.
- A city or town may additionally require the Owner to develop and submit a site-specific risk analysis and enhanced COVID-19 safety plan. The city or town shall review and approve such plan and may require such projects to pause construction until such a risk analysis and plan is submitted and approved. Once such an enhanced COVID-19 safety plan is approved, a violation of the plan shall be treated the same as a violation of the COVID-19 Construction Safety Guidance.
- A site-specific COVID-19 Officer (who may also be the Health and Safety Officer) shall be designated for every site.
- The approved project Health and Safety Plan (HASP) shall be modified to require that the Contractor's site-specific project COVID-19 Officer submit a written daily report to the Owner's Representative. The COVID-19 Officer shall certify that the contractor and all subcontractors are in full compliance with the COVID-19 Construction Safety Guidance.
- Public Projects: For all projects undertaken, managed or funded by a state agency or authority there shall be joint enforcement responsibility between the project's public Owner and the city or town where the project is located.
 - The Owner of the project has the lead responsibility for compliance and enforcement including frequent on-site inspections by an employee or contractor of the state agency or authority who is familiar with the COVID-19 Construction Safety Guidance and is authorized to enforce that guidance and shut down work at the site if violations are found.
 - The Owner of the project is required to notify the municipality where the work is taking place whenever a site is shut down or of any violations of the COVID-19 Construction Safety Guidance and the resulting corrective action plan, as well as to provide copies of the COVID-19 Officer's written daily reports upon request.
 - While the public Owner has the lead responsibility for enforcement, cities and towns retain the authority to take enforcement action against public projects found not in compliance with the COVID-19 Construction Safety Guidance, including the authority to order the project to shut down until a corrective action plan is developed, approved and implemented.
- Private Projects: For all private projects the primary enforcement responsibility rests with the city or town, with the Massachusetts Department of Transportation and other state agencies providing technical assistance and resource support.
 - Cities and towns are authorized to enforce the COVID-19 Construction Safety Guidance using their public health staff, building inspectors or any other appropriate official or contractor.
 - Cities and towns may enforce the safety and distance protocols including requiring the Owner and/or Contractor to safely secure the site and pause construction activities until a corrective action plan is prepared, submitted and approved by the city or town.

- The city or town may require the Owner of a private project to pay for an independent, third party inspector or inspection firm (or to pay into a pool to pay for such inspections). The third party inspector shall be accountable solely to the city or town and shall be responsible for enforcement on behalf of the city or town. A city or town may require private projects to pause construction until such a third-party inspector has been secured.

Any questions about these enforcement procedures or the accompanying Guidance can be directed to:

- For MassDOT, Michael McGrath, Assistant Administrator for Construction Engineering, michael.a.mcgrath@state.ma.us
- For DCAMM, Jay Mitchell, Deputy Commissioner, Jayson.mitchell@mass.gov

2.0 OSHA

2.1 OSHA ALERT – COVID-19 GUIDANCE FOR THE CONSTRUCTION WORKFORCE

The OSHA ALERT - COVID-19 Guidance for the Construction Workforce (OSHA 4000 dated April 2020) (one page) is included immediately following this Document.

END OF DOCUMENT

COVID-19 Guidance for the Construction Workforce

OSHA is committed to protecting the health and safety of America's workers and workplaces during these unprecedented times. The agency will be issuing a series of industry-specific alerts designed to keep workers safe.

When working in the construction industry, the following tips can help reduce the risk of exposure to the coronavirus:

- Encourage workers to stay home if they are sick.
- Allow workers to wear masks over their nose and mouth to prevent them from spreading the virus.
- Continue to use other normal control measures, including personal protective equipment (PPE), necessary to protect workers from other job hazards associated with construction activities.
- Advise workers to avoid physical contact with others and direct employees/contractors/visitors to increase personal space to at least six feet, where possible. Where work trailers are used, all workers should maintain social distancing while inside the trailers.
- Train workers how to properly put on, use/wear, and take off protective clothing and equipment.
- Encourage respiratory etiquette, including covering coughs and sneezes.
- Promote personal hygiene. If workers do not have immediate access to soap and water for handwashing, provide alcohol-based hand rubs containing at least 60 percent alcohol.
- Use Environmental Protection Agency-approved cleaning chemicals from [List N](#) or that have label claims against the coronavirus.
- To the extent tools or equipment must be shared, provide and instruct workers to use alcohol-based wipes to clean tools before and after use. When cleaning tools and equipment, workers should consult manufacturer recommendations for proper cleaning techniques and restrictions.
- Keep in-person meetings (including toolbox talks and safety meetings) as short as possible, limit the number of workers in attendance, and use social distancing practices.
- Clean and disinfect portable jobsite toilets regularly. Hand sanitizer dispensers should be filled regularly. Frequently-touched items (i.e., door pulls and toilet seats) should be disinfected.
- Encourage workers to report any safety and health concerns.

For more information, visit www.osha.gov/coronavirus or call 1-800-321-OSHA (6742).

*OSHA issues alerts to draw attention to
worker safety and health issues and solutions.*

DOCUMENT 00 84 00

WAGE RATE DETERMINATION SCHEDULE

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACTING REQUIREMENTS, and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 MASSACHUSETTS PREVAILING WAGE LAW (MGL. c149, §§26-27H) - AN IMPORTANT GUIDE FOR CONTRACTORS DOING PUBLIC WORKS PROJECTS IN MASSACHUSETTS

A. Prevailing Wage Schedules

1. Every contractor should obtain a schedule of prevailing wage rates for every public works project from the Awarding Authority (city, town, county, district, state agency or authority). It is the Awarding Authority's responsibility to ensure that a copy of the wage schedule is provided to all contractors from whom estimates or bids are solicited for all projects. The Commonwealth of Massachusetts Division of Occupational Safety (DOS), Department of Labor and Workforce Development will not issue wage schedules directly to contractors or employees.
2. Once a wage schedule has been issued for a project by DOS, it will remain in effect for the entire project. Appeals of wage determinations or classifications of employment may be made to the DOS Commissioner.
3. A copy of the wage schedule is required to be posted at the work site.
4. A wage schedule issued for a project may not be used on any other project. If, by chance, an Awarding Authority fails to provide you with a wage schedule to use when figuring your bid, do not use one you may have from another project. In this case, you should contact DOS immediately and urge the Awarding Authority to contact DOS to correct the oversight.
5. The failure of an Awarding Authority to provide a wage schedule does not excuse a contractor from paying the prevailing rate.

B. Bidding

1. The Attorney General's Division of Fair Labor and Business Practices enforces the prevailing wage law. All bids must reflect prevailing wage rates. Contractors may be required by an Awarding Authority to "demonstrate how (they) could complete the project and comply with Massachusetts General Laws." The Division issued an "Advisory" discussing these and other points. For a copy, please contact the Attorney General's Office.

C. Paying Employees

1. Prevailing wages must be paid to all employees on public works projects regardless of whether they are employed by the general contractor, a filed sub-bidder or any sub-contractor. The prevailing wage applies equally to unionized and non-unionized workers.
2. All employees who perform work on a public works project must be paid hourly according to the wage schedule issued for the particular project.
3. The wage schedule issued for each project is in effect for the duration of that project. All wage increases listed on the schedule must be paid on the specified dates.

4. Employers are limited in the deductions that can be made from the hourly rate (represented as the "total rate" on the wage schedules). Only contributions to the following plans may be deducted:
 - Health and Welfare
 - Pension
 - Supplementary Unemployment
5. All contributions must be made to bona fide plans.
6. If an employer contributes to any, or all, of the above plans, it may deduct the hourly amount contributed from the "total rate." If the employer does not contribute to any of the benefit plans listed above, then the employee's hourly rate of pay will be the "total rate" from the wage schedule.
7. All other deductions, including but not limited to the following, may not be subtracted from the employee's hourly prevailing wage rate:
 - Vacation Time
 - Sick Time
 - Training Funds
 - Charitable Contributions
 - Worker's Compensation
 - Unemployment Insurance
 - Uniforms
8. Overtime, which must be paid to all employees who work more than 40 hours per week, shall be at least time-and-one-half the base rate ("total rate" less benefits, if any).
9. Any "separate check" given to an employee as the "benefit portion" of the prevailing wage may not be treated differently than the check for "base wages." All "separate checks" are considered wages and subject to state and federal taxes, unemployment insurance and worker's compensation requirements.

D. Payroll Records

1. Employers are required to submit weekly certified payroll reports to the Awarding Authority and keep them on file for three (3) years. A reporting form is sent along with each wage schedule that may be used. Each report must contain at least: the employee's name, address, occupational classification, hours worked and wages paid. Do not submit weekly payroll reports to DOS.
2. After each contractor completes its portion of the public works project, the contractor must submit a Statement of Compliance to DOS. A Statement of Compliance form is also sent along with each wage schedule issued.

E. Apprentices

1. If your company employs apprentices, they must be registered with the Division of Apprentice Training (DAT). All persons not registered with DAT must be paid the "total rate" listed on the wage schedule. An apprentice sheet showing percentages based on the apprentice steps is included with all wage schedules.

F. Penalties

1. Failure to pay the prevailing wage subjects the contractor to potential civil and criminal liability.

G. Wage schedules are issued by:

Massachusetts Department of Labor and Workforce Development
Division of Occupational Safety
19 Staniford Street
Boston, Massachusetts 02108
Telephone 617-727-3492

H. Enforcement is carried out by:

Office of the Attorney General
Fair Labor and Business Practices Division
200 Portland Street
Boston, Massachusetts 02114
Telephone 617-727-3465

1.03 WAGE RATES

A. Classifications and wage rates as established by the Commonwealth of Massachusetts Division of Occupational Safety (DOS), Department of Labor and Workforce Development under the provisions of MGL Chapter 149, Section 26 immediately follows this Document.

1. The rate per hour of the wages to be paid to mechanics, apprentices, teamsters, chauffeurs, and laborers employed on the work shall not be less than the rate of wages included under "Minimum Wage Rates".
2. The Contractor shall keep posted on the site a legible copy of said schedule. The Contractor shall also keep on file the wage rates and classifications of labor employed on this work in order that they may be available for inspection by the Awarding Authority, Administrator, or the Architect.
3. Apprentices employed pursuant to this determination of wage rates must be registered and approved by the State Apprenticeship Council. Wherever rates for journeymen or apprentices are not listed, and if any other labor is not included in this list, the Contract shall insert the rates of all those employed on the work.
4. The Contractor shall pay to any reserve police officers employed on the work the prevailing rate of wages paid to regular police officers as required by MGL Chapter 149 Section 34b, as amended. Such police officers shall be covered by Workmen's Compensation Insurance and Employer's Liability Insurance by the Contractor.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF DOCUMENT

**WEEKLY PAYROLL RECORDS REPORT
& STATEMENT OF COMPLIANCE**

In accordance with Massachusetts General Law c. 149, §27B, a true and accurate record must be kept of all persons employed on the public works project for which the enclosed rates have been provided. A Payroll Form has been printed on the reverse of this page and includes all the information required to be kept by law. Every contractor or subcontractor is required to keep these records and preserve them for a period of three years from the date of completion of the contract.

In addition, every contractor and subcontractor is required to submit a copy of their weekly payroll records to the awarding authority. For every week in which an apprentice is employed, a photocopy of the apprentice's identification card must be attached to the payroll report. Once collected, the awarding authority is also required to preserve those records for three years.

In addition, each such contractor, subcontractor, or public body shall furnish to the awarding authority directly, within fifteen days after completion of its portion of the work a statement, executed by the contractor, subcontractor or public body who supervises the payment of wages, in the following form:

<p>STATEMENT OF COMPLIANCE</p> <p style="text-align: center;">_____, 20____</p> <p>I, _____, _____</p> <p style="text-align: center;">(Name of signatory party) (Title)</p> <p>do hereby state:</p> <p style="text-align: center;">That I pay or supervise the payment of the persons employed by</p> <p>_____ on the _____</p> <p style="text-align: center;">(Contractor, subcontractor or public body) (Building or project)</p> <p>and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty nine of the General Laws.</p> <p style="text-align: right;">Signature _____</p> <p style="text-align: right;">Title _____</p>	
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SECTION 01 11 00

SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 PROJECT IDENTIFICATION AND DESCRIPTION OF WORK

- A. Project Identification: The name of the Project on the Bidding and Contract Documents is

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER

10 Elm Street
Boxford, Massachusetts 01921

for the Owner/Awarding Authority, the **TOWN OF BOXFORD** acting by and through its **BOARD OF SELECTMEN**.

- B. Project Description: The proposed construction includes historic rehabilitation of existing Cummings House per the Design Development Submission Documents; demolishing and removal of existing structures to east of Cummings House (the ell, the stairs, the former library structure, the barn) and replacing with new single story addition for new community/senior center.

- 1. This work will be publicly bid through MGL Chapter 149.

1.03 CONDITIONS OF THE CONTRACT

- A. Unless otherwise indicated, the Conditions of the Contract shall be Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS, are hereby incorporated by reference and made a part hereof.

1.04 CONSTRUCTION PERIOD

- A. Construction shall be executed in a timely and orderly manner in accordance with the construction period established by the Architect and Owner [Owner's Project Manager (OPM)]; refer to Document 00 31 00, FORM FOR GENERAL BID.

1.05 WORK UNDER OTHER CONTRACTS

- A. Contract Coordination: Briefly without limitation, the work of this Contract includes coordination with other contractors performing certain construction operations and work under separate contracts with the Owner.
- B. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.06 CONTRACT AND CONDITIONS OF THE CONTRACT

- A. Form of Contract and Conditions of the Contract shall be as follows:
1. Form of Contract between Owner and Contractor: Lump Sum, Stipulated Sum Contract; Refer to Document 00 51 00, AGREEMENT, as amended.
 2. Conditions of the Contract: Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS.

1.07 CONTRACTOR'S USE OF PREMISES

- A. Work will be constructed in accordance with the Construction Schedule established by the Owner and the Contractor, in conjunction with the Contractor's proposed work plan.
- B. Coordinate use of premises under direction of the OPM.
- C. Move any stored Products, under Contractor's control, which interfere with operations of the Owner or separate contractor.
- D. Worker's vehicles shall be parked on street and municipal lots in accordance with Town of Boxford police department and parking regulations. Limited on-site parking of workers' vehicles is available.
- E. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.
- F. Obtain and pay for the use of additional storage or work areas needed for operations.
- G. Portable Toilets On-Site: Portable chemical toilets will be required on-site for duration of construction; refer to Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS.
1. Construction personnel will not be permitted to use existing building's toilet facilities.
- H. Building Conditions and Restrictions: Comply with requirements of the Owner and Owner's Project Manager (OPM) regarding use of site including restrictions and conditions established for the building and adjacent site and conditions of existing building. Comply with all Town of Boxford Building Department conditions and restrictions and other Town of Boxford requirements including neighborhood restrictions, adjacent properties, and all other municipal restrictions and ordinances.
- I. Temporary Field Office: An on-site field office for shared use by General Contractor and Owner's Project Manager is required for this Project; refer to Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS.
- J. Comply with COVID-19 Regulations and Protocols. Refer to Document 00 80 50, COVID-19 GUIDELINES AND PROCEDURES DURING CONSTRUCTION.

1.08 OWNER-FURNISHED, CONTRACTOR-INSTALLED EQUIPMENT AND PRODUCTS (O-F, C-I)

- A. Products furnished and paid for by the Owner, described in Specifications Sections:
1. FF&E.
- B. Owner's Responsibilities:

1. Arrange for and deliver necessary shop drawings, product data, and samples to the Contractor.
2. Arrange and pay for Product delivery to the site, in accordance with the construction schedule.
3. Deliver supplier's bill of materials to Contractor.
4. Inspect deliveries jointly with Contractor.
5. Submit claims for transportation damage.
6. Arrange for replacement of damaged, defective, or missing items.
7. Arrange for manufacturer's warranties, bonds, service, inspections, as required.

C. Contractor's Responsibilities:

1. Designate delivery date for each Product in the Construction Schedule.
2. Review shop drawings, product data, and samples.
3. Receive and unload Products at the site.
4. Promptly inspect products jointly with Owner, record shortages, damaged, or defective items.
5. Handle Products at the site, including uncrating and storage.
6. Protect Products from exposure to elements, from damage.
7. Assemble, install, connect, adjust, and finish Products, as stipulated in the respective Section of Specifications.
8. Repair or replace items damaged by Contractor.

1.09 OWNER-PROVIDED EQUIPMENT AND PRODUCTS (O-F, O-I)]

A. Products provided (furnished and installed) by the Owner (O-F, O-I), described in Specifications Sections:

1. All Items designated as O-F, O-I.

B. General Contractor's Responsibility:

1. Coordinate with Owner and Owner's installing contractor.
2. Provide all required blocking on walls to receive installed items to the extent indicated on the Drawings.

C. Owner's Responsibilities:

1. Arrange and pay for Product delivery to the site, in accordance with the construction schedule.
2. Install items.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 REQUIREMENTS INCLUDED

- A. Unit pricing shall be performed by the General Contractor and/or Subcontractor as applicable.
- B. Unit price work will be paid for in accordance with unit prices listed by the General Contractor, based on estimated quantities calculated by the Architect.
- C. All unit prices shall include their pro-rata share of all costs for overhead, profit, bond, labor, materials, disposal, and equipment to perform the work item complete, as identified.
- D. Unit Price Proposal Sheets shall be included with Subcontractor form for bid when applicable.
- E. The total amount of all unit price work shall be included in the amount to be entered in applicable bid forms.
- F. Unit Prices shall provide for a variance in quantities of plus or minus 100 percent of those listed on the Unit Price Proposal Sheet.
- G. If quantities exceed the units established in the contract, including the aforesaid overage percentage, an equitable unit price adjustment will be determined by the Architect or Owner's Project Manager.
- H. A change order will be initiated by the Architect or Owner's Project Manager (OPM) to adjust the contract price resulting from the final quantities of the unit price work.

1.03 UNIT PRICES

- A. Should certain additional work be required, or should the quantities of certain classes of work be increased or decreased from those required by the Contract Documents, by authorization of Owner, the below unit prices shall, at the option of Owner, be the basis of payment to the General Contractor or credit to the Owner, for such increase or decrease in the work.
 - 1. The Unit Prices shall represent the exact net amount per unit to be paid the General Contractor (in the case of additions or increases) or to be refunded the Owner (in the case of decreases).
 - 2. No additional adjustment will be allowed for overhead, profit, insurance, or other direct or indirect expenses of the General Contractor or Subcontractors.
- B. Unit prices shall include costs for all materials, labor, accessories, etc. required for the following.

NO.	DESCRIPTION OF WORK	UNIT	BASE BID QUANTITY	ADD/DEDUCT PRICE (Insert only one number)
1.		SF		\$ _____
2.		SF		\$ _____
34.		SF		\$ _____
4.		SF		\$ _____

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. For each of the alternates Scheduled at the end of this Section, state the amount in the proposal to be added to or deducted from the Contract Sum for the work.

1.03 RELATED REQUIREMENTS

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:

1. Document 00 31 00, FORM FOR GENERAL BID.
2. Document 00 35 00, FORM OF SUB-BID.

1.04 ALTERNATES - GENERAL

- A. Definition: "Alternates" are alternate products, materials, equipment, systems, methods, units of work or major elements of the construction, which may, at the Awarding Authority's option and under the terms established by the Contract or Agreement, be selected for the work in lieu of the corresponding requirements of the Contract Documents.
- B. Alternate Requirements: A Schedule of Alternates is included at the end of this Section. Each alternate is defined using abbreviated language, recognizing that the Contract Documents define the requirements. Coordinate related work to ensure that work affected by each alternate is complete and properly interfaced with work of each selected alternate.
- C. Provide written proposals for each alternate on the Form of Proposal for the Awarding Authority's consideration. Each proposal amount shall include the entire cost of the alternate portion of the work including overhead, profit, taxes, insurance, and other costs including cost of interfacing and coordinating the alternate with related and adjacent work.
- D. Selection of Alternates: Selection of alternates to be included in the work will be by the Awarding Authority. Alternates must be taken in order. The first alternate before the second alternate, etc.
- E. Notification: Prepare and distribute to each entity a notification of status of each alternate. Indicate which alternates have been accepted or rejected, or when such decision is anticipated.

1.05 DESCRIPTION OF ALTERNATES

A. ALTERNATE NO. 1 - _____: State the amount to be added to the Base Bid to _____
_____ .

1. Refer to Drawings and Specifications.

B. ALTERNATE NO. 2 - _____: State the amount to be added to the Base Bid to _____
_____ .

1. Refer to Drawings and Specifications.

1.06 BID FORM INSTRUCTIONS

A. General Contractor – enter amount on Document 00 31 00, FORM FOR GENERAL BID.

B. Each Sub-bidder – enter amount on Document 00 35 00, FORM FOR SUB-BID.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 01 2900, PAYMENT PROCEDURES; Administrative procedures governing Applications for Payment.
 - 2. Section 01 3200, CONSTRUCTION PROGRESS DOCUMENTATION; Requirements for the Contractor's Construction Schedule.
 - 3. Section 01 6000, PRODUCT REQUIREMENTS: Administrative procedures for handling requests for substitutions made after award of the Contract.

1.03 MINOR CHANGES IN THE WORK

- A. The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time.

1.04 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: The Owner will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal requests issued by the Owner are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
 - 2. Within the time specified in the Proposal Request or 20 days (whichever is less) of after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the

Contract, the Contractor may propose changes by submitting a request for a change.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with the total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Comply with requirements of Section 01 60 00, PRODUCT REQUIREMENTS if the proposed change requires substitution of one product or system for product or system specified.

- C. Proposal Request Form: Use AIA Document G709, Proposal Request or other form acceptable to Architect.

1.05 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order Proposal on the difference between the purchase amount and the allowance, multiplied by the final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
1. Include installation costs in the purchase amount only where indicated as part of the allowance.
 2. If requested, prepare explanations and documentation to substantiate distribution of overhead costs and other margins claimed.
 3. Submit substantiation of a change in scope of work, if any, claimed in the Change Orders related to unit-cost allowances.
 4. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 21 days after such authorization.

1.06 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701, Change Order or other form acceptable to Architect.

1.07 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When directed or approved by the Owner, the Architect may issue a Construction Change Directive on Construction Change Directive (CCD) form; this form instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.
 2. Form: AIA G714, Construction Change Directive or other form acceptable to Architect.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Section 01 26 00, CONTRACT MODIFICATION PROCEDURES; Administrative procedures for handling changes to the Contract.
 - 2. Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION; Administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.
- C. Payments shall comply with Massachusetts General Laws.

1.03 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Sub-schedules: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - 1). Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.05 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment or other forms acceptable to Architect and Owner.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit five (5) signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Products list.
 5. Schedule of unit prices.
 6. Submittals Schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.

12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds if required.
 15. Data needed to acquire Owner's insurance.
- H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims", or other acceptable form.
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens", or other acceptable form.
 6. AIA Document G707, "Consent of Surety to Final Payment", or other acceptable form.
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General Project coordination procedures.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 01 11 00, SUMMARY; Owner occupancy.
 - 2. Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION: Preparing and submitting the Contractor's Construction Schedule.
 - 3. Section 01 77 00, CLOSEOUT PROCEDURES: Coordinating Contract closeout.

1.03 COORDINATION

- A. General Coordination Procedures: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.

1.04 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Indicate relationship of components shown on separate Shop Drawings.
 2. Indicate required installation sequences.
- B. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.05 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and other involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare meeting agenda. Distribute the agenda to all attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within five (5) days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference scheduled and conducted by the Owner and Architect before starting construction. The conference will be held at Project site or another convenient location. Participate in the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing.
 - d. Designation of responsible personnel.

- e. Procedures for processing field decisions, RFIs, and Change Orders.
 - f. Procedures for processing Applications for Payment.
 - g. Distribution of the Contract Documents.
 - h. Submittal procedures.
 - i. Preparation of Record Documents.
 - j. Use of the premises.
 - k. Responsibility for temporary facilities and controls.
 - l. Parking availability.
 - m. Construction waste management.
 - n. Office, work, and storage areas.
 - o. Equipment deliveries and priorities.
 - p. First aid.
 - q. Security.
 - r. Progress cleaning.
 - s. Working hours.
- C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction or where required by a particular technical section.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related Change Orders.
 - d. Purchases.
 - e. Deliveries.
 - f. Submittals.
 - g. Review of mockups.
 - h. Possible conflicts.
 - i. Compatibility problems.
 - j. Time schedules.
 - k. Weather limitations.
 - l. Manufacturer's written recommendations.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities and controls.
 - q. Space and access limitations.
 - r. Regulations of authorities having jurisdiction.
 - s. Testing and inspecting requirements.
 - t. Required performance results.
 - u. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements.
 4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Attend progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be cured; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time. Provide a weekly two-week look-ahead schedule at each Project meeting.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Construction waste management.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) Change Orders.
 - 15) Documentation of information for payment requests.
 - 16) Safety program.
 3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- 1.05 ELECTRONIC DOCUMENT SUBMITTAL SERVICE
- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via email.

PART 2 - PRODUCTS

GRLA 2020120.01

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Preliminary Construction Schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Submittals Schedule.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Field condition reports.
 - 7. Special reports.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 01 11 00, SUMMARY; Description of project, work by Owner, Project phasing.
 - 2. Section 01 29 00, PAYMENT PROCEDURES for submitting the Schedule of Values.
 - 3. Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION for submitting and distributing meeting and conference minutes.
 - 4. Section 01 33 00, SUBMITTAL PROCEDURES for submitting schedules and reports.
 - 5. Section 01 40 00, QUALITY REQUIREMENTS for submitting a schedule of tests and inspections.
 - 6. Section 01 77 00, CLOSEOUT PROCEDURES for submitting photographic negatives as Project Record Documents at Project closeout.
 - 7. Divisions 02 through 33 for specific requirements for particular trades.

1.04 SUBMITTALS

- A. Contractor's Construction Schedule: Submit electronic and printed copies of initial schedule, a blue- or black-line print, large enough to show entire schedule for entire construction period.
 - 1. Submit an electronic copy of schedule, using software indicated, on thumbdrive suitably labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.
- B. CPM Reports: Concurrent with CPM schedule, submit three printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.

1.05 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from parties involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.
- C. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities including temporary lighting.
- D. Building Occupants and Tenants: Coordinate with Owner regarding tenants and building occupants that are to remain in building throughout construction period. Provide all notifications and communications required to provide safe occupancy of building throughout construction. Maintain egress paths, MAAB accessibility, and utilities at all time.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning and Scheduling."
- B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion and Final Completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
 1. Activity Duration: Define activities so no activity is longer than 45 days, unless specifically allowed by Owner and Architect.
 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 4. Startup and Testing Time: Include not less than 30 days for startup and testing.

5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 11 00, SUMMARY. Delivery dates indicated stipulate the earliest possible delivery date.
 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 11 00, SUMMARY. Delivery dates indicated stipulate the earliest possible delivery date.
 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 8. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion for each phase.
- F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
1. Refer to Section 01 29 00, PAYMENT PROCEDURES for cost reporting and payment procedures.

- G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall Project Schedule.
- 2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)
- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 3. Use "one workday" as the unit of time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Purchase of materials.
 - c. Delivery.
 - d. Fabrication.
 - e. Installation.
 2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- D. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Principal events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the Schedule of Values).
- E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity duration in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

F. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.03 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. High and low temperatures and general weather conditions.
5. Accidents.
6. Meetings and significant decisions.
7. Unusual events (refer to special reports).
8. Stoppages, delays, shortages, and losses.
9. Emergency procedures.
10. Orders and requests of authorities having jurisdiction.
11. Change Orders received and implemented.
12. Construction Change Directives received.
13. Services connected and disconnected.
14. Partial Completions and occupancies.
15. Substantial Completions authorized.
16. Number of workers on-site per contractor.
17. Work descriptions and locations.
18. Time and material (T&M) work, if any.
19. Visitors.
20. Inspections.

B. Daily Construction Report Submission: Submit each daily report to the Owner.

2.04 SPECIAL REPORTS

- A. General: Submit special reports directly to the Owner within one day of an occurrence. Distribute copied of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Architect and Owner in advance when these events are known or predictable.

2.05 TWO-WEEK LOOK-AHEAD

- A. Submit for Project Meeting a two-week look-ahead at each weekly job meeting in bar chart or bullet point format acceptable to the Owner.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before the regularly scheduled progress meeting at which it will be reviewed.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, duration, actual starts and finishes, and activity duration.
 - 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.02 SUBMISSION OF CONTRACTOR'S CONSTRUCTION SCHEDULE IS A CONDITION FOR PROCESSING OF MONTHLY APPLICATION FOR PAYMENT.

- A. Submission of updated Contractor's Construction Schedule monthly is a condition for processing of monthly Application for Payment.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of Work, including:

- 1. Progress schedules.
- 2. Submittal schedule.
- 3. Shop drawings.
- 4. Product data.
- 5. Samples.

- B. Administrative Submittals: Refer to requirements specified in other Division 01 – GENERAL REQUIREMENTS Specification Sections, and other Contract Documents, for administrative submittals, including:

- 1. Permits.
- 2. Applications for payment.
- 3. Insurance certificates.
- 4. List of subcontractors.

1.03 RELATED REQUIREMENTS

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:

- 1. Section 01 11 00, SUMMARY; Scope of work, work by Owner, phasing of project.
- 2. Section 01 77 00, CLOSEOUT PROCEDURES; Closeout submittals.

1.04 SUBMITTAL PROCEDURES

- A. Coordination of Submittals: Coordinate timing of submittals with construction activities. Transmit submittals well enough in advance of performance of Work to avoid delays. Coordinate submittals of related elements of Work.

- 1. Architect may reject or withhold action on submittals requiring coordination with other submittals until related submittals are received.

- B. Processing of Submittals: Allow sufficient review time to ensure installation will not be delayed because of time required to process submittals. Minimum processing times are as follows:

- 1. Review by Architect: Allow ten (10) business days for review and processing.

2. Reprocessing of Submittals: For submittals not approved initially, allow five (5) business days for review and reprocessing of submittals by Architect.
 3. No extension of Contract Time will be authorized due to failure to transmit submittals sufficiently in advance of scheduled performance of Work.
- C. Contractor's Preparation of Submittals: Place permanent label or title block on each submittal for identification. Indicate Project Name, Architect's Project Number, Specification Section number and title, date of submittal, name and address of Architect, name and Address of Contractor, name and address of subcontractor and/or supplier, name of manufacturer, Drawing number and detail reference.
1. Contractor's Review and Action Stamp: Provide suitable space on label or title block for Contractor's review and action stamp. Stamp and sign each submittal to show Contractor's review and approval prior to transmittal to Architect. Submittals not signed and stamped by Contractor will be returned without action.
 2. Architect's Review and Action Stamp: Provide minimum 4 in. x 4 in. space on label or title block for Architect's review and action stamp. Deliver submittals to Architect at address listed on cover of Project Manual.
 3. Modify and customize submittals as required to show interface with adjacent work and attachment to building.
- D. Transmittal of Submittals: Transmit each item with Architect-accepted transmittal form. Identify Project, Contractor, subcontractor, major supplier; identify pertinent Drawing sheet and detail number, and Specification section number, as appropriate, on transmittal form.
1. Source: Submittals received from sources other than Contractor will be returned without action.
 2. Deviations from Contract Documents: When products, materials, or systems submitted deviate from Contract Documents, record deviations clearly on transmittal form, or separate attached sheet.
- E. Comply with progress schedule for submittals related to Work progress.
- F. After Architect reviews submittal, revise and resubmit as required. Identify changes made since previous submittal.
- G. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report inability to comply with provisions.
- 1.05 PROGRESS SCHEDULE
- A. Timing: Submit progress schedule within 10 calendar days of Award of Contract.
 - B. Preparation of Progress Schedule: Prepare construction schedule per Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
 - C. Distribution: Print and distribute progress schedule to Architect, Owner, subcontractors, and other parties affected.
 - D. Revisions: Update and reissue progress schedule monthly in conjunction with Application for Payment.

1.06 SUBMITTAL SCHEDULE

- A. Timing: Prepare and issue complete Submittal Schedule no later than ten (10) working days after Architect accepts Progress Schedule.
- B. Preparation: Coordinate Submittal Schedule with Progress Schedule, and Schedule of Values.
- C. Content of Submittal Schedule: Prepare schedule in order by Specification Section. Provide the following information for each submittal:
 - 1. Scheduled date of initial submittal.
 - 2. Specification Section number.
 - 3. Submittal type.
 - 4. Name of subcontractor or supplier.
- D. Distribution: Print and distribute Submittal Schedule to Architect, Owner, subcontractors, and other parties affected.
- E. Revisions: Update and reissue Submittal Schedule monthly in conjunction with Application for Payment.

1.07 SHOP DRAWINGS

- A. Provide accurately prepared large scale and detailed shop drawings prepared specifically for this Project on reproducible sheets. Show adjacent conditions and related work. Show accurate field dimensions where appropriate. Identify materials and products shown. Note special coordination required. Standard information prepared without specific reference to Project is not considered shop drawings.
- B. Shop drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings.
- C. Show every component of fabricated item, notes regarding manufacturing process, coatings and finishes, identifying numbers conforming to Contract Documents, (i.e., door numbers, etc.) dimensions, and appropriate trade names. Show anchorage and fastening details, including type, size and spacing. Show material gage and thickness. Indicate welding details and joint types.
- D. Shop Drawing Sheet Size: Except for templates, patterns, and other full-size drawings, submit shop drawings on sheets at least 8-1/2 in. x 11 in., but no larger than 36 in. x 48 in.
- E. Submittal Quantities: Submit shop drawings in following minimum quantities: electronic. Provide one full size color hard copy of approved shop drawings to OPM.

1.08 PRODUCT DATA

- A. Definition: Product data includes manufacturer's standard published literature, such as installation instructions, catalog cuts, color charts, rough-in diagrams and wiring diagrams. When product data must be prepared specifically because standard published data is not suitable for use, submit as shop drawing.
- B. Preparation: Mark each copy of product data to show applicable choices and options. Where published product data includes information on several products and choices, mark copies to clearly indicate information applicable to this Project.

- C. Do not submit product data until compliance with requirements of Contract Documents has been confirmed.
- D. Submittal Quantities: Submit product data in following quantities: electronic. Provide one full size color hard copy of approved product data to OPM.
- E. Installer Copy: Verify that installer of Work possesses a current copy of Architect-approved product data prior to installation.

1.09 SAMPLES

- A. Submit samples identical with materials and products to be installed. Where indicated, prepare samples to match Owner's sample. Label sample with description, source, manufacturer's name, and catalog number. Submit samples along with certifications that products comply with referenced standards.
- B. Architect Review: Architect will review samples for confirmation of visual intent, color, pattern, texture, and type. Architect will not test samples for compliance with other specified requirements, which shall remain exclusive responsibility of Contractor.
- C. Submittal Quantities: When variation in color, pattern, or texture can be expected in finish work, submit multiple samples (minimum of three) to show approximate limits of variations. Submit samples in following quantities:
 - 1. Initial Selection: For initial selection of color, texture, and pattern, submit one (1) full set of manufacturer's available samples.
 - 2. Verification Samples: Submit three sets of samples selected. One set will be returned to Contractor for use at Project Site for quality control comparisons.
- D. Distribution: Distribute additional sets of approved samples to subcontractors, suppliers, installers, and others required for proper performance of Work. Indicate distribution on transmittal forms.

1.10 DAILY PROGRESS REPORTS

- A. Prepare daily construction Progress Reports. Record following information concerning events on Project Site:
 - 1. List of subcontractors at site.
 - 2. General weather conditions.
 - 3. Accidents and unusual events.
 - 4. Meetings and significant decisions.
 - 5. Orders and requests by governing authorities.
 - 6. Change orders received.
 - 7. Equipment or system tests and start-ups.
 - 8. Partial completions and occupancies.
 - 9. Authorized substantial completions.
 - 10. Work by Owner documentation.
 - 11. Number of workers on-site per contractor.
 - 12. Work descriptions and locations.
 - 13. Time and material (T&M) work, if any.
 - 14. Visitors.
 - 15. Inspections.
- B. Distribution: Distribute copies to Architect and the Owner's Representative weekly.

1.10 ARCHITECT'S ACTION

A. General:

1. The Architect will not review submittals that do not bear Contractor's review stamp and will return them without action.
2. The Architect will review only those submittals explicitly required by the Contract Documents or requested by the Architect as the work proceeds.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken as follows:

1. "NO EXCEPTIONS TAKEN": No corrections, no marks: Resubmission not required.
2. "MAKE CORRECTIONS NOTED": Minor amount of corrections; all items can be fabricated without further corrections to original submittal; checking is complete and all corrections are deemed obvious without ambiguity. Resubmission not required.
3. "REVISE AND RESUBMIT": Minor corrections required; items noted shall not be fabricated until further corrections of original submittal is completed and Architect-approval is obtained; checking is complete; clarify details of items noted by checker for approval; items without marks may be fabricated without further submittal. Resubmission required.
4. "REJECTED": Submittal does not conform to Contract Documents, and requires too many corrections, or is rejected for other justifiable reasons. Architect will state reasons for rejection. Correct and resubmit. Do not fabricate.

C. Other Action: Submittal for information or record purposes will be returned with no action marked.

D. Required Resubmittals: Make corrections or changes to submittals required by Architect and resubmit until approved. Revise initial shop drawings or product data, and resubmit as specified for initial submittal. Indicate changes made other than those requested by Architect. Submit new samples as required for initial submittal.

E. Submittal Procedures:

1. Fabrication or installation of work for which Architect's review is required should not begin until the submittal is acceptable to the Architect. Fabrication or installation begun without Architect's acceptance is undertaken at the Contractor's sole risk.
2. In resubmitting, comply with requirements specified for the initial submittal. Transmit each resubmittal with a new letter of transmittal and note the transmittal number of the first submission on the transmittal form.
3. Informational Submittals: The Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

F. Description of Actions:

1. If submittal is stamped "No Exceptions Taken" items covered by the submittal are in conformance with requirements of the Contract Documents and may be incorporated in the Work. The submittal (shop drawings, product data or samples) need not be resubmitted.

2. If submittal is stamped "Make Corrections Noted" subject to corrections noted, items covered by the submittal are in conformance with requirements of the Contract Documents and may be incorporated in the Work. Resubmit corrected submittal for Record only. The submittal (shop drawings, product data or samples) need not be resubmitted. Make changes noted to the actual item prior to fabrication and installation.
3. If submittal is stamped "Revise and Resubmit" make corrections or changes required by the Architect in the submittals and resubmit submittal for review. Items covered by the submittal are not approved for incorporation into the Work.
4. If submittal is stamped "Rejected" the submittal does not conform to the requirements of this Section, or deviates from the requirements of the Contract. A conforming submittal must be submitted, and the items covered by the incorporated work.

G. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 3516

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 REQUIREMENTS INCLUDED

- A. Coordinate Work and schedule elements of alterations and renovation work by procedures and methods that expedite completion of the Work.
- B. In addition to demolition specified in Section 02 41 25, SELECTIVE DEMOLITION, and indicated on Drawings, cut, move and remove miscellaneous existing work as necessary to provide access and to allow alterations and new work to proceed. Include but do not limit work to:
 - 1. Repair and removal of hazardous and unsanitary conditions and materials.
 - 2. Removal of abandoned items and items that serve no useful purpose, such as abandoned piping, conduit and wiring.
 - 3. Removal of unsuitable and extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals and deteriorated concrete.
 - 4. Cleaning of surfaces, and removal of surface finishes as needed to install new work and finishes.
- C. Patching, repair, and refinishing existing work intended for reuse, to specified condition for each material, with suitable transition to adjacent new items of construction.

1.03 ALTERATIONS, CUTTING, AND PROTECTION

- A. Ensure that work is performed by workers qualified for each condition and material encountered.
- B. Cutting of existing construction required to install equipment under various Sections shall be done by coring or sawing method under Section appropriate to materials and construction.
- C. Cut and remove minimum materials necessary and avoid damage to adjacent work intended for reuse.
- D. Cut finish surfaces such as trim and metals by methods that terminate surfaces in a straight line at natural points of division.
- E. Cutting and patching work shall comply with requirements of Section 01 73 10, CUTTING AND PATCHING.
- F. Protect existing finishes, equipment, and adjacent work scheduled to remain from damage from weather and extremes of temperature.
 - 1. Maintain existing interior work above 60°F.

2. Provide weather protection, waterproofing, heat and humidity control as necessary to prevent damage to remaining existing work and to new work.
- G. Provide temporary enclosures to separate work areas from existing building and from areas occupied by Owner and tenants, and to provide weather protection.

PART 2 - PRODUCTS

2.01 SALVAGED MATERIALS FOR REUSE

- A. Salvage sufficient quantities of cut and removed materials to replace damaged work of existing construction when material is not readily obtainable on current markets.
1. Store salvaged items in dry, secure place on site.
 2. Items not required for use in repair of existing work shall remain Owner's property.
 3. Do not incorporate salvaged or used materials in new construction without Architect's approval and approval of Owner.

2.02 PATCHING, EXTENDING, AND MATCHING

- A. Provide same products or types of construction as those in existing structure, as needed to patch, extend, and match existing work.
- B. Generally, Contract Documents do not define products or standards of workmanship present in existing construction; determine products and workmanship by inspection and testing. Architect will judge workmanship and materials against existing as a sample of comparison.
- C. Provide products, finishes, and types of construction for patching, extending and matching shall be performed as necessary to make work complete and consistent to identical standards of quality.

PART 3 - EXECUTION

3.01 PERFORMANCE

- A. Patching of existing construction to accommodate work of various Sections shall be performed under Sections that specify methods and materials similar to adjacent existing construction, in the following areas:
1. Holes adjacent to penetrations for electrical conduit, plumbing pipes and ductwork where exposed to view.
 2. Holes adjacent to penetrations through fire walls for electrical conduit, plumbing pipes and ductwork through fire walls as required by code.
 3. Areas adjacent to installation of new doors and windows and other framed wall and partition penetrations.
 4. Removal and patching of damaged material where indicated.
- B. Patch areas exposed to view after removal of existing construction and intersecting walls as indicated.
- C. Patch and extend existing work using skilled workers who are capable of matching existing quality of workmanship. Quality of patched or extended work shall be equal to that specified for new work.

3.02 ADJUSTMENTS

- A. Where partitions are removed, patch floors, walls, and ceilings, with finish materials to match existing.

3.03 DAMAGED SURFACES

- A. Patch and replace parts of existing finished surface which is found to be damaged, lifted, discolored, or otherwise imperfect, with matching materials.
 - 1. Provide adequate support of substrate before patching finish.
 - 2. Refinish patched portions of painted and coated surfaces to produce uniform color and texture over entire surface.
 - 3. When existing surface finish cannot be matched, refinish entire surface to nearest intersections.

3.04 TRANSITION FROM EXISTING TO NEW WORK

- A. When new work abuts or finishes flush with existing work, make smooth transition. Patched work shall match existing adjacent work in texture and appearance so that patch or transition is not visible from 5 ft. away.
- B. When finished surfaces are cut so that smooth transition with new work is not possible, terminate existing surface in a neat manner along straight line at natural line of division. Provide trim appropriate to finished surface.

3.05 CLEANING

- A. Perform periodic and final cleaning as specified in Section 01 77 00, CLOSEOUT PROCEDURES.
- B. At completion of work of each Section, clean area and prepare surfaces for work of other Sections.
- C. At completion of alterations work in each area, provide final cleaning and return space to condition suitable for use by Owner.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
 - 1. Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION for developing a schedule of required tests and inspections.
 - 2. Section 01 73 10, CUTTING AND PATCHING for repair and restoration of construction disturbed by testing and inspecting activities.
 - 3. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.
- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.04 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certification by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to the Architect.

1.05 REGULATORY REQUIREMENTS

- A. Copies of Regulations: Obtain copies of the following regulations and retain at Project site to be available for reference by parties who have a reasonable need:
1. Massachusetts State Building Code.
 2. Massachusetts Fire Protection Code.
 3. Massachusetts State Plumbing and Gas Code.
 4. United States disabled access regulations, "Americans with Disabilities Act (ADA)", ANSI Guidelines for Accessibility.
 5. Mechanical, plumbing, and electrical codes, current edition, as adopted by the Commonwealth of Massachusetts.

1.06 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Delegated Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by a responsible design professional, for each product and system specifically assigned to the Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include lists of codes, loads, and other factors used in performing these services.
- C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
 2. Description of test and inspection.
 3. Identification of applicable standards.
 4. Identification of test and inspection methods.
 5. Number of tests and inspections required.
 6. Time schedule or time span for tests and inspections.
 7. Entity responsible for performing tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.
- D. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.

8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Ambient conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- 1.07 QUALITY ASSURANCE
- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.
- H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.

1.08 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
1. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Testing agency will retest and reinspect corrected work.
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 5. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field-curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
 2. Comply with the Contract Document requirements for Section 01 73 10, CUTTING AND PATCHING.
- B. Protect construction exposed by or for quality-control service activities.

- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 42 00

REFERENCES AND STANDARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the CONDITIONS OF THE CONTRACT,
- B. "Reviewed": When used to convey Architect's action on General Contractor's submittals, applications, and requests, "reviewed" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities subject to Owner's approval. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source, and have available on site for reference.

1.04 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

AA	Aluminum Association, Inc. (The)
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ABAA	Air Barrier Association of America
ACI	ACI International (American Concrete Institute)
AGC	Associated General Contractors of America (The)
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
APA	APA - The Engineered Wood Association
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (The American Society of Mechanical Engineers International)
ASTM	ASTM International (American Society for Testing and Materials International)
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
CDA	Copper Development Association
CISCA	Ceilings & Interior Systems Construction Association
CRI	Carpet & Rug Institute (The)
CSI	Construction Specifications Institute (The)
DHI	Door and Hardware Institute
EPA	Environmental Protection Agency (United States)
FM	Factory Mutual
FMRC	Factory Mutual Research (Now FM Global)
FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America

GS	Green Seal
HPVA	Hardwood Plywood & Veneer Association
ICRI	International Concrete Repair Institute, Inc.
IESNA	Illuminating Engineering Society of North America
ILI	Indiana Limestone Institute of America, Inc.
ISO	International Organization for Standardization
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek Testing Service NA
LEED	Leadership in Energy & Environmental Design (USGBC)
MassDOT	Massachusetts Department of Transportation
MFMA	Maple Flooring Manufacturers Association, Inc.
MHD	Massachusetts Highway Division
NAAMM	National Association of Architectural Metal Manufacturers
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCMA	National Concrete Masonry Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NFPA	NFPA (National Fire Protection Association)
NFRC	National Fenestration Rating Council
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)
NRCA	National Roofing Contractors Association
NSF	NSF International (National Sanitation Foundation International)
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NWWDA	National Wood Window and Door Association (Now WDMA)
SDI	Steel Deck Institute
SGCC	Safety Glazing Certification Council
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
UL	Underwriters Laboratories Inc.
USGBC	U.S. Green Building Council
WCLIB	West Coast Lumber Inspection Bureau
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WWPA	Western Wood Products Association

- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of current edition of Codes in the Commonwealth of Massachusetts.

PART 2 - PRODUCTS

Not Used.

GRLA 2020120.01

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 43 29

MOCK-UPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. General: Provide and coordinate mock-up assemblies at Project site for Architect’s review and acceptance, in accordance with requirements of the Contract Documents. Refer to individual Specification Sections for mock-up requirements. Generally, without limitation, mock-ups on site include the following:
 - 1. Mock-ups of individual pieces of the work, as specified within individual Specification Section.
 - 2. Field Mock-Up of exterior components/systems as indicated.
 - 3. Field Mock-Up of interior components/systems as indicated.
- B. It shall be the responsibility of the Contractor to coordinate the work of the related Specification Sections so that each mock-up meets the specified requirements.
- C. Related Sections include the following:
 - 1. Document 00 51 00, AGREEMENT and Document 00 70 00, GENERAL CONDITIONS: Agreement and General Conditions of the Contract.
 - 2. Section 01 23 00, ALTERNATES; Description of alternates.
 - 3. Section 01 45 00, QUALITY CONTROL; Inspection and testing.
 - 4. Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS; Temporary enclosures.
 - 5. Divisions 02 through 34; Individual Specification Sections that specify field mock-ups of individual pieces of the Work.

1.03 SUBMITTALS

- A. Shop Drawings of Mock-Ups: Provide large scale shop drawings for fabrication, installation and erection of all parts of each mock-up. Provide plans, elevations, and details of anchorage, connections and accessory items.
- B. Photographs of Mock-Ups: Submit photographs of mock-ups after completion of installation and acceptance of each mock-up.
- C. Samples: Refer to individual Specification Sections for submittal requirements of mock-up components and coordinate accordingly.

1.04 QUALITY ASSURANCE

- A. Design Modifications: Make design modifications to work only as required to meet performance requirements and to coordinate the work. Indicate proposed design modifications on shop drawings. Maintain original design concept without altering profiles and alignments indicated.

PART 2 - PRODUCTS

2.01 MATERIALS AND PRODUCTS

- A. Provide materials, components, and products for mock-ups as specified in individual Specification Sections.
 - 1. When indicated in individual Specification Sections, approved mock-ups may be incorporated into the finish work.
 - 2. Provide as many mock-ups as required until approval of Architect and OPM has been received.

PART 3 - EXECUTION

3.01 GENERAL

- A. Refer to PART 3, EXECUTION portions of the various Specification Sections for specific requirements regarding condition of surfaces, erection, and erection tolerances.

3.02 FIELD MOCK-UP OF EXTERIOR CONSTRUCTION

- A. Provide a field mock-up of the following exterior construction items at locations and in configuration indicated on Drawings or as otherwise directed. Obtain Architect and Owner's acceptance of visual qualities prior to commencing work that individual mock-up is intended to represent. Protect and maintain approved mock-ups throughout the work of the Contract. Locate mock-ups at the Project site as directed by Architect or Owner.
 - 1. Refer to Drawings for extent of the field mock-up.
- B. Exterior Construction Mock-ups: Provide mock-ups of various exterior construction as indicated or as specified in the applicable Specification Sections, as directed by Architect and Owner, and as listed below:
 - 1. Exterior masonry.
 - 2. Exterior siding and trim.
 - 3. Exterior window system.
 - 4. All other mock-ups as directed.

3.03 FIELD MOCK-UP OF INTERIOR CONSTRUCTION

- A. Provide a field mock-up of the following interior construction items at locations and in configuration indicated on Drawings or as otherwise directed. Obtain Architect and Owner's acceptance of visual qualities prior to commencing work that individual mock-up is intended to represent. Protect and maintain approved mock-ups throughout the work of the Contract. Locate mock-ups at the Project site as directed by Architect and Owner.
 - 1. Refer to Drawings for extent of the field mock-up.
- B. Interior Construction Mock-ups: Provide mock-ups of various interior construction as indicated or as specified in the applicable Specification Sections, as directed by Architect and Owner, and as listed below:
 - 1. Interior flooring.
 - 2. Architectural woodwork.
 - 3. Paint and coating systems.

3.04 OTHER MOCK-UPS

- A. Provide mock-ups of types and sizes required by individual Specification Sections to evaluate and set the standard of quality for that work. Obtain Architect and Owner's acceptance of visual qualities prior to commencing work that individual mock-up is intended to represent. Protect and maintain approved mock-ups throughout the work of the Contract. Locate mock-ups at the Project site as directed by Architect and Owner.
 - 1. Provide as many mock-ups as required until Architect and Owner's approval has been received.
 - 2. When indicated in individual Specification Sections, approved mock-ups may be incorporated into the finish work.

3.05 REMOVAL AND DISPOSAL

- A. Demolish and remove mock-ups from site at the completion of the Project. Legally dispose of demolished mock-up materials.

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SECTION INCLUDES

- A. This section specifies procedures for measuring and reporting the quality and performance of construction, including:
 - 1. Supporting services provided during tests and inspections performed by an independent testing agency employed by the Owner and by governing authorities.
 - 2. Tests and inspections provided by the Contractor or by an independent testing agency employed by the Contractor.
 - 3. Mock-ups and field samples.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 01 40 00, QUALITY REQUIREMENTS; Inspection and testing.
 - 2. Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS; Temporary enclosures.
 - 3. Individual Specification Sections that specify field mock-ups of individual pieces of the Work.

1.04 SUBMITTALS

- A. Test Reports: For tests and inspections which are required to be performed by the Contractor, submit certified written reports.

1.05 TESTING BY OWNER

- A. Where inspections, tests, and other requirements of the Contract Documents are specifically indicated to be the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.

1.06 CONTRACTOR'S RESPONSIBILITIES

- A. Scope of Testing Performed by Contractor: The Contractor shall provide all other inspections, tests, and other quality control services specified elsewhere in the Contract Documents or required by authorities having jurisdiction. Include costs for these services in the Contract Sum.

1. Unless the Contract Documents or local authorities permit such testing or inspections to be performed by the Contractor's own forces, the Contractor shall employ and pay a qualified independent testing agency or agencies to perform these services. This agency shall be referred to as "the Contractor's Testing Agency" or "the Contractor's Testing and Inspection Agency".
- B. Regardless of whether testing and inspection is performed by the Owner's Testing and Inspection Agency or the Contractor's Testing and Inspection Agency, the Contractor shall be responsible for coordination and scheduling of testing, and for associated services, as follows:
1. Schedule times for inspections, tests, taking samples, and similar activities. Coordinate this schedule with construction activities so that testing does not delay the work, and so that testing is completed before work to be tested is closed in or otherwise made inaccessible.
 2. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable support services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services may include, but are not limited to, the following:
 - a. Provide access to the Work.
 - b. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 - c. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 - d. Provide facilities for storage and curing of test samples.
 - e. Deliver samples to testing laboratories.
 - f. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 - g. Provide security and protection of samples and test equipment at the Project Site.
 - h. Protect construction exposed by or for quality-control service activities.
- C. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Documents, regardless of whether the original test was Contractor's responsibility.
- D. Do not cover or enclose with permanent construction items or assemblies which are to be tested or inspected until such testing or inspection has been completed and the Work has been accepted in accordance with the Contract Documents. Protect construction exposed by or for testing and inspection until it is covered or enclosed with permanent construction. After inspection and testing is completed, complete the enclosing Work and repair substrates and finishes that have been damaged by the testing.
- E. Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with requirements for cutting and patching specified in Section 01 73 10, CUTTING AND PATCHING.
- 1.07 DUTIES OF THE TESTING AGENCY; REPORTING PROCEDURES
- A. Duties of the Testing Agency:
1. Provide qualified personnel to perform required inspections and tests.
 2. Furnish equipment, tools and supplies necessary for taking samples and performing tests, except where sampling is indicated to be the responsibility of the Contractor.
 3. Prepare test reports, as specified elsewhere in this Section.
 4. Promptly notify the Architect and the Contractor of irregularities or deficiencies observed in the Work during performance of its services.

- B. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
- C. Promptly after completion of each inspection or test performed, the testing agency shall prepare a certified written report of the tests or inspections performed. Submittal of such reports shall be a prerequisite to payment for the work being tested.
- D. Report Data: Include as a minimum, the following information:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Name of individual making the inspection or test. Have this person sign the report after it is completed.
 - 5. Identification of product or assembly and Specification Section.
 - 6. Dates and locations of samples and tests or inspections.
 - 7. Ambient conditions at the time of sample taking and testing.
 - 8. Description of the type of inspection or test method.
 - 9. Complete inspection or test data.
 - 10. An interpretation of test results, including comments or professional opinion on whether inspected or tested Work complies with the Contract Documents.
 - 11. Recommendation for remedial action or retesting.
- E. Submittal: The Testing Agency shall deliver reports to the Architect, Owner and Contractor, as follows:
 - 1. Architect: Two copies, plus additional copies as requested by the Architect for special distribution. The Architect will forward test reports to the local authority having jurisdiction, if required.
 - 2. Owner: One copy.
 - 3. Contractor: Two copies. The Contractor will place one of these copies in the Project Record File.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 45 33

STRUCTURAL TESTS AND INSPECTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. A program of Structural Tests and Inspections including a 'Program of Structural Tests and Inspections' and a 'Schedule of Structural Tests and Inspections' in accordance with Commonwealth of Massachusetts State Building Code, has been developed by the Structural Engineer for this Project, DeSIMONE CONSULTING ENGINEERS, hereinafter referred to as the Structural Engineer of Record (SER).
- B. The Owner will engage independent testing and inspection agencies for construction testing and quality assurance. The Contractor shall coordinate such work in accordance with the following documents:
 - 1. Structural Special Inspections and Procedures; refer to Structural Drawings including Structural Drawing S2.0 – PROGRAM OF SPECIAL INSPECTIONS.
- C. Unless otherwise indicated, required structural tests and inspections shall comply with the requirements of local authorities having jurisdiction.
 - 1. Comply with the requirements of Massachusetts State Building Code, (latest edition), and the Town of Boxford Building Department.
- D. Related Sections include the following:
 - 1. Document 00 51 00, AGREEMENT and Document 00 70 00, GENERAL CONDITIONS: Agreement and General Conditions of the Contract.
 - 2. Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.
 - 3. Respective sections of specifications: Certification of products.
 - 4. Section 01 40 00, QUALITY REQUIREMENTS.
 - 5. Section 01 45 00, QUALITY CONTROL.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. This Section specifies construction facilities and temporary controls, including, but not limited to:

- 1. Temporary utilities.
- 2. Temporary construction and support facilities.
- 3. Temporary signage.
- 4. Security and protection facilities.

- B. Requirements include:

- 1. Existing utilities / Dig-Safe notification.
- 2. Temporary water.
- 3. Weather protection.
- 4. Heating during construction.
- 5. Temporary power.
- 6. Hoisting equipment and machinery.
- 7. Staging.
- 8. Maintenance of access.
- 9. Dust control.
- 10. Noise control.
- 11. Enclosures.
- 12. Cleaning during construction.
- 13. Field offices.
- 14. Telephone and communications services.
- 15. Equipment.
- 16. Sanitary facilities.
- 17. Construction barriers.
- 18. Parking.
- 19. Vehicle and equipment protection.
- 20. Shoring.
- 21. Debris control and removal, including construction waste recycling and management.
- 22. Safety protection.
- 23. Project Identification.
- 24. Fire protection during construction.
- 25. All scaffolding and lifts necessary for both interior work and exterior envelope repairs shall be provided and installed by the GC except for Masonry Filed Sub-bid.

- C. Related Work Specified in Other Sections: Refer to Division 01 and Division 02 Specification Sections, including:

- 1. Document 00 23 10, EXISTING CONDITIONS; Description of existing conditions.

2. Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS; Conditions of the Contract.
3. Section 01 11 00, SUMMARY; Description of work and work of separate contracts, phasing.

1.03 SUBMITTALS

- A. Schedule: Submit a schedule indicating implementation and termination of each temporary utility within fifteen days of date established for Commencement of the Work.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of authorities having jurisdiction, codes, utility companies, OSHA, and industry standards including, but not limited to:
 1. NFPA 241.
 2. NFPA 70.
 3. ANSI A10.
 4. NECA NJG-6.
- B. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:
 1. Commonwealth of Massachusetts State Building Code requirements.
 2. Health and safety regulations including OSHA Standards and Regulations.
 3. Utility company regulations.
 4. Town of Boxford Police Department rules.
 5. Town of Boxford Fire Department requirements.
 6. Town of Boxford Bylaws.
 7. Environmental protection regulations.

1.05 PROJECT CONDITIONS

- A. Temporary Utilities: Existing building services may be used as source for temporary power for proposed work including the following: electric power and water service. The Owner will permit tie-in to these services at locations authorized by the Owner. The Owner reserves the right to limit services should the temporary utilities interrupt Owner's existing uses at the building or when in the opinion of the Owner there is evidence of waste or abuse.
 1. Existing service is limited; Contractor shall supplement service with additional service as required.
- B. Conditions of Use: Maintain temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload temporary facilities. Do not allow hazardous, dangerous, or unsanitary conditions to develop on site.
- C. Contractor's Identification and Access to Building and Work Areas:
 1. Identification of Workers: All Contractors and subcontractors working on this Project shall be issued by the General Contractor an identification badge including photograph and identification of worker including company employing worker as a form of identification; actual badge format shall be subject to Owner's approval.

1.06 NOISE CONTROL

- A. Develop and maintain a noise-abatement program and enforce strict discipline over all personnel to keep noise to a minimum.
 - 1. Submit noise control plan to Owner and the Owner's Project Manager (OPM) within ten (10) days of Notice to Proceed.
- B. Execute construction work by methods and by use of equipment which will reduce excess noise.
 - 1. Equip air compressors with silencers, and power equipment with mufflers.
 - 2. Manage vehicular traffic and scheduling to reduce noise.
 - 3. No heavy equipment may be started or idled before 7:00 A.M.
 - 4. Radios are prohibited.

1.07 ACCEPTABLE HOURS OF OPERATION

- A. Contractor shall conduct construction in compliance with applicable Town of Boxford ordinances or bylaws relative to acceptable hours of operation. Except where approved by the Owner, no work shall occur prior to 7:00 AM, Monday through Friday.
- B. Normal Work Hours: Normal work hours shall be 7:00 AM to 3:30 PM, Monday through Friday.
- C. Saturday Work: Work on Saturdays may occur subject to approval by Owner and OPM.
- D. Sunday Work: No work will be permitted on Sundays.

1.08 MAINTENANCE OF ACCESS

- A. The General Contractor shall provide and maintain for the duration of his contract, a means of access to, around and within the site, as indicated on the Contract Drawings, for vehicular traffic and authorized personnel. This means of access shall be construed to sustain the weight of equipment customarily engaged for use in construction projects of this type and magnitude. The General Contractor shall, without additional compensation from the Owner, furnish labor and materials as may be required from time to time to maintain this means of access in an acceptable condition as determined by the Architect. Pedestrian access shall provide adequate protection against falling debris, slippage, adequate lighting, warning and directional signs, and protection against construction activities.

1.09 DUST CONTROL

- A. The General Contractor shall provide adequate means for the purpose of preventing dust caused by construction operations both interior and exterior from creating a hazard, nuisance, and from entering adjacent occupied areas throughout the period of the construction contract. Submit dust control plan to Owner and OPM within ten (10) days of Notice to Proceed.
 - 1. Provide positive methods and apply dust control materials to minimize raising dust from construction operations.
 - 2. Provide positive means to prevent air-borne dust from dispersing into the atmosphere.
 - 3. Provide suitable fire retardant partitions or enclosures at all work areas to separate these work areas from occupied areas of each building and other facilities.
 - 4. Dust free construction includes temporary stud walls with Type X gypsum board sheathing taped.
 - 5. Designate temporary egress corridors and temporary access for wheelchairs, etc.

- B. This provision does not supersede any specific requirements for methods of construction or applicable Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS set forth in the Contract Articles with added regard to performance obligations of the General Contractor.

1.10 INDOOR AIR QUALITY MANAGEMENT

- A. Minimize exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke. At a minimum, take the following measures:
 - 1. Smoking is prohibited at jobsite.
- B. The Contractor shall develop a Construction Indoor Air Quality Management Plan for this Project and meet requirements of LEED EQ Cr 3.1 and 3.2.
- C. During Construction: Comply with the following requirements, per LEED EQ Cr. 3.1:
 - 1. During construction meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3.
 - 2. Protect stored on-site and installed absorptive materials from moisture damage.
- D. At Completion of Construction: Comply with the following requirements, per LEED EQ Cr. 3.2:
 - 1. Air Quality Testing (Contractor-engaged indoor-air-quality testing):
 - a. Conduct a baseline indoor air quality testing procedure consistent with the United States Environmental Protection Agency's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air."
- E. Construction Indoor Air Quality Management Plan Submittal:
 - 1. Within 21 calendar days after receipt of Notice to Proceed, the Contractor shall submit to the Owner's Project Manager a finalized Construction IAQ Management Plan.
 - 2. The proposed Plan shall comply with requirements of LEED EQ Cr 3.1 and 3.2.
 - 3. The proposed Plan shall include, but not be limited to, the following:
 - a. Protection of ventilation system components during construction.
 - b. Cleaning and replacing contaminated ventilation system components after construction, including filtration media.
 - c. Temporary ventilation.
 - d. Protection of absorptive materials from moisture damage when stored on-site and after installation, including exterior wall rain protection.
 - e. Sequence of finish installation plan.
 - f. Selection of cleaning products and procedures to be used during construction and final cleaning.
 - g. Schedule of emission test data recorded by Contractor's testing laboratory.
- F. Take special care to prevent accumulation of moisture on materials and within packaging during delivery, storage, and handling to prevent development of mold and mildew inside packaging and on products.
- G. Immediately remove from site and properly dispose of materials showing signs of mold and mildew, including materials with moisture stains.

H. IAQ Plan Implementation:

1. IAQ Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Construction IAQ Management Plan for the Project.
2. Distribution: The Contractor shall distribute copies of the Construction IAQ Management Plan to the jobsite foreman, each subcontractor, Owner's Project Manager (OPM), and the Architect.
3. Instruction: The Contractor shall provide on-site instruction of appropriate procedures and methods to be used by all parties at the appropriate stages of the Project.
4. Preconditioning: Allow products, which have odors and significant VOC emissions, to off-gas in a dry, well-ventilated space for sufficient period to dissipate odors and emissions prior to delivery to Project.
5. Remove containers and packaging from materials prior to conditioning to maximize off-gassing of VOCs.
6. Condition products in ventilated warehouse or other building.
7. Coordinate Construction IAQ Management Plan with final cleaning.

1.11 ENCLOSURES

- A. Provide temporary, insulated, weather tight closures of openings in exterior surfaces for providing acceptable working conditions and protection for materials, allowing for heating during construction, and preventing entry of unauthorized persons. Provide doors with self-closing hardware and locks.
- B. All utilities including electric ducts, conduits, telephone lines, sprinklers, and other utilities shall be protected against damage from construction activity. The General Contractor shall be responsible for all damage to the utilities from construction and shall repair all such damage at no additional cost to Owner.

1.12 TEMPORARY POWER

- A. The Owner will provide electrical energy required for temporary light, power, fire alarm, and exit signage, using existing power in the building. The Electrical Contractor is required under Section 26 00 00 - ELECTRICAL WORK, to provide temporary feeders of sufficient capacity at the point designated on the drawings, to provide for the electric light and power requirements of the Project while under construction and until the permanent feeders have been installed and are in operation. It is not the intent of the above statement to relieve the General Contractor of the responsibility of payment for energy consumed during construction, but rather to afford him use of permanent feeder, etc. for electric distribution during construction. Payment for energy consumed during construction shall be the responsibility of the General Contractor until either Use and Occupancy or Final Acceptance has occurred.
- B. The General Contractor shall pay for the cost of electric energy consumed by himself and by all of his Subcontractors. Any temporary wiring of a special nature, other than that specified in Section 26 00 00 - ELECTRICAL WORK, shall be paid for by the Subcontractor requiring it, such as:
 1. Special circuits required by electric welders, elevators, lifts or other special equipment requiring high-amperage and/or special voltage service, etc.
 2. Exterior lighting circuits for protection against vandalism, public warning lights, lights for advertising, and similar items.
- C. The General Contractor and all Subcontractors, individually, shall furnish all extension cords, sockets, motors, and accessories required for their work. They shall also pay for all temporary wiring of construction offices and buildings used by them.

- D. The General Contractor shall pay for the offices of the General Contractor and the OPM specified in the Contract Documents. The shared field offices (located on-site) shall be wired from the building or a separate power drop with meter (from the utility company), the costs of which shall be paid for by the General Contractor. The Electrical Contractor shall provide for all required wiring for power and high-speed internet cable service for the shared field office General Contractor and the OPM which shall be paid for by the General Contractor.
- E. All temporary wiring installed by the Electrical Contractor shall be removed after it has served its purpose. Use copper wire only.
- F. All relocations of temporary service, lighting, fire alarm, and exit signs to meet construction and/or phasing requirements shall be performed at no additional cost to the Owner.

1.13 HEATING DURING CONSTRUCTION

- A. Within 10 calendar days after the commencement of work under this Contract, the General Contractor shall submit in writing to the Architect for approval, three (3) copies of his method and time schedule for heating during construction which shall concur with his general progress schedule required under Document 00 51 00, AGREEMENT and the CONDITIONS OF THE CONTRACT (Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS).
- B. After the building or portion thereof is completely enclosed by either permanent construction or substantial temporary materials having a comparable resistance as the specified permanent construction. The General Contractor shall pay and provide heat therein of not less than 50 degrees F., nor more than 75 degrees F., which shall be continuously maintained in the enclosed area to the extent necessary to properly progress and protect the work until the project is accepted.
- C. The General Contractor shall furnish and install one accurate recording Fahrenheit thermometer at a place designated by the Architect or the OPM, and one additional accurate thermometer for every 2,000 square feet of floor space, located as directed by the Architect in order to determine if the specified temperatures are maintained. The General Contractor or his authorized agent shall furnish daily to the OPM three (3) copies of a signed statement of temperatures recorded every three hours.
- D. The General Contractor, with the approval of the Architect and the Owner, may use the permanent heating system as specified for the project once it has been tested, flushed out and chemically treated, thoroughly cleaned of all construction dust and dirt, and is ready to operate. The General Contractor shall pay all energy costs for heating during construction and provide meters if required. The General Contractor and the HVAC and/or Electrical Subcontractor shall coordinate their work so that the permanent heating system for the building will be available and ready to provide heat as soon as the building is closed in.
- E. It shall be the sole responsibility of the General Contractor to arrange for and pay the HVAC and/or Electrical General Contractor to operate and to put in first-class condition all portions of the permanent heating system used for Heating During Construction.
- F. The installation and operation of heating devices shall comply with all safety regulations including provisions for adequate ventilation and fire protection. Heating devices which may cause damage to finish surfaces shall not be used.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Materials may be new or used but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- B. Lumber and Plywood: Provide materials that conform to the following:
 - 1. Signs and Directory Boards: Provide exterior grade, Medium Density Overlay (MDO) plywood, conforming to USDC PS1, of size and thickness indicated.
- C. Sheeting for Temporary Enclosures: Type X gypsum board.

2.02 TEMPORARY UTILITIES

- A. Scope: Temporary utility work includes, but is not limited to:
 - 1. Water service and distribution.
 - 2. Electric power and light.
 - 3. Telephone service.
- B. Temporary Water Service and Distribution: Water service is available at the building. Install water service and distribution piping in sizes and pressures adequate for construction.
 - 1. Provide water for construction purposes, including water for drinking and fire protection.
 - 2. Pay costs for installation, maintenance, removal, and service charges for water used. Install branch piping with taps located so water is available through hoses throughout construction.
 - 3. Protect piping and fittings against freezing.
- C. Electric Power Service: Electrical service is available at the building. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Pay costs of power used and pay costs to bring extend service to project site, including service charges, installation, maintenance, and removal of this temporary electric service if existing system is inadequate.
 - 1. Provide circuit and branch wiring, with area distribution boxes located so power and lighting is available throughout construction by use of construction-type power cords.
 - 2. Provide adequate artificial lighting where natural light is not adequate for work, and for areas accessible to public. Comply with applicable standards and OSHA requirements.
 - 3. Work shall meet applicable requirements of NFPA 70 and OSHA regulations.
 - 4. All temporary power and lighting shall be installed by the Electrical Subcontractor. Refer to Section 26 00 00, ELECTRICAL WORK.

2.03 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES

- A. Scope: Temporary construction and support facilities include, without limitation:
 - 1. Temporary heat and ventilation; and cooling.
 - 2. Field offices and storage sheds.
 - 3. Sanitary facilities.
 - 4. Temporary enclosures.
 - 5. Construction aids.
 - 6. Waste disposal services including construction waste recycling and management.

7. Water control.
8. Pollution and dust control.

B. Temporary Heat and Ventilation and Cooling:

1. Provide temporary heat and ventilation required to maintain adequate environmental conditions to facilitate progress of Work, to meet manufacturers' specified minimum installation conditions, and to protect materials and finishes from damage due to temperature and humidity.
2. Maintain heat and cooling to all occupied spaces during construction.

C. It shall be the sole responsibility of the General Contractor to arrange for and pay the HVAC and/or Electrical Contractor to operate and to put in first-class condition all portions of the permanent heating system used for Heating During Construction.

2.04 WEATHER PROTECTION

- A. It is the intent of these Specifications to require that the General Contractor shall provide temporary enclosures and heat to permit construction work to be carried on during the months of November through March in compliance with M.G.L. Chapter 149, Section 44D(G). These Specifications are not to be construed as requiring enclosures or heat for operations that are not economically feasible to protect in the judgment of the Architect. Included in the preceding category, without limitation, are such items as site work, excavation, steel erection, erection of certain "exterior" wall panels, roofing, and similar operations.
- B. "WEATHER PROTECTION" shall mean the temporary protection of that work adversely affected by moisture, wind and cold, by covering, enclosing and/or heating. This protection shall provide adequate working areas during the months of November through March as determined by the Architect and consistent with the approved construction schedule to permit the continuous progress of all work necessary to maintain an orderly and efficient sequence of construction operations. The General Contractor shall furnish and install all "weather protection" material and be responsible for all costs, including heating required to maintain a minimum temperature of 50 degrees F. at the working surface. This provision does not supersede any specific requirements for methods of construction, curing of materials or the applicable general conditions set forth in the Contract Articles with added regard to performance obligations of the Contractor.
- C. Within 30 calendar days after his award of contract, the General Contractor shall submit in writing to the Architect for approval, three copies of his proposed methods for "Weather Protection."
- D. Installation of weather protection and heating devices shall comply with all safety regulations including provisions for adequate ventilation and fire protection devices. Heating devices which may cause damage to finish surfaces shall not be used.

2.05 HOISTING EQUIPMENT AND MACHINERY

- A. All hoisting equipment and machinery required for the proper and expeditious prosecution and progress of the work shall be furnished, installed, operated and maintained in safe condition by the General Contractor for the use of all Subcontractors' material and/or equipment delivered to the designated hoisting area except that which is specifically required to be provided by the Subcontractors themselves and is so stated in each appropriately related Section of the Specifications. All costs for hoisting operating services shall be borne by the General Contractor unless specifically excepted in the Contract Documents.

1. Hoisting required for Masonry Filed Sub-bid shall be the responsibility of the respectable Filed Subcontractor.
 - B. The use of cranes and hoists shall be subject to review by Owner and acceptance of Contractor's Safety Plan. All crane and hoisting work shall comply with applicable federal, state, Town of Boxford, and local authorities having jurisdiction and shall comply with OSHA Standards.
 - C. Provide hoisting as part of Contractor's Safety Program and Safety Plan submittals.
- 2.06 STAGING
- A. All staging, exterior and interior, required to be greater than eight feet (8 ft.) in height, shall be furnished and erected by the General Contractor and shall be maintained in safe condition by the General Contractor without charge to and for the use of all trades as needed by them for proper execution of their work, unless noted otherwise in subcontractor sections.
 - B. Any staging that is eight feet (8 ft.) or less in height shall be furnished and erected by the applicable subcontractor.
 1. Ventilate enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, and gases.
 2. Portable heaters shall be standard approved units with controls.
 3. Pay costs of installation, maintenance, operation, and removal, and fuel consumed.
- 2.07 CONTRACTOR'S FIELD OFFICES AND SHEDS
- A. Prior to installation of offices and sheds, consult with Architect and Owner on location, access, and related facilities.
 1. Unless otherwise directed, field office may be located in area indicated on the Site Plan included as part of the Contract Documents.
 - B. Provide field offices and sheds as follows:
 1. Construction: Provide structurally sound, weathertight units, with floors raised above ground. At Contractor's option, portable or mobile buildings may be used. Mobile units, when used, shall be modified for office use.
 2. Temperature and Moisture Transmission Resistance: Compatible with occupancy and storage requirements.
 3. Contractor's Office and Facilities: Size units as required for general use and to provide space for project meetings.
 4. Furnishings in Meeting Area: Provide conference table and chairs for at least ten people. Provide rack and file for Project Record Documents in, or adjacent to, the meeting area.
 5. Other furnishings: Water cooler and supplies.
 6. Provide resilient floor covering and painted gypsum wallboard walls and acoustical ceiling. Provide operable windows with adjustable blinds and insect screens.
 7. Provide an electric heater with thermostat capable of maintaining a uniform indoor temperature of 68 deg F.
 8. Provide an air-conditioning unit capable of maintaining an indoor temperature of 72 deg F.
 9. Provide fluorescent light fixtures capable of maintaining average illumination of 20 fc at desk height.
 10. Provide 110- to 120-V duplex outlets spaced at not more than 12-foot intervals, one (1) per wall in each room.
 11. Miscellaneous Items: Provide one 10 in. outdoor type thermometer.

12. Storage Sheds: Provide types and sizes required to meet requirements of various trades and to adequately store and handle products. Provide heating and ventilation necessary to comply with manufacturer's product data and with code requirements for products stored.

C. Common-Use Field Office for Use by Owner's Clerk of the Works, the OPM and Contractor: Provide an insulated, weathertight, heated and air-conditioned field office, 10 ft. x 36 ft. office trailer with two separate ends suitable for separate office space for Contractor and for Clerk/OPM; for entrances and lockable interior door, and high speed Internet service, for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of ten (10) persons at Project site. Keep office clean and orderly.

1. Furnish and equip offices as follows:

- a. Desk and chairs, four-drawer file cabinet, a plan table, a plan rack, a 4 ft. x 4 ft. tackboard, and a bookcase.
- b. Provide computer monitor, ACER x223 and multifunction 'all-in-one' workstation able to print/scan/color copy up to 11 in. x 17 in. paper size including all service, paper, and ink/toner throughout the construction duration (or equal). Equipment will be returned to General Contractor at project completion.
- c. Coffee machine and supplies, including regular and decaffeinated coffee, filters, cups, stirring sticks, creamer, sugar, and sugar substitute.
- d. Provide a room of not less than 240 sq. ft. for Project meetings. Furnish room with conference table, 12 folding chairs, and 4-foot- square tack board.

2.08 TEMPORARY CONTROLS

A. Sanitary Facilities: Provide and maintain clean portable toilet facilities. Do not use permanent facilities within the building.

B. Temporary Enclosures: Provide temporary weathertight enclosures of exterior walls and roof areas as Work progresses. Design and construct temporary enclosures to provide acceptable working conditions, to provide weather protection for materials, to allow effective temporary heating, and to prevent entry of unauthorized persons.

1. Provide temporary exterior doors with self-closing hardware and padlocks.
2. Design enclosures to be removable to allow handling of materials.

C. Construction Aids: Provide construction aids and equipment required by personnel to facilitate execution of the Work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.

1. Refer to respective sections for particular requirements for each trade.
2. When permanent stair framing is in place, provide temporary treads, platforms, and railings, for use by construction personnel.
3. Where required to permit access to and from building areas, erect suitable protective enclosures or the like to prevent Town employees, tenants, and public from danger from ongoing construction operations.
4. Where any areas around building are required to be closed off or otherwise restricted by hoists, cranes, scaffolds, platforms, etc., the Owner shall be notified in advance of the areas affected, the anticipated length of time of closure, and all other requirements affecting use or access to the building and surrounding facilities.

D. Pollution Control: Provide methods, means, and facilities required to prevent contamination

of soil, water, or atmosphere by the discharge of noxious substances from construction operations. Provide equipment and personnel, perform emergency measures required to contain any spillage and to remove contaminated soils or liquids.

1. Take special measures to prevent harmful substances from entering public waters.
2. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
3. Provide systems for control of atmospheric pollutants.
4. Prevent toxic concentrations of chemicals.
5. Prevent harmful dispersal of pollutants to atmosphere.

E. Fencing of Construction and Staging Areas:

1. The General Contractor shall provide fencing of the construction and staging areas.
2. Fencing and lockable gates shall be as detailed on the Drawings; fencing shall be not less than six feet in height above grade and shall be continuous, surrounding and enclosing the work area totally separating the general public from construction activity, and of sufficient height to satisfy the CONDITIONS OF THE CONTRACT (Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS).
3. Temporary fencing shall also be provided at other locations indicated on the site drawings.
4. Relocate temporary fencing in accordance with phasing requirements, and remove from site at the conclusion of the project.

2.09 DEBRIS CONTROL AND REMOVAL AND CONSTRUCTION WASTE MANAGEMENT

A. Intent: The Owner and Architect have established that this Project shall generate the least amount of waste practical and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed by the General Contractor.

1. Of the waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized to the greatest extent practical.
2. With regard to these goals the Contractor shall develop, for the Owner's and Architect's review, a Waste Management Plan for this Project submitted to Architect and OPM for review within 20 days from Notice to Proceed.

B. Debris Control:

1. Provide containers for deposit of debris.
2. Provide periodic inspection of traffic areas to enforce requirements.
3. Schedule daily collection and disposal of debris within building.
4. Provide additional collections and disposals of debris whenever the periodic schedule is inadequate to prevent accumulation of debris on-site.
5. The Owner has approved a dumpster location in parking area as designated on Site Plan. Coordinate final dumpster location with OPM.

C. Each subcontractor shall be responsible for segregating their own waste into different dumpsters as directed by the General Contractor subject to acceptance by the OPM.

D. Debris shall not be permitted to accumulate or migrate and the work shall at all times be kept satisfactorily clean. The Owner's trash receptors shall not be used for the disposal of debris. Dumpster shall be provided by the General Contractor for removal of debris for all trades including subtrades unless noted otherwise.

- E. The General Contractor shall remove debris from the work site on a daily basis and dispose of same at any (private or public) DEP approved facility that the General Contractor may choose providing that the General Contractor shall make all arrangements and obtain all approvals and permits necessary from the owner or officials in charge of such dumps. Proposed dump site shall be submitted to be approved by Owner prior to start of demolition. During disposal process, copies of daily receipts from dump site shall be submitted on a regular basis.
1. The General Contractor shall be responsible for ensuring that debris will be disposed of at appropriately designated licensed solid waste disposal facilities.
- F. Referenced Standards: In addition to applicable regulations, the following document is cited as a reference to provide the waste management programs established by the Owner for this Project:
1. Guide to Construction and Demolition Recycling - 'Recycling Construction and Demolition Wastes - A Guide for Architects and Contractors', dated November 2004 including all revisions and addenda.
- G. Definitions
1. Asphalt Pavement, Brick, and Concrete (ABC) Rubble: Rubble that contains only weathered (cured) asphalt pavement, clay bricks and attached mortar normally used in construction, or concrete that may contain rebar. The rubble shall not be mixed with, or contaminated by, another waste or debris.
 2. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
 3. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
 4. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
 5. Recycle: Diversion of demolition and construction waste from the landfill for reuse.
 6. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
 7. Salvage for Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- H. Performance Requirements
1. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 75 percent by weight of total waste generated by the Work, and as required.
 2. Salvage/Recycle Requirements: Salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
 - Demolition Waste:
 - Asphaltic concrete paving.
 - Concrete and concrete reinforcing steel.
 - Brick and concrete masonry units.
 - Wood studs, wood joists, plywood, oriented strand board, paneling and trim.
 - Casework and cabinetry.
 - Structural steel, miscellaneous steel and rough hardware.
 - Roofing.
 - Insulation.
 - Doors, door frames and door hardware.

- Windows and glazing.
- Metal studs.
- Gypsum board (new unpainted scrap).
- Acoustical tile and panels.
- Carpet and carpet pad.
- Demountable partitions.
- Equipment.
- Plumbing fixtures, piping, supports, hangers, valves and sprinklers.
- Mechanical equipment and refrigerants.
- Electrical conduit, copper wiring, lighting fixtures, lamps, and ballasts.
- Electrical devices, switchgear, panelboards and transformers.
- Construction Waste.
- Site-clearing waste.
- Concrete and concrete reinforcing steel.
- Masonry and CMU.
- Lumber, wood sheet materials and wood trim.
- Metals.
- Roofing.
- Insulation.
- Carpet and pad.
- Gypsum board.
- Piping.
- Wire and cable
- Electrical conduit.
- Packaging: 100 percent of the following uncontaminated packaging materials: Paper, cardboard, boxes, plastic sheet and film, polystyrene packaging, wood crates, plastic pails.

I. Submittals

1. Recycling Plan: Prior to preparation of the Waste Management Plan or engagement of waste or recycling subcontractors, submit the recycling plan to the Owner's Project Manager (OPM) for approval.
2. Waste Management Plan: Submit three (3) copies of plan within 30 days of date established for the Notice to Proceed, in a format acceptable to the OPM.
3. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three (3) copies of report. Include separate reports for demolition and construction waste. Include the following information:
 - Material category.
 - Generation point of waste.
 - Total quantity of waste in tons.
 - Quantity of waste salvaged, both estimated and actual in tons.
 - Quantity of waste recycled, both estimated and actual in tons.
 - Total quantity of waste recovered (salvaged plus recycled) in tons.
 - Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
 - Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
 - Record Keeping for Donations, Recycling and Landfill Disposal: Documentation shall be submitted by the Contractor and include the following:
 - Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

- Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices. Include documentation for back charge fees, if any, for improperly segregated waste.
- Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- Facility Permitting Information: For ABC rubble crushing and/or recycling facilities, provide a statement from the facility that references its specific exemption from the solid waste regulations (per 310 CMR 16.05 (3) (e) or provide a copy of the facility's current solid waste management facility permit in accordance with 310 CMR 19.000.

J. Quality Assurance

1. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council, or three years documented experience with construction waste management activities.
2. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program, using recycling/recovery equipment that has a current EPA Registration.
3. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction, including but not limited to, Massachusetts solid waste regulations contained in 310 CMR 16.00 and 310 CMR 19.00.
4. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management including, but not limited to, the following:
 5. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 6. Review requirements for documenting quantities of each type of waste and its disposition.
 7. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 8. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 9. Review waste management requirements for each trade.
10. Provide recycling education and recycling information to Contractor and subcontractor employees working on the project.

K. Waste Management Plan

1. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight throughout waste management plan.
2. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
3. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
4. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
5. Salvaged Materials for Sale: No salvaged material will be for sale.

6. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
7. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
8. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
9. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
10. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
 - a. Total quantity of waste.
 - b. Estimated cost of disposal (cost per ton). Include hauling and tipping fees and rental cost of collection containers for each type of waste.
 - c. Total cost of disposal (with no waste management).
 - d. Savings in hauling and tipping fees by donating materials.
 - e. Savings in hauling and tipping fees that are avoided.
 - f. Handling and transportation costs. Include cost of collection containers for each type of waste.
 - g. Net additional cost or net savings from waste management plan.

L. Plan Implementation

1. General: Implement waste management plan as approved by the OPM. Provide containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
2. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
3. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
4. Distribute waste management plan to everyone concerned within three days of submittal return.
5. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
6. Provide recycling education for all workers, subcontractors and suppliers engaged in on-site activities.
7. Distribute recycling educational literature.
8. Provide appropriate recycling signage for containers and workspaces.
9. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
10. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
11. Comply with project requirements for controlling dust and dirt, environmental protection, and noise control.

M. Salvaging Demolition Waste

1. Salvaged Items for Reuse in the Work:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until installation.

- d. Protect items from damage during transport and storage.
 - e. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
2. Salvaged Items for Owner's Use as indicated on Drawings:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until delivery to Owner.
 - d. Transport items to Owner's storage area off-site within Town limits.
 - e. Protect items from damage during transport and storage.
 - f. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- N. Recycling Demolition and Construction Waste, General
1. General: Recycle paper and beverage containers used by on-site workers.
 2. Recycling Receivers and Processors: Available recycling receivers and processors include, but are not limited to, those listed in the Massachusetts Recycling Directory, available from the Massachusetts State Bookstore (617-727-2834) located in the State Capitol Building, for recycling operations within the Commonwealth of Massachusetts.
 3. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to the Owner.
 4. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical. For waste that cannot be separated at Project site, co-mingle only with waste which is to be separated later at a recycling facility.
 5. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin. Inspect containers and bins for contamination and remove contaminated materials if found.
 6. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 7. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 8. Store components off the ground and protect from the weather.
 9. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.
 10. On-site crushing of asphalt pavement, brick, and concrete (ABC) rubble as described in 310 CMR 16.05, is not allowed. All ABC waste must be transported off-site to an asphalt batching plant or to an ABC crushing or recycling operation that is either conditionally exempt from 310 CMR 16.00 or has been sited and permitted in accordance with 310 CMR 16.00 and 310 CMR 19.000, respectively.
- O. Recycling Demolition Waste
1. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
 2. Concrete: Deposit all debris in designated container to be transported to approved aggregate recycling facility to be crushed and screened for use as satisfactory soil for fill or sub-base.
 3. Masonry: Deposit all masonry debris in designated container to be transported to approved aggregate recycling facility to be crushed and screened for use as satisfactory soil for general fill or satisfactory soil for fill or sub-base. Clean and stack undamaged whole masonry units on wood pallets for reuse.

4. Wood Materials: Sort and stack salvageable members according to size, type, and length. Separate lumber waste and deposit into appropriate container. Separate engineered wood products, panel products, and treated wood materials into designated containers.
 5. Metals: Separate metals by type if practical. Stack salvageable structural steel members according to size, type of member, and length.
 6. Asphalt Shingle Roofing: Organic and glass-fiber asphalt shingles and felts shall be disposed of at a facility permitted by Massachusetts Department of Environmental Protection (DEP) to process post-consumer (used) asphalt shingles. Recycle nails, staples acceptable, flashing trim and accessories as metals.
 7. Asbestos containing shingles shall be pre-abated and properly disposed of by a Massachusetts licensed asbestos abatement contractor, in accordance with all applicable regulations. Asbestos abatement work, including disposal of asbestos contain materials, is not included in the scope of the Work and will be performed by others.
 8. Gypsum Board: Deposit clean gypsum scrap into appropriate containers. Protect from weather. Remove edge trim and sort with other metals. Remove and dispose of fasteners and other contaminants.
 9. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets, stretch wrap and store in a dry location. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
 10. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
 11. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
 12. Plumbing Fixtures: Separate by type and size fixtures suitable for reuse. Deposit all other fixtures into designated containers by material type to be transported to approved recycling facility.
 13. Piping: Separate piping materials by material composition. Deposit in designated containers. Separate supports, hangers, valves, sprinklers, and other components by material type and deposit in designated containers for transport to approved recycling facility.
 14. Lighting Fixtures: Separate lamps by type and protect from breakage.
 15. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
 16. Conduit: Deposit conduit and fittings into designated container.
- P. Recycling Construction Waste
1. Packaging - Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 2. Polystyrene Packaging: As much as possible, separate and bag materials.
 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: As much as possible, break down crates into component wood pieces and comply with requirements for recycling wood.
 5. Site-Clearing Wastes: N/A
 6. Concrete: As much as possible, deposit all debris in designated container to be transported to approved aggregate recycling facility to be crushed and screened for use as satisfactory soil for fill or sub-base.
 7. Masonry: As much as possible, deposit all masonry debris in designated container to be transported to approved aggregate recycling facility to be crushed and screened for use as satisfactory soil for general fill or satisfactory soil for fill or sub-base. Clean and stack undamaged whole masonry units on wood pallets for reuse.

8. Metals: Separate metals by material type if practical. Stack salvageable structural steel members according to size, type of member, and length.
9. Wood Materials:
 - a. As much as possible, clean cut-offs of Lumber: Deposit into designated clean wood container to be transported to designated recycling facility for use as mulch or bio-fuel.
 - b. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
10. Clean Gypsum Board: Deposit scraps of clean gypsum board into designated container protected from weather and transport to appropriate gypsum recycling facility to be processed into new gypsum board.

2.10 TEMPORARY SIGNAGE

- A. Scope: Provide temporary signage as required including but not limited to the following:
 1. Project identification sign.
 2. Informational signs.
 3. Temporary signs maintaining egress and fire exits during construction period in compliance with NFPA 241 Plan.
- B. Project Identification Signs: Provide one painted 4 ft. x 8 ft. sign, with two (2) 4 x 4 pressure treated wood posts for support and with painted graphic content to include, title of Project, name of Owner including Owner's Representative and Owner's Project Manager OPM), name of Architect and Professional Consultants, name of Contractor (Prime Contractor/General Contractor) and major subcontractors. Include as applicable all sources of funding for project. Provide sign as designed by the Owner and Architect.
 1. Obtain all required permits from the Town of Boxford for project identification sign.
- C. Informational Signs: Provide painted signs with painted lettering, or standard products. Erect at appropriate locations to provide required information.
 1. Size of signs and lettering: as required by regulatory agencies, or as appropriate to usage.
 2. Colors: as required by regulatory agencies, otherwise of uniform color throughout Project.
 3. Submit to Architect for approval.
- D. Sign Painter: Professional with minimum five years' experience in type of work required.
- E. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.
- F. Sign Structure and Framing: New or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.
- G. Sign Surfaces: Exterior softwood plywood with medium density overlay (MDO), standard 4 ft. x 8 ft. sheets, 3/4 in. thick
- H. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.
- I. Rough Hardware: Galvanized steel or cadmium plated.

J. Paint: Exterior quality, as specified in Section 09 91 00, PAINTING.

1. Use Bulletin colors for graphics.
2. Colors for structure, framing, sign surfaces, and graphics: As selected by Architect.

2.11 SECURITY AND PROTECTION FACILITIES

A. Scope: Security and protection facilities include but is not limited to the following:

1. Temporary fire protection.
2. Barricades, warning signs, lights.
3. Flagman and traffic control.
4. Construction parking.
5. Safety requirements.
6. Security procedures.

B. Temporary Fire Protection: Provide and maintain suitable fire protection equipment and services. Establish procedures for fire protection for Hot Work including torching, welding and other potentially hazardous construction operations. Ascertain and comply with requirements of Project insurance carrier, Town of Boxford Fire Department and the Commonwealth of Massachusetts State Fire Marshal.

1. Coordinate fire protection program with Owner and where required Boxford Fire Department or Inspectional Services Department.
2. Locate temporary portable fire extinguishers in convenient locations, not less than one extinguisher per floor.
3. Store combustible materials in safety cabinets in fire-safe locations.
4. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes.
5. Any salamanders used must exhibit an approval tag from the Massachusetts State Fire Marshal and any Contractor intending to utilize a salamander shall meet the requirements of 527 CMR 20 and obtain a permit from the Boxford Fire Department.
6. All Hot Works, including cutting, welding, brazing, etc., requires a permit from the Boxford Fire Department. A Hot Works permit is not required for work performed outside (unless it is in a temporary enclosure such as a tent). Contractor must provide a minimum of one operable fire extinguisher approved by a recognized testing laboratory and rated for the intended purpose near each Hot Work operation. At least one employee of the Contractor shall remain on the site for one hour after the hot work has ceased to ensure against the outbreak of fire.
7. Use of Liquefied Propane Gas (LPG) and containers on site must be approved by and a permit must be secured through the Boxford Fire Department.
 - a. Conformance to State Fire Prevention Regulations 527 CMR 6 and National Fire Protection Association Standard on LPG: NFPA 58 1998.
 - b. Contractor must provide a minimum of one operable 20 BC rated fire extinguisher approved by a recognized testing laboratory near each LPG operation.
8. Use of torches or other flame-producing devices for the removal of paint from buildings, or the application or removal of roofing materials must conform with the State Fire Marshal's regulations (527 CMR 10.24).
 - a. Permit must be secured through the Boxford Fire Department.
 - b. An approved and operable fire extinguisher must be kept in the work area.
 - c. At least one (1) workman must remain at the work area for one (1) hour after the use of the torch or flame-producing device has ceased.

9. Maintain sprinkler protection and fire alarm systems for all occupied areas. Coordinate with Owner's Project Manager, NFPA 241 Plan, and Town of Boxford Fire Department requirements for fire protection during construction.
- C. Barricades, Warning Signs, and Lights: Provide and maintain barricades, warning signs, warning lights, railings, walkways, and the like. Paint signs and barricades with appropriate colors, graphics, and warnings to inform public and job-site personnel of hazards.
 1. Prior to commencement of work, provide a full description and scope of various barricades and other warning to be employed throughout renovation project.
 2. All areas shall be provided with required safety barriers and protection per OSHA Standards.
- D. Flagmen and Traffic Control: As required by the Owner and/or by local authorities having jurisdiction and the following:
 1. Contractor shall provide a flagman for all equipment moves (Lull, lift, etc.) and for all deliveries.
- E. Construction Parking: Parking on-site will be allowed for site superintendent only within the designated laydown area. There is no available parking on-site for any other Contractor/Subcontractor personnel under this Contract. All other parking shall be off of Town property. Where parking on-streets is required, comply with Town of Boxford Parking Regulations.
- F. Access roads and fire-lanes on and about the site shall be kept open and free at all times, including public roads and access to building, and adjacent properties and businesses.
- G. Safety Program: Submit for review a fully detailed project specific health and safety plan for this Project per NFPA 241 requirements describing all required proposed provisions for safety at Project Site per applicable laws and standards including OSHA-approved Safety Plan including provisions relative to COVID-19 (refer to Document 00 80 50, COVID-19 GUIDELINES AND PROCEDURES DURNING CONSTRUCTION).
- H. Security: Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft
 1. Secure project against unauthorized entry at all times. Provide secure, locked, temporary entrances to prevent vandalism, theft, and similar violations of security.
 2. Provide secure, locked facilities for areas where materials and equipment are stored.
 3. Comply with Owner's security program and requirements regarding building access.
- I. Superintendence: Contractor's superintendent shall be on-site from the beginning of the Work, prior to placing or erecting temporary construction specified in this Section.
- J. Standards: Contractor shall be responsible for identifying and complying with applicable standards and guidelines for safe construction of the Work.
- K. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

2.12 HEATING DURING CONSTRUCTION

- A. Within 30 calendar days after the commencement of work under this Contract, the General Contractor (Prime Contractor/General Contractor) shall submit in writing to the Architect for approval, three copies of his method and time schedule for heating during construction which shall concur with his general progress schedule hereto before submitted as required under Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS.
- B. The General Contractor (Prime Contractor/General Contractor) shall provide heat, fuel, and services necessary to protect all work and materials against injury due to dampness and cold until final acceptance of the Work. The Contractor (Prime Contractor/General Contractor) shall provide temporary heat as follows:
 - 1. At all times during the placing, setting, and curing of concrete and masonry, provide sufficient heat to ensure that the temperature of the spaces involved are at least 50 degrees Fahrenheit. Provide temporary enclosures around exterior construction as necessary to maintain this temperature.
- C. Maintain heat and cooling in occupied areas. The General Contractor (Prime Contractor/General Contractor) shall pay and provide heat therein of not less than 50 degrees F., nor more than 75 degrees F., which shall be continuously maintained in the enclosed area until the project is accepted.
- D. The General Contractor (Prime Contractor/General Contractor) shall furnish and install one accurate recording Fahrenheit thermometer at a place designated by the Architect, and one additional accurate thermometer for every 2,000 square feet of floor space, located as directed by the Architect in order to determine if the specified temperatures are maintained. The General Contractor or his authorized agent shall furnish daily to Owner's Representative, three copies of a signed statement of temperatures recorded every three hours.

PART 3 - EXECUTION

3.01 MAINTENANCE, TERMINATION, AND REPAIR

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit waste and abuse.
- B. Termination and Removal:
 - 1. Unless otherwise requested by Owner or Architect, remove each temporary facility when no longer useful, or when replaced by permanent facility, or no later than Substantial Completion.
 - 2. Clean and renovate permanent facilities that have been used during construction period. Remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion.
- C. Repair public right-of-way where disturbed by construction or removal of temporary facilities, including paving, plantings, lawns, and improvements, in accordance with the standards and requirements of authorities having jurisdiction, as applicable, and leave public property in as good condition after completion as before operations started.

END OF SECTION

SECTION 01 50 10

CONTROL OF MOISTURE DURING CONSTRUCTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Requirements for providing moisture control during construction to establish and maintain moistures levels within building and building areas at an acceptable range for installation of finishes and equipment.
- B. With regard to these goals the Contractor shall develop, for Owner and Architect review, a Moisture Control Management Plan for this Project.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect the work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 01 33 00, SUBMITTAL PROCEDURES; Submittal requirements.
 - 2. Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS.
 - 3. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
 - 4. Division 23 – HVAC.
 - 5. Divisions 02 through 33 Specification Sections; Specific requirements relating to air quality of each Section.

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with minimum requirements of ASHRAE 62-1999, Ventilation for Acceptable Indoor Air Quality and approved Addenda.
 - 1. Coordinate with requirements of Division 23 – HVAC.

1.05 MOISTURE CONTROL MANAGEMENT PLAN

- A. The Contractor shall submit a preliminary plan identifying proposed methods and timetables for closing in construction and establishing conditions acceptable for subsequent construction. Include description of temporary ventilation to be employed, monitoring of building moisture, techniques to employ in hot, humid, and rainy periods, and ranges of relative humidity to maintain during construction.

1.06 MOISTURE CONTROL REQUIREMENTS

- A. The Contractor shall provide establishment and maintenance of moisture levels and humidity within buildings throughout construction.

- B. Unless otherwise indicated, provide conditions suitable for construction operations occurring; including establishment and maintenance of proper moisture and humidity levels to prepare substrates to receive finish materials and maintaining desired conditions during product installation, curing, and other requirements to provide optimum conditions for installation of proposed materials and finishes.
- C. At a minimum, the measures to employ shall include, but not be limited to:
1. Providing temporary ventilation until the Owner and Architect permit the use of the permanent building ventilation system. Unless otherwise indicated, permanent building ventilation system will not be permitted to be used until the building is dust free and sufficiently dry.
 2. Systematic monitoring of moisture and humidity levels in each building and in areas where work is being performed. Moisture content shall be specifically monitored for concrete work and masonry.
 3. Providing positive measures as necessary to maintain conditions within acceptable levels. Include the broadcasting of dessicant and other drying techniques as required especially in hot, humid, and wet periods.
 4. Seal exterior openings to permit drying out of interiors; prevent introduction of moisture to exterior walls or wetting with hoses, etc.
 5. If wetting occurs, dry surfaces and areas as soon as practical but in any case within 48 hours. Any wet areas must be dried to provide a dry air with a relative humidity below 30%.
 6. Properly control use of water and dispose of wash waters and excess moisture in a proper manner which will not introduce moisture to other building areas.
 7. Provide all other means and methods required to provide desired conditions.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 IMPLEMENTATION

- A. The Contractor shall provide appropriate procedures and methods to be used by all parties at the appropriate stages of the Project to achieve the desired conditions in accordance with the Contractor's approved plan.
- B. Where required, supplement and/or modify program as necessary to achieve desired results.

END OF SECTION

SECTION 01 57 15

CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Requirements for minimum indoor air quality (IAQ) performance standards during the construction period and before occupancy.
- B. With regard to these goals the Contractor shall develop, for Owner and Architect review, a Construction Indoor Air Quality Management Plan for this Project.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect the work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 01 33 00, SUBMITTAL PROCEDURES; Submittal requirements.
 - 2. Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS.
 - 3. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
 - 4. Division 23 - HVAC.
 - 5. Divisions 02 through 33 Specification Sections; Specific requirements relating to air quality of each Section.

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with minimum requirements of ASHRAE 62-1999, Ventilation for Acceptable Indoor Air Quality and approved Addenda.
 - 1. Coordinate with requirements of Division 23 - HVAC.
- B. Prevent exposure of building systems to environmental tobacco smoke during construction. At a minimum, take the following measures:
 - 1. Do not allow smoking in enclosed portions of the project site.
 - 2. Do not allow smoking adjacent to fresh air intakes for the building.
- C. Comply with minimum requirements of Sheet Metal and Air Conditioning National Contractors Association (SMACNA) 'IAQ Guideline for Occupied Buildings under Construction'.
- D. Protect stored on-site or installed absorptive materials from moisture damage. If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used at each return air grille, as determined by ASHRAE 52.2-1999. Replace all filtration media immediately prior to occupancy
- E. After construction but before occupancy, comply with one of the following:

1. Perform a building flush-out with outside air; or
2. Conduct baseline IAQ testing for air contaminate levels in the building.

1.05 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN

- A. Construction Indoor Air Quality Management Plan: With the completed Form of Bidder's Proposal, the Contractor shall submit a preliminary Construction IAQ Management Plan. Within seven (7) calendar days after receipt of Notice to Proceed, the Contractor shall submit to the Owner a finalized Construction IAQ Management Plan. The proposed Plan shall comply with Division 23 - HVAC requirements. The proposed Plan shall include, but not be limited to, the following:
1. Protection of ventilation system components during construction.
 2. Cleaning and replacing contaminated ventilation system components after construction.
 3. Temporary ventilation.

PART 2 - PRODUCTS

2.01 FILTRATION MEDIA

- A. Filtration media shall comply with ASHRAE 52.2-1999 and provide MERV as required.

PART 3 - EXECUTION

3.01 CONSTRUCTION IAQ MANAGEMENT PLAN IMPLEMENTATION

- A. IAQ Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Construction IAQ Management Plan for the Project.
- B. Distribution: The Contractor shall distribute copies of the Construction IAQ Management Plan to the Job Site Foreman, each subcontractor, the Owner, and the Architect.
- C. Instruction: The Contractor shall provide on-site instruction of appropriate procedures and methods to be used by all parties at the appropriate stages of the Project.
- D. Coordinate Construction IAQ Management Plan with final cleaning as indicated in Section 01 77 00, CLOSEOUT PROCEDURES.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Section 01 42 00, REFERENCE STANDARDS AND DEFINITIONS for applicable industry standards for products specified.
 - 2. Section 01 77 00, CLOSEOUT PROCEDURES for submitting warranties for contract closeout.
 - 3. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.03 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

- D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.04 SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A or the form included in Specification Section 01 63 10, SUBSTITUTION REQUEST FORM, or other form acceptable to Architect.
 - 2. Substitution Identification: Mark submittal clearly to identify products for which it is being substituted.
 - 3. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

4. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Acceptance: Change Order; as for other submittals, as covered in Section 01 33 00, SUBMITTAL PROCEDURES.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
 - c. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00, SUBMITTAL PROCEDURES. Show compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given the option of selecting between two or more products for use on the Project the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. Store products to allow for inspection and measurement of quantity or counting of units.
 6. Store materials in a manner that will not endanger Project structure.
 7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 9. Protect stored products from damage.
- B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Refer to Division 02 through Division 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00, CLOSEOUT PROCEDURES.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS OF SPECIFIED PRODUCTS AND SYSTEMS

- A. Substitutions of specified products and systems shall comply with requirements of Chapter 30, Section 39M of General Laws and additional requirements and procedures specified herein.
- B. The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible materials and equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect will judge the design, functionality, and appearance of proposed substitutes on the basis of their suitability in relation to the overall design of the project, as well as for their intrinsic merits. The Architect will not approve, as equal to materials specified, proposed substitutes which, in the Architect's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the Work. With respect to exterior finishes value or effect, the Architect may not approve as equal any proposed substitute which, in the Architect's sole opinion, would not produce the same artistic or aesthetic value or effect. In order to permit coordinated design of color and finishes the General Contractor shall, if required by the Architect, furnish the substituted material in any color, finish, texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the Owner.
- C. Specific reference in the Specification to any product, material, or process by name, make, or catalog number shall be interpreted as establishing a standard of quality. An item will be considered equal to the item so named or described if (1) it is at least equal in quality, durability, appearance, strength and design; (2) it will perform at least equally the function imposed by the general design for the work; and (3) it conforms substantially, even with deviations to the detailed requirements for the item in the Specification. [M.G.L. Chapter 30, Section 39M (b).] The Architect shall be the sole judge of whether and proposed substitute product, material, process, or method is equal to that specified according to this standard, and his decision shall be final and binding on the General Contractor and any Subcontractor or Sub-Subcontractor.
 1. If the General Contractor proposes to use a material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the General Contractor shall inform the Architect in writing of the nature of such deviations at the time the material is submitted for approval, and shall request written approval of the deviation from the requirements of the Contract Documents.
 2. In requesting approval of deviations of substitutions, the General Contractor shall provide, upon request, evidence leading to a reasonable certainty that the proposed substitution or deviation will provide a quality or result at least equal to that otherwise attainable. If in the opinion of the Architect, the evidence presented by the General Contractor does not provide a sufficient basis for such reasonable certainty, the Architect may reject such substitution or deviation without further investigation.
 3. Any additional cost, loss, or damage arising from the substitution of any material or any method for those originally specified shall be borne by the General Contractor, notwithstanding approval or acceptance of such substitution by Owner or the Architect, unless such substitution was made at the written request or direction of Owner or the Architect.

GRLA 2020120.01

THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 63 10

SUBSTITUTION REQUEST FORM

No substitutions will be considered without this completed Substitution Request Form and supporting documentation.

Substitutions made without completion of this form will be considered defective work as stated in the CONDITIONS OF THE CONTRACT. Refer to the Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS.

Date: _____

Number: _____

Project: **THE CENTER AT 10 ELM COMMUNITY / SENIOR CENTER**
10 Elm Street
Boxford, Massachusetts 01921

To: **GORMAN RICHARDSON LEWIS ARCHITECTS, INC.**
239 South Street
Hopkinton, Massachusetts 01748-1822
Telephone: 508-544-2600

Re: **REQUEST FOR SUBSTITUTION**

The Contractor proposes the following substitution in accordance with the requirements of the Contract Documents:

Scope of Substitution: _____

Specification Reference: _____

Drawing Reference: _____

Reason for Proposed Substitution: _____

Impact on Project Cost: _____

Impact on Project Schedule: _____

Impact on Guarantees and Warranties: _____

Response Date: List date by which response by Architect is requested to maintain project schedule and allow sufficient time for inclusion of proposed substitution.

Response Date: _____

Submitted By: _____

Firm and Address: _____

Signature below signifies acceptance of responsibility for accuracy and completeness of information included in this Substitution Request Form.

Authorized Signature: _____

ARCHITECT'S RESPONSE

Notations listed below shall have same meaning as on Architect's approval stamp. Clarifications to or changes in project schedule or time shall be processed using standard project forms.

- APPROVED
- APPROVED AS NOTED, REVISE AND RESUBMIT
- NOT APPROVED
- RETURNED WITHOUT REVIEW

Remarks:

Date: _____

Signed: _____

END OF SECTION

SECTION 01 73 00
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. General installation of products.
 - 3. Coordination of Owner-installed products.
 - 4. Progress cleaning.
 - 5. Disposal requirements.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
 - 8. Correction of the Work.

1.03 RELATED REQUIREMENTS

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 01 73 10, CUTTING AND PATCHING for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
 - 2. Section 01 77 00, CLOSEOUT PROCEDURES for submitting Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.

- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two (2) days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a RFI to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on a standard RFI form, numbered sequentially with date of request and space for Architect's reply. Form for RFI shall be the following, as approved by Owner and Architect:
 - 1. AIA G716, "Request for Information" form.

3.03 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 10 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.04 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 deg F
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
 - D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
 - E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
 - F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
 - G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
 1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
 - H. Waste Disposal: Burying or burning waste material on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
 1. Comply with the provisions of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
 - I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
 - J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
 - K. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.05 PROTECTION OF INSTALLED CONSTRUCTION
- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
 - B. Comply with manufacturer's written instructions for temperature and relative humidity.
- 3.06 CORRECTION OF THE WORK
- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 01 73 10, CUTTING AND PATCHING.
 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
 - B. Restore permanent facilities used during construction to their specified condition.

- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. This Section specifies requirements for the Contractor's implementation of waste management controls and systems for the duration of the Work.
- B. Consult the individual sections of the specifications for the specific construction waste management and disposal required under those sections and for further details and descriptions of the requirements.
- C. Note that available on-site space is very limited and may not allow for a dumpster or recycle containers; coordinate dumpster and recycle container location(s) with Owner.

1.03 RELATED REQUIREMENTS

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS.

1.04 DEFINITIONS

- A. Asphalt Pavement, Brick, and Concrete (ABC) Rubble: Rubble that contains only weathered (cured) asphalt pavement, clay bricks and attached mortar normally used in construction, or concrete that may contain rebar. The rubble shall not be mixed with, or contaminated by, another waster or debris.
- B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- C. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- D. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- E. Recycle: Diversion of demolition and construction waste from the landfill for reuse.
- F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

- G. Salvage for Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- H. Salvage for Owner's Use: Recovery of demolition or construction waste and subsequent separation, cleaning, and turning over to Owner.

1.05 PERFORMANCE REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of the following percent by weight of total waste generated by the Work: Minimum seventy-five percent (75%).
- B. Salvage/Recycle Requirements: Salvage and recycle as much nonhazardous construction waste as possible including the following materials:
 - 1. Construction Waste:
 - a. Lumber, wood sheet materials and wood trim.
 - b. Metals.
 - c. Roofing.
 - d. Insulation.
 - e. Packaging: 100 percent of the following uncontaminated packaging materials: Paper, cardboard, boxes, plastic sheet and film, polystyrene packaging, wood crates, plastic pails.
- C. In the event the Contractor encounters previously unidentified material that is reasonably believed to be hazardous, asbestos containing, coated with lead-based paint, or oily debris, the Contractor shall immediately stop work in the affected area and report the condition to the Owner's Representative. At no time shall such material be handled or disposed of by the Contractor. The Contractor agrees to cooperate with the Owner's Representative and any consultants engaged by the Owner to perform services with respect to the analysis, detection, removal, containment, treatment and disposal of such regulated materials.

1.06 SUBMITTALS

- A. Recycling Plan: Prior to preparation of the Waste Management Plan or engagement of waste or recycling subcontractors, submit the recycling plan to the Owner's Representative for approval.
- B. Waste Management Plan: Submit three (3) copies of plan within ten (10) days of date established for the Notice to Proceed, in a format acceptable to the Owner's Representative.
- C. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for demolition and construction waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

- D. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices. Include documentation for backcharge fees, if any, for improperly segregated waste.
- E. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Facility Permitting Information: For ABC rubble crushing and/or recycling facilities, provide a statement from the facility that references its specific exemption from the solid waste regulations (per 310 CMR 16.05 (3) (e) or provide a copy of the facility's current solid waste management facility permit in accordance with 310 CMR 19.000.
- G. Penalties and Assessments: Copies of penalty notices for non-compliance with regulations assessed by authorities having jurisdiction, and proof of payment.

1.07 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Minimum three (3) years documented experience with construction waste management activities.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction, including but not limited to, Massachusetts solid waste regulations contained in 310 CMR 16.00 and 310 CMR 19.000.
- C. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.
 - 6. Review salvaged waste for Owner's use.

1.08 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

PART 2 – PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by the Owner's Project Representative. Provide containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- E. Comply with project requirements for controlling dust and dirt, environmental protection, and noise control.

3.02 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: Available recycling receivers and processors include, but are not limited to, those listed in the Massachusetts Recycling Directory, available from the Massachusetts State Bookstore (617-727-2834) located in the State Capitol Building, for recycling operations within the Commonwealth of Massachusetts.
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to the User Agency
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical. For waste which cannot be separated at Project site, co-mingle only with waste which is to be separated later at a recycling facility. Contamination of recycling containers with trash or other contaminants is subject to penalty.
- E. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin. Inspect containers and bins for contamination and remove contaminated materials if found. Note that available on-site space is very limited and may not allow for a recycling container; coordinate recycle container location(s) with Owner.

3.03 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
- C. Metals: Separate metals by material type if practical. Stack salvageable structural steel members according to size, type of member, and length.
- D. Wood Materials:
1. Clean Cut-Offs of Lumber: Deposit into designated clean wood container to be transported to designated recycling facility for use as mulch or bio-fuel.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- 3.04 DISPOSAL OF WASTE
- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. For solid waste disposal facilities located in the Commonwealth of Massachusetts, dispose of materials only in facilities which currently comply with applicable regulations, including requirements of MGL Title XVI - Public Health, Chapter 111, Section 150A Solid Waste Disposal Facilities; Maintenance and Operation; Applications for Site Assignment and Section 150A 1/2 Standards and Criteria for Siting of Facilities; Rules and Regulations.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off the property and legally dispose of waste materials.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Operation and maintenance manuals.
 - 3. Warranties.
 - 4. Instruction of Owner's personnel.
 - 5. Final cleaning.

1.03 RELATED REQUIREMENTS

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 01 29 00, PAYMENT PROCEDURES for requirements for Applications for Payment for Substantial and Final Completion.
 - 2. Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION for submitting Final Completion construction photographs and negatives.
 - 3. Section 01 70 00, EXECUTION REQUIREMENTS for progress cleaning of Project site.
 - 4. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.04 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negatives, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touch-up painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.05 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Section 01 29 00, PAYMENT PROCEDURES.
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.06 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A Preparation: Submit four (4) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A, or other form acceptable to Owner and Architect.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.07 OPERATION AND MAINTENANCE MANUALS

- A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
 1. Maintenance Data:
 - a. Manufacturer's information, including list of spare parts.
 - b. Name, address, and telephone number of Installer or supplier.
 - c. Maintenance procedures.
 - d. Maintenance and service schedules for preventive and routine maintenance.
 - e. Maintenance record forms.
 - f. Copies of warranties and bonds.
- B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.08 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-inch by 11-inch (115-mm by-280-mm) paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and anti-pollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Clean exposed exterior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - e. Remove debris and surface dust from limited access spaces, including roofs, balconies, terraces, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - f. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous Record Submittals.

1.03 RELATED REQUIREMENTS

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 01 77 00, CLOSEOUT PROCEDURES for general closeout procedures and operation and maintenance manual requirements.
 - 2. Divisions 02 through 34 Sections for specific requirements for Project Record Documents of products in those Sections.

1.04 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one (1) set of marked-up Record Prints.
 - 2. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal: Submit one (1) set of corrected Record Transparencies, one (1) set of plots from corrected Record CAD Drawings, and one (1) set of marked-up Record Prints. General Contractor will initial and date each transparency, plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. General Contractor will return transparencies, plots, and prints for organizing into sets, printing, binding, and final submittal.
 - b. Final Submittal: Submit one (1) set of marked-up Record Prints. Plot and print each Drawing, whether or not changes and additional information was recorded.
 - c. Electronic Media: Submit Record Drawings on CD-ROM media.
- B. Record Shop Drawings shall indicate date, name, and approval action marked on latest submittal.
- C. Record Specifications: Submit one copy of Project Specifications, including addenda and contract modifications.

- D. Record Product Data: Submit one copy of each approved Product Data submittals.
1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data but indicate cross reference.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Details not on the original Contract Drawings.
 - l. Field records for variable and concealed conditions.
 - m. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult with Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
 3. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

- A. Mark Specifications to indicate actual installation where installation varies substantially from that indicated in Specifications, addenda and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of the manufacturer, supplier and installer, and other information necessary to provide a record of selections made.
 4. For each principal product specified, indicate whether Record Product Data has been submitted in the operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Drawings, and Product Data where applicable.

2.03 RECORD PRODUCT DATA

- A. Mark Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Drawings, and Product Data where applicable.

2.04 MISCELLANEOUS RECORD SUBMITTAL

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training videotapes.

1.03 RELATED REQUIREMENTS

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Document 00 70 00, GENERAL CONDITIONS and Document 00 80 00, SUPPLEMENTARY CONDITIONS.
 - 2. Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION for requirements for Pre-Instruction Conferences.
 - 3. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS; Commissioning General Requirements
 - 4. Divisions 02 through 34 Sections for specific requirements for demonstration and training for products in those Sections.

1.04 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. At completion of training, submit one complete training manual(s) for Owner's use.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

- E. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.
1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Owner, Architect, and OPM.
 - d. Name of Contractor.
 - e. Date videotape was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 2. Transcript: Prepared on 8-1/2-by-11-inch (215-by-280-mm) paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

1.05 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Pre-Instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.06 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
1. Fire alarm systems
 2. Fire suppression systems
 3. Electronic security systems.
 4. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, and water distribution piping.
 5. Refrigeration systems, including chillers, cooling towers, condensers, pumps, all distribution piping.
 6. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
 7. HVAC instrumentation and controls.
 8. Electrical service and distribution, including transformers, switchboards, panel boards, uninterruptible power supplies, and motor controls.
 9. Lighting equipment and controls.
 10. Communication systems, including intercommunication, surveillance, clocks and programming, voice and data, and television equipment.
 11. Plumbing systems and equipment, including hot water heaters, well pumps and systems, booster pumps, treatment systems, and rainwater harvesting systems
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.

- e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.
9. Energy and Environment
- a. Energy impact.
 - b. Optimization of energy utilization.
 - c. Environmental impact.
 - d. Ongoing strategies revised to maintain performance.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Provide manufacturer's instructors or instructors certified by manufacturer as being experienced in operation and maintenance procedures for each system, subsystem, or piece of equipment to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner through Owner's Project Manager and CxA with at least fourteen (14) days' advance notice.
 - 2. Schedule training to conform to personnel availability at Site and to conclude prior to start-up of system.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and/or a demonstration performance-based test.
- E. In addition to written technical descriptions, training shall detail training program to allow those who have completed training to provide training for new employees resulting in self-perpetuating training program.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 DEMONSTRATION AND TRAINING VIDEOTAPES

- A. General: Engage a qualified commercial photographer to record demonstration and training videos. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Format: Provide high-quality video on DVD.

- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
- D. Narration: Describe scenes on videotape by audio narration by microphone while video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- E. As part of training, devote one (1) lesson plan to reviewing of video to allow new employees to view tape at their own convenience and be able to comprehend system without need for instructor in attendance.

END OF SECTION

SECTION 01 91 00

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION

- A. Commissioning prior to start up and testing is intended to verify that applicable equipment and systems are installed according to the manufacturer’s recommendations and in accordance with the Contract Documents.
- B. Commissioning during start-up and testing is intended to determine that equipment and systems operate as defined in the Contract Documents.
- C. Commissioning is the systematic process of assuring by third-party design review, testing, documentation, and training from the design through construction, acceptance, and warranty phases that building facility systems perform independently and interactively in accordance with the design intent and design documentation. The independent third-party Commissioning Agent for this project will be as selected by Owner. This section relates to the work associated with the systems being commissioned with the involvement of the independent third-party Commissioning Agent. The requirements of this section are intended to supplement the other specification sections.
- D. Commissioning shall be used to verify the following for building systems:
 - 1. Completeness and functional performance according to design intent and Owner’s operational needs prior to occupancy,
 - 2. Documented performance provided by the installed systems, deficiencies found, and corrective actions taken,
 - 3. Pertinent, useful, and organized operation and maintenance (O&M) data,
 - 4. Component and systems training of facility staff to enable intended function, and sustain reliable operation and maintenance for the useful life of the building.
- E. The designers and installing contractors retain their full contract document responsibilities in providing a finished and fully functional facility. Commissioning does not take away from or reduce these responsibilities.
- F. Commissioning requires active project team involvement and participation to deliver effective and successful results for all concerned.
- G. The conditions of the construction contract, Division 01 - GENERAL REQUIREMENTS, Division 23 - HVAC, and Division 26 - ELECTRICAL.
- H. Completion of commissioning shall be accomplished as a prerequisite for substantial completion. This includes all documentation required relating to O&M requirements submitted in both hard copy and electronic copy as required.

- I. Verification Testing: Verification testing shall occur 10 months following Project Completion.
- J. All guarantees and warranties shall not begin until final acceptance of the systems and equipment by the Owner. Acceptance requires, at a minimum, complete systems commissioning.
- K. Commissioning Tasks
 - 1. Start up and testing of equipment and systems.
 - 2. Verification testing to take place 10 months following completion.
 - 3. Identification and documentation of equipment and system deficiencies and failures.
 - 4. Corrective actions and acceptance of corrected equipment and systems. Include addressing any deficiencies found as a result of the one year (12 month) warranty period.
 - 5. Equipment and systems use and maintenance training.
 - 6. Operation and maintenance manuals.
 - 7. Compliance with and coordination of Subcontractor/Installer requirements.

1.03 RELATED WORK

- A. Specific Commissioning Requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this Section.
 - 1. Division 23 - HVAC; Mechanical commissioning requirements.
 - 2. Division 26 - ELECTRICAL; Electrical commissioning requirements.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

- A. All standard testing equipment required to perform start-up and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 – HVAC shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23 - HVAC, except for equipment specific to and used by the testing and balancing contractor in their commissioning responsibilities. Two-way radios shall be provided by the Division contractor.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be provided by the appropriate subcontractor and left on site.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.01 COMMISSIONING REPORTING / DOCUMENTATION

- A. Commissioning reporting shall be as specifically referenced in the following:
 - 1. Division 23 - HVAC; Mechanical commissioning requirements.
 - 2. Division 26 - ELECTRICAL; Electrical commissioning requirements.

- B. As part of Commissioning requirements, all documentation required relating to O&M requirements submitted in both hard copy and electronic copy as required.

END OF SECTION 01 91 00

SECTION 02 41 25

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

A. Work Included:

1. Demolition and removal of selected portions of building as required for new work. Refer to the Drawings for additional requirements.
2. Salvage of existing items to be reused or turned over to the Owner.
3. Removal and legal disposal of demolished materials off site. Except those items specifically designated to be relocated, reused, or turned over to the facility, all existing removed materials, items, trash and debris shall become property of the Contractor and shall be completely removed from the site and legally disposed of at her/his expense. Salvage value belongs to the Contractor. On-site sale of materials is not permitted.
4. Demolition and removal work shall properly prepare for alteration work and new construction to be provided under the Contract.
5. Scheduling and sequencing operations without interrupting utilities serving occupied areas. If interruption is required, obtain written permission from the utility company and the Owner's Project Manager (OPM). Schedule interruption when the least amount of inconvenience will result.

B. Alternates: Not Applicable.

C. Items To Be Installed Only: Not Applicable.

D. Items To Be Furnished Only: Not Applicable.

E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS: Maintenance of access, cleaning during construction, dust and noise control.

1.03 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to the Owner ready for reuse, at a location designated by the Owner. Protect from weather until accepted by Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Protect from weather until reinstallation.

- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques, antiques, and other items of interest or value to the Owner that may be encountered during selective demolition remain property of the Owner. Carefully remove each item or object in a manner to prevent damage and deliver promptly to a location acceptable to the Owner's Project Manager.

1.05 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with early and late starting and finishing dates for each activity. Ensure Owner's on-site operations are uninterrupted if applicable.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other occupants affected by selective demolition operations.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 6. Means of protection for items to remain and items in path of waste removal from building.
- B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged, and turned over to the Owner.
- C. Pre-demolition Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01 – GENERAL REQUIREMENTS. Submit before Work begins.
- D. Landfill Records: Provide trip tickets (receipts) indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
- E. Construction Dust and Odor Control Plan: Submit proposed Construction Dust and Odor Control Plan per 310 CMR 7.09.
- F. Noise Control Plan: Submit proposed Noise Control Plan per 310 CMR 7.10.

1.06 QUALITY ASSURANCE

- A. Examination of Existing Conditions: The Contractor shall examine the Contract Drawings for demolition and removal requirements and provisions for new work. Verify all existing conditions and dimensions before commencing work. The Contractor shall visit the site and examine the existing conditions as he finds them and shall inform herself/himself of the character, extent and type of demolition and removal work to be performed. Submit any questions regarding the extent and character of the demolition and removal work in the manner and within the time period established for receipt of such questions during the bidding period.

- B. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- C. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- D. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- E. Standards: Comply with ANSI A10.6 and NFPA 241.
- F. Predemolition Conference: Conduct conference at Project site. Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.07 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Engage a professional engineer registered in the Commonwealth of Massachusetts to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction videotapes.

- G. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
- H. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS.
 - 2. Maintain adequate passage to and from all exits at all times. Before any work is done which significantly alters access or egress patterns, consult with the Architect and obtain approval of code required egress. Under no condition block or interfere with the free flow of people at legally required exits, or in any way alter the required condition of such exits.
- B. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
 - 2. Remove temporary shoring, bracing and structural supports when no longer required.
 - 3. Post warning signs and place barricades as applicable during placement and removal of temporary shoring.
- C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area(s).
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Provide temporary barricades as required to limit access to demolition areas.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
- D. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.

3.03 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering

- and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during and after flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly.
 10. Brick to be Salvaged: Existing brick removed shall be salvaged for reuse as indicated. Brick shall be removed carefully, cleaned, and stored on-site at location acceptable to Owner. Salvaged brick will be used by the mason under the work of the Filed Sub-bid for MASONRY; refer to Division 04 – MASONRY and the Drawings.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by the Owner's Project Manager.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

E. Items for Re-use and Preservation of Existing Surfaces to Remain:

1. The Contractor shall inspect closely each item specifically designated to be relocated, re-used, or turned over to the Owner prior to its removal, and immediately report damages and defects to the Architect and Owner's Project Manager. The Contractor shall be responsible for any subsequent damage to the same other than latent defects not readily apparent from close inspection and shall bear responsibility for its repair or same replacement as directed by the Architect, to the satisfaction of the Owner's Project Manager.
2. Unless special surface preparation is specified under other Specification Sections, leave existing surfaces that are to remain in a condition suitable to receive new materials and/or finishes.

3.04 PROTECTION OF PUBLIC AND PROPERTY

- A. Provide all measures required by federal, state and municipal laws, regulations, and ordinances for the protection of surrounding property, the public, workmen, and Commonwealth's employees during all demolition and removal operations. Measures are to be taken, but not limited to installation of sidewalks, sheds, barricades, fences, warning lights and signs, trash chutes and temporary lighting.
- B. Protect all walks, roads, streets, curbs, pavements, trees and plantings, on and off premises, and bear all costs for correcting such damage as directed by the Architect, and to the satisfaction of the Owner's Project Manager.
- C. Demolition shall be performed in such a manner that will insure the safety of adjacent property. Protect adjacent property from damage and protect persons occupying adjacent property from injuries which might occur from falling debris or other cause and so as not to cause interference with the use of other portions of the building, of adjacent buildings or the free access and safe passage to and from the same.
- D. Every precaution shall be taken to protect against movement or settlement of the building, of adjacent buildings, structures, sidewalks, roads, streets, curbs and pavements. Provide and place at the Contractor's own expense, all necessary bracing and shoring in connection with demolition and removal work.
- E. Remove portions of structures with care by using tools and methods that will not transfer heavy shocks to existing and adjacent building structures, both internal and external of the particular work area.
- F. Provide and maintain in proper condition, suitable fire resistive dust barriers around areas where interior demolition and removal work is in progress. Dust barriers shall prevent the dust migration to adjacent areas. Remove dust barriers upon completion of major demolition and removal in the particular work area.
- G. Protect unaltered portions of existing construction, including finishes, furnishings and equipment.
- H. Provide secure weather protection where demolition has removed a portion of the exterior envelope.

3.05 DISCOVERY OF HAZARDOUS MATERIALS

- A. If hazardous materials, such as chemicals, asbestos-containing materials, or other hazardous materials are discovered during the course of the work, cease work in affected area only and immediately notify the Architect and the Owner's Project Manager of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.
- B. If unmarked containers are discovered during the course of the work, cease work in the affected area only and immediately notify the Architect and the Owner's Project Manager of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Take immediate precautions to prohibit endangering the containers integrity. Continue work in other areas.
- C. Hazardous Materials Abatement including ACM: Reference is made to the following:
 - 1. Appendix B – HAZARDOUS MATERIALS SURVEY / ABATEMENT.

3.06 CUTTING

- A. Perform all cutting of existing surfaces in a manner which will ensure a minimal difference between the cut area and new materials when patched. Use extreme care when cutting existing surfaces containing concealed utility lines which are indicated to remain and bear full responsibility for repairing or replacement of all such utilities that are accidentally damaged.
- B. Provide a flush saw cut edge where pavement, curb and concrete removals abut new construction work or existing surfaces to remain undisturbed.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Comply with the following.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.08 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Premises shall be left in a clean condition and ready to accept alteration work and new construction.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following applications:
 - a. Footings.
 - b. Foundation walls.
 - c. Slabs-on-grade.
 - d. Building walls.
 - e. Coordination with and cutting and patching of mechanical and electrical penetrations through cast-in-place concrete.
- B. Alternates: Refer to Section 01 23 00, ALTERNATES.
- C. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
 - 1. Section 04 50 00, MASONRY AND STONE RESTORATION.
 - 2. Section 05 50 00, METAL FABRICATIONS: Lintels, nosing angles, sleeves, anchors, inserts, plates, and similar items for miscellaneous and ornamental metal.
 - 3. Section 21 00 00, FIRE PROTECTION: Sleeves, anchors, inserts, and similar items for fire protection systems.
 - 4. Section 22 00 00, PLUMBING: Sleeves, anchors, inserts, sumps, and similar items for plumbing systems.
 - 5. Section 23 00 00, HEATING, VENTILATING AND AIR CONDITIONING: Sleeves, anchors, inserts, and similar items for heating, ventilating, and air conditioning systems. Pipe and duct sleeves for placement into cast-in-place concrete openings.
 - 6. Section 26 00 00, ELECTRICAL WORK: Sleeves, anchors, inserts, floor boxes, and similar items for electrical systems.
- D. Items To Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 09 61 10, VAPOR MITIGATION AT SLABS for vapor mitigation, where required prior to finish flooring installation.
 - 2. Section 31 20 00, EARTHWORK for establishing subgrades and for drainage fill under slabs-on-grade.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
 - 2. Indicate amount of fly ash in the mix.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer licensed in the Commonwealth of Massachusetts detailing fabrication, assembly, and support of formwork.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
 - 2. Blockouts for Architectural Joint Systems: Indicate blockouts and coordination with architectural joint systems
- E. Formwork Inspection: Indicate compliance with approved shop drawings.
- F. Anchor Bolt and Building Anchorage Locations: Indicate compliance with approved shop drawings.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- H. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Waterstops.
 - 7. Curing compounds.
 - 8. Floor and slab treatments.
 - 9. Bonding agents.
 - 10. Adhesives.
 - 11. Vapor retarders.
 - 12. Semi-rigid joint filler.
 - 13. Joint-filler strips.

14. Repair materials.
 - I. Floor surface flatness and levelness measurements to determine compliance with specified tolerances and requirements for applied finishes and materials, except as noted for slope to drains.
 - J. Field quality-control test and inspection reports.
 - K. Minutes of preinstallation conference.
- 1.05 QUALITY ASSURANCE
 - A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548. Testing Agency and personnel must be licensed by the Commonwealth of Massachusetts per 780 CMR 110.R.1
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
 - C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
 - D. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."
 - E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301, "Specification for Structural Concrete."
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
 - G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cement: shall be American-made Portland Cement, free from water soluble salts or alkalis which will cause efflorescence on exposed surfaces. Portland Cement shall be Type II, ASTM C 150. Use only one brand of cement for each type of cement throughout project. The Contractor shall be responsible for whatever steps are necessary to insure that no visual variations in color will result in exposed concrete and shall place on order and secure in advance a sufficient quantity of this (these) cement(s) to complete concrete work specified herein.

1. Fly Ash: ASTM C 618.
2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

- B. Normal Weight Fine Aggregate: shall be washed, inert, natural sand conforming to ASTM C33 and following additional requirements:

1. Gradation:

Sieve	Retained Percent
#4	0 - 5
#16	25 - 40
#50	70 - 87
#100	93 - 97

2. Fineness Modulus: 2.80 (Plus/Minus 0.20).
3. Organic: Plate 2 maximum.
4. Silt: 2.0 percent maximum.
5. Mortar Strength: 100 percent minimum compression ratio.
6. Soundness: 5 percent maximum loss, magnesium sulfate, five cycles.

- C. Normal Weight Coarse Aggregate: shall be well graded crushed stone or washed gravel conforming to ASTM C33 and the following additional requirements:

1. Designated Size: 3/4 in.
2. F.M.(+/-0.20): 6.70.
3. Organic: Plate 1 maximum.
4. Silt: 1.0 percent maximum.

5. Soundness: 5 percent maximum loss, magnesium sulfate, five cycles.
- D. Concrete Fill for Steel Stair and Landing Pans: shall be composed of 1:2:2 mix with three-eighths inch maximum size normalweight aggregate and shall be placed with a 0 inches to 1 inch slump.
- E. Water: shall be from approved source, potable, clean and free from oils, acids, alkali, organic matter and other deleterious material.
- F. Admixtures:
 1. Water-reducing agent:
 - a. WRDA, GCPAT.
 - b. Plastocrete 100, Sika Corp.
 - c. Master Pozzolith 322, BASF.
 - d. Or Architect approved equal.
 - e. Note: Water-reducing agent shall be by same manufacturer as air-entraining agent.
 2. Air-entraining agent:
 - a. Darex AEA, GCPAT.
 - b. Sika Air 260, Sika Corp.
 - c. MasterAir VR 10, BASF.
 - d. Or Architect approved equal.
 3. Superplasticizer: High-range water-reducer conforming to ASTM C494, Type F or Type G.
 4. Admixtures retarding setting of cement in concrete shall not be used without written approval of Architect.
 5. Admixtures causing accelerated setting of cement in concrete shall not be used without written approval of Architect.

2.02 CONCRETE MIXTURES

- A. The Contractor shall recommend, on the basis of trial mixes and strength curves specified below, design mixes for each type and strength of concrete. The Testing Agency will verify that the proposed mix designs conform to all specification requirements.
- B. Sufficient materials for concrete mix design shall be furnished by the Contractor not less than five weeks before use. Duplicate small samples plainly and neatly labeled with source, where proposed to be used, date, and name of collector shall be provided and presented to Testing Agency for permanent reference.
- C. Mixes shall be designed in accordance with "Method 1" of ACI 301, and the requirements of this Section. All concrete is normalweight unless specifically designated otherwise; air-dry weight not to exceed 150 lbs. per cubic foot.
- D. In all slabs and walls exposed to weather, all concrete shall contain the approved air-entraining admixture as per manufacturer's written instructions, to provide entrained air, by volume, in the cured concrete within 4.5 to 7.5 percent.
- E. Interior floor slabs receiving a steel trowel finish shall not have air-entraining added to the mix.

- F. Water-Reducing Admixture - The approved water-reducing admixture shall be used in all concrete, in accordance with manufacturer's written instructions.
- G. Concrete slabs, including slabs on grade, shall have a maximum water cement ratio of 0.45.
- H. The approved superplasticizer shall be used in all concrete slabs, including slabs on grade.
- I. Water content and cement content of concrete to be used in work shall be based on curve showing relation between water content, cement content, and 7 and 28 day compressive strengths of concrete made using proposed materials. Curves shall be determined by four or more points, each representing an average of at least three test specimens at each age, and shall have range of values sufficient to yield desired data, including all compressive strengths required by Contract Documents, without extrapolation. Design mix of concrete to be used in work, as determined from curve, shall correspond to following test strengths obtained in laboratory trial mixtures:

Minimum Strength of Lab Trial Mixes (psi)

Design Strength	Trial Mix Strength	
	7-days	28-days
4000	3800	5200
4500	4275	5700

- J. Any deviation from approved mix design, which the Contractor deems desirable under certain project conditions, will not be allowed without written approval of Architect. Cost of any additional testing by Testing Agency associated therewith shall be paid for by the Contractor.

2.03 FORM MATERIALS

- A. Construct formwork to shapes, lines, and dimensions required, plumb and straight, secured and braced sufficiently rigid to prevent deformation under load, and sufficiently tight to prevent leakage, all in conformance with ACI Standard 347, "Recommended Practice for Concrete Formwork".
- B. Formwork for exposed concrete shall be medium-density plastic overlaid plywood, 5/8 in. minimum thickness; for concealed concrete shall be "Plyform" plywood, 5/8 in. minimum thickness, or equal.
- C. Chamfer Strips: Three-quarter inch, 45 degree poplar wood strips, nailed six inches on center, and installed in inside corners of all forms, unless otherwise directed by Architect.
- D. Form Ties and Spreaders: Richmond Tyscrus by Richmond Screw Anchor Co.; Superior-ties by Superior Concrete Accessories, Ind.; or Sure-Grip Ties by Dayton, or equal. Sure-Grip and Shore Co. Wire ties shall not be used. Ties for foundation walls shall be snap-ties or type specified above with removal cones and shall incorporate water seal washer. Ties shall be arranged in a symmetrical manner.
- E. Form Release Agent: Non-staining and non-emulsifiable type, or equal approved by Architect. Form release agent shall be biodegradable and shall not impart any stain to concrete nor interfere with adherence of any material to be applied to concrete surfaces.

2.04 REINFORCEMENT AND ACCESSORIES

- A. Reinforcing Steel Bars shall be newly rolled billet steel conforming to ASTM A615 Grade 60. Bars shall be bent cold.
- B. Welded Wire Fabric shall conform to ASTM A1064, Galvanized.
- C. All structural steel embedded items shall be hot-dip galvanized after fabrication in accordance with ASTM A123.
- D. All hot-dip galvanized steel shall be inspected for compliance with ASTM A123 and shall be marked with a stamp that indicates the number of ounces of zinc per square foot of steel. After galvanizing, the bars shall be dipped in a 0.2 percent chromic acid solution. A notarized Certificate of Compliance with all of the above shall be required from the galvanizer.
- E. Reinforcement Accessories shall conform to Product Standard PS7-766, National Bureau of Standards, Department of Commerce, Class C, as produced by Dayton Superior Co., R.K.L. Building Specialties Co., Inc., or equal. Reinforcement accessories shall include spacers, chairs, ties, slab bolsters, clips, chair bars, and other devices for properly assembling, placing, spacing, supporting, and fastening reinforcement. Tie wire shall be galvanized or stainless wire of sufficient strength for intended purpose, but not less than No. 18 gage. Metal supports shall be of such type as not to penetrate surface of formwork and show through surface of concrete. Accessories touching interior formed surfaces exposed to view shall have not less than 1/8 inch of plastic between metal and concrete surface. Plastic tips shall extend not less than 1/2 inch up on metal legs. Individual and continuous slab bolsters and chairs shall be of type to suit various conditions encountered and must be capable of supporting 300 pound load without damage or permanent distortion.

2.05 MISCELLANEOUS MATERIALS

- A. Grout shall be ready-to-use non-shrink, non-metallic aggregate product requiring only addition of water at job site. Grout shall be easily workable and shall have no drying shrinkage at any age. Compressive strength of grout (2 in. x 2 in. cubes) shall not be less than 5000 psi at 7 days, and 7500 psi at 28 days.
- B. Vapor Retarder: Minimum 10 mil polyethylene. All joints shall be lapped 6 inches and taped, and sealed at all penetrations.
- C. Membrane Curing Compound: Membrane curing compound will not be permitted; all concrete shall be water cured.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Contractor's inspection agency shall examine all work prepared by others to receive work of this Section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.
- B. A pre-placement inspection shall be performed by Owner's Testing Agency and the Architect. Provide a minimum of 48 hours notice prior to placing concrete. No concrete can be placed without these inspections.

3.02 HANDLING, STORAGE, AND PROTECTION OF MATERIALS

- A. Handle and store materials separately in such manner as to prevent intrusion of foreign matter, segregation, or deterioration. Do not use foreign materials or those containing ice. Remove improper and rejected materials immediately from point of use. Cover materials, including steel reinforcement and accessories, during construction period. Stockpile concrete constituents properly to assure uniformity throughout project.

3.03 ERECTION OF FORMWORK, SHORING AND RESHORING

- A. Set and maintain formwork to insure complete concrete work within tolerance limits listed in ACI 347 latest edition, "Recommended Practice for Concrete Formwork", and with following additional requirements:

- 1. Maximum variations from plumb:

- a. In surfaces of columns and walls:

- 1). In any 10 feet of length: 1/4 inch.
- 2). Maximum for entire length: 1/2 inch.

- 2. Maximum variations from established position in plan shown on the Drawings:

- a. Column: 1/2 inch.
- b. Walls: 3/4 inch.

- 3. Variations in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:

- a. Minus: 1/8 inch.
- b. Plus: 1/4 inch.

- B. For a minimum of one hour prior to concrete placement, wet forms continuously with water to swell forms in order to prevent leakage of concrete matrix and to minimize absorption of concrete matrix water by form materials. This requirement may be waived for those specific cases where Architect deems it unnecessary or impractical. Care must be exercised to prevent a build-up of water at base of forms.

- C. Before form materials can be re-used, surfaces that will be in contact with freshly cast concrete shall be thoroughly cleaned, damaged areas repaired, and projecting nails withdrawn. Re-use of form material shall be subject to approval by Architect.

3.04 PLACING OF REINFORCEMENT

- A. Reinforcement shall be placed in accordance with requirements of CRSI 93, "Recommended Practice for Placing Reinforcing Bars" and CRSI 93, "Recommended Practice for Placing Bar Supports" and with further requirements below.

- B. Reinforcement shall be accurately placed in accordance with Contract Documents and shall be firmly secured in position by wire ties, chairs, spacers, and hangers, each of type approved by Architect.

- C. Bending, welding or cutting reinforcement in field in any manner other than as shown on Drawings, is prohibited, unless specific approval for each case is given by Architect.

- D. Reinforcement shall be continuous through construction joints unless otherwise indicated on Drawings.
- E. Reinforcement shall be spliced only in accordance with requirements of Contract Documents or as otherwise specifically approved by Architect. Splices of reinforcement at points of maximum stress shall generally be avoided. Welded wire fabric shall lap six inches or one space plus two inches whichever is larger, and shall be wired together.
- F. At time concrete is placed, reinforcement shall be free of excessive rust, scale, or other coatings that will destroy or reduce bond requirements. Reinforcement expected to be exposed to weather for a considerable length of time shall be painted with a heavy coat of cement grout. Protect stored materials so as not to end or distort bars in any way. Bars that become damaged will be rejected.
- G. Before concrete is cast, check all reinforcement after it is placed to insure that reinforcement conforms to Contract Documents and approved Shop Drawings. Such checking shall be done only by qualified experienced personnel. In addition, the Architect shall be notified at least 48 hours prior to concrete placement and given opportunity to inspect completed reinforcement and formwork before concrete placement. Prior approval of Shop Drawings shall in no way limit Architect 's right to demand modifications or additions to reinforcement or accessories.

3.05 JOINTS

- A. Construction and control joints indicated on Drawings are mandatory and shall not be omitted.
- B. Joints not indicated or specified shall be placed to least impair strength of structure and shall be subject to approval of Architect.

3.06 INSTALLATION OF EMBEDDED ITEMS

- A. Conform to requirements of ACI 318, paragraph 6.3, "Conduits and Pipes Embedded in Concrete", and as specified below.
- B. Install steel sleeves, embedded wall plates and similar items, furnished by other trades, at locations shown on the drawings.
- C. Anchor bolts and anchorage devices for column base plates shall be installed with templates provided. Vertical alignment and plan locations shall be maintained within one-sixteenth inches of the locations shown on the Drawings.
 - 1. Inspection shall be performed by a surveyor licensed in the Commonwealth of Massachusetts hired by the Contractor. Certify compliance with shop drawings.

3.07 MIXING, CONSISTENCY, AND DELIVERY OF CONCRETE

- A. Concrete shall be ready-mixed, produced by plant acceptable to Architect. Hand or site mixing shall not be done. Constituents, including admixtures except certain corrosion inhibitors and superplasticizers, shall be batched at central batch plant. Admixtures shall be premixed in solution form and dispensed as recommended by manufacturer.
- B. Central plant and rolling stock equipment and methods shall conform with Truck Mixer and Agitator Standard of Truck Mixer Manufacturer's Bureau of National Ready-Mixed Concrete Association, and Contract Documents. Consistency of concrete at time of deposit shall be as follows:

Portion of Structure	Slump Recommended	Maximum Range
Walls, columns	4 in.	3 in. – 5 in.
Slabs, beams	3 in.	2 in. – 4 in.

- C. Ready mixed concrete shall be transported to site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Discharge at site shall be within one and one-half hours after cement was first introduced into mix. Discard cement not discharged within one and one-half hours and dispose of legally. Concrete with a temperature greater than 85 degrees F. shall not be placed. Central mixed concrete shall be plant mixed a minimum of five minutes. Agitation shall begin immediately after premixed concrete is placed in truck and shall continue without interruption until discharged. Transit mixed concrete shall be mixed at mixing speed for at least ten minutes immediately after charging truck followed by agitation without interruption until discharged. Concrete shall be furnished by a single plant unless accepted by the Architect in writing.
- D. Retempering of concrete which has partially hardened, that is, mixing with or without additional cement, aggregates, or water, will not be permitted.

3.08 PLACING CONCRETE

- A. Intent of this Specification is that concrete shall not be pumped. Refer to "Submittals and Concrete Constituents" in this Section for requirements should pumping be proposed.
- B. Remove water and foreign matter from forms and excavations and, except in freezing weather or as otherwise directed, thoroughly wet wood forms just prior to placing concrete. Place no concrete on frozen soil and provide adequate protection against frost action during freezing weather.
- C. To secure full bond at construction joints, surfaces of concrete already placed, including vertical and inclined surfaces, shall be thoroughly cleaned of foreign materials and laitance, roughened with suitable tools such as chipping hammers or wire brushes, and recleaned by stream of water or compressed air. Well before new concrete is deposited, joints shall be saturated with water. After free or glistening water disappears joints shall be given thorough coating of neat cement slurry mixed to consistency of very heavy paste. Surface shall receive coating of approximately one-eighth inch thick; this shall be scrubbed in by means of stiff bristle brushes. New concrete shall be deposited before neat cement dries or changes color.
- D. Do not place concrete having slump outside of allowable slump range.
- E. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcement, and which avoid rehandling. Deposit no partially hardened concrete. When concrete is conveyed by chutes, equipment shall be of such size and U-shaped design as to insure continuous flow in chute. Flat (coal) chutes shall not be employed. Chutes shall be of metal or metal lines and different portions shall have approximately same slope. Slope shall not be less than 25 degrees nor more than 45 degrees from horizontal and shall be such as to prevent segregation of ingredients. Discharge end of chute shall be provided with baffle plate or spout to prevent segregation. If discharge end of chute is more than five feet above surface of concrete in forms, spout shall be used, and lower and maintained as near surface of deposit as practicable. When operation is intermittent, chute shall discharge into hopper. Chute shall be thoroughly cleaned before and after each run and debris and any water used shall be discharged outside forms. Concrete shall not be allowed to flow horizontally over distances exceeding five feet.

- F. Concrete shall be placed in such manner as to prevent segregation, and accumulations of hardened concrete on forms or reinforcement above mass of concrete being placed. To achieve this end, suitable hoppers, spouts with restricted outlets and tremies shall be used as required.
 - G. During and immediately after depositing, concrete shall be thoroughly compacted by means of internal type mechanical vibrators or other tools, or by spading to produce required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or "pumping" of air. Vibrators used for normalweight concrete shall operate at speed at not less than 7,000 vpm and be of suitable capacity. Do not use vibrators to move concrete. Vibration shall be supplemented by proper wooden spade puddling to remove included bubbles and honeycomb adjacent to visible surfaces. At least one vibrator shall be on hand for every 10 cubic yards of concrete placed per hour, plus one spare. Vibrators shall be operable and on site prior to starting placement.
 - H. Vertical lifts shall not exceed 18 inches. Vibrate completely through successive lifts to avoid pour lines. Vibrate first lift thoroughly until top of lift glistens to avoid stone pockets, honeycomb, and segregation.
 - I. Concrete shall be deposited continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within section. If section cannot be placed continuously between planned construction joints, as specified, field joint and additional reinforcement shall be introduced so as to preserve structural continuity. Architect shall be notified in any such case.
 - J. Cold joints, particularly in exposed concrete, including "honeycomb", are unacceptable. If they occur in concrete surfaces exposed to view, Architect will require that entire section in which blemish occurs be removed and replaced with new materials at the Contractor's expense.
 - K. When placing exposed concrete walls or columns, strike corners of forms rapidly and repeatedly from outside along full height while depositing concrete and vibrating.
 - L. Chutes, hoppers, spouts, adjacent work, etc. shall be thoroughly cleaned before and after each run and water and debris shall be discharged outside form.
- 3.09 FINISHING OF UNFORMED CONCRETE SURFACES
- A. Smooth troweled finish: shall be provided where concrete flatwork is to be exposed in the finished work or is to receive resilient flooring materials.
 - B. Floated finish: shall be provided where concrete flatwork is to receive waterproofing membranes or setting beds for finished materials.
 - C. Floated finish: shall be provided for top surfaces of walls, slabs and beams.
 - D. Rough struck surface shall be provided at top of pedestals.
 - E. Steel Broom Finish (with smooth edging): shall be provided at exterior concrete walks, pavements and steps.
 - F. The Contractor, at his own expense, shall level depressed spots and grind high spots in concrete surfaces which are in excess of specified tolerances. Leveling materials proposed for providing proper surface shall be approved by Architect.

3.10 REPAIRING OF UNFORMED CONCRETE SURFACES

- A. Tops of slabs and walls shall be repaired by using either same material as originally cast or by use of dry-pack material, as approved by Architect. Areas affected shall be chipped back square and to depth of one inch minimum. Hole shall then be moistened with water for a minimum of two hours, followed by brush coat of 1/16 inch thick cement paste. Immediately plug hole with concrete, or with dry pack material consisting of 1:1.5 mixture of cement and concrete sand mixed slightly damp to touch. Hammer dry-pack into hole until dense, and excess paste appears on surface. Finish patch flush and to same texture as surrounding concrete. For large repairs employ 1-1-2 mixture of cement, concrete sand and pea gravel at same dry-pack consistency.

3.11 CURING AND PROTECTION

- A. When concrete is placed at or below ambient air temperatures of 40 degrees F. or whenever in opinion of Architect, such or lower temperatures are likely to occur within 48 hours after placement of concrete, cold weather concreting procedures, according to ACI 306 and as specified herein, shall be followed. To this end, entire area affected shall be protected by adequate housing or covering, and heating. No salt, chemicals or other foreign materials shall be used in the mix to lower freezing point of concrete.
- B. Protect concrete work against injury from heat, cold, and defacement of any nature during construction operations.
- C. Concrete shall be treated and protected immediately after concreting or cement finishing is completed, to provide continuous moist curing above 50 degrees F. for at least seven days, regardless of ambient air temperatures.
- D. Curing compounds will not be permitted. Water cure all concrete.
- E. Keep permanent temperature record showing date and outside temperature for concreting operations. Thermometer readings shall be taken at start of work in morning, at noon, and again late in afternoon. Locations of concrete placed during such periods shall likewise be recorded, in such manner as to show any effect temperatures may have had on construction. Copies of temperature record shall be distributed daily to Architect.

3.12 REMOVAL OF FORMWORK, SHORING AND RESHORING

- A. The Contractor shall be responsible for proper removal of formwork, shoring, and reshoring.
- B. Forms shall be removed only after concrete has attained sufficient strength to support its shown weight, construction loads to be placed thereon and lateral loads, without damage to structure or excessive deflection.
- C. Forms and supports shall remain in place for not less than minimum periods of time noted below. These periods represent cumulative number of days or fractions thereof, consecutive unless otherwise approved by Architect during which time mean daily air temperature at surfaces of concrete is above 50 degrees F.
 - 1. Vertical Surfaces: concrete shall have reached 100 day-degrees# and shall have attained strength of not less than 30 percent of f'c. Where such forms also support formwork for slab or beam soffits, removal times for latter shall govern.
 - 2. Horizontal Surfaces: except as noted below, concrete shall have reached 300 day-degrees of curing and attained strength of not less than 60 percent of f'c.

- a. Soffits of beams or girders shall remain supported and in place until concrete has attained 600 day-degrees#.
 - b. Forms and supports of floor slabs shall remain in place until concrete has reached 400 day-degrees.
 - c. Definition of day-degrees: Total number of days times mean daily air temperature at surfaces of concrete. For example, five days at temperature of 60 degrees F. equals 300 day degrees. Days or fractions of days in which temperature is below 50 degrees F. shall not be included in calculation of day-degrees.
- D. Form removal shall be so performed that reshores are placed at same time as stripping operations, and that no area larger than one-fourth of a slab panel is unsupported at any time.
 - E. Any test cylinders required to verify the specified minimum strengths for form removal shall be field cured under the same conditions as the concrete they represent. Such cylinders and testing shall be at the Contractor's expense.

3.13 REPAIRING AND FINISHING OF FORMED AND ARCHITECTURAL CONCRETE SURFACES

- A. In accordance with the provisions of ACI 301, Chapter 10, all concrete shall have "smooth form finish".
- B. Intent of this Specification is to require forms, mixtures of concrete, and workmanship so that concrete surfaces will require no patching, except for plugging of tie holes. However, where patching is acceptable to Architect, procedure described below shall be followed.
- C. Defective concrete and honeycombed areas shall not be patched unless examined and approval is given by Architect. If such approval is received by the Contractor, areas involved shall be chipped down square and at least one inch deep to sound concrete by means of cold chisels or pneumatic chipping hammers. If honeycomb exists around reinforcement, chip to provide clear space at least three-quarter inch wide all around steel to afford proper ultimate bond thereto. For areas less than one and one-half inches deep, patch shall be made in same manner as described above for filling unformed concrete surfaces, care being exercised to use crumbly-dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs shall require build-up in successive days, each layer being applied as described. To aid strength and bonding of multiple layer repairs, non-shrink, non-metallic aggregate shall be used as an additive as follows:

Materials	Volumes	Weights
Cement	1.0	1.0
Non-Metallic Aggregate	0.15	0.25
Sand	1.5	1.55

For very heavy (generally, formed) patches, pea gravel may be added to mixture and proportions modified as follows:

Materials	Volumes	Weights
Cement	1.0	1.0
Non-Metallic Aggregate	0.2	0.33
Sand	1.0	1.0
Pea Gravel	1.5	1.55

After hardening, rub lightly as described above for form tie holes.

1. Mortar for patching shall be same mix as above except aggregate shall pass a No. 14 sieve.
 2. For all concrete to receive "smooth" finish, remove formwork fins and clean entire surface of grease, form oil, laitance, dust, and other foreign matter.
 3. "Smooth" finish shall consist of having all fins removed, joint marks smoothed off, blemishes removed, and surfaces left smooth and unmarred.
 4. Begin finishing operations as soon as practicable after removal of forms, continue with curing operations after finishing is completed. After concrete has been well cured, carefully inspect surfaces. Remove any fins, rough spots, streaks, hardened mortar or grout and other foreign material. Patch defects with finishing mortar as specified above, to satisfaction of Architect.
- D. Patches which become crazed, cracked, or sound hollow upon tapping shall be removed and replaced with new material at the Contractor's expense.
- 3.14 FIELD QUALITY CONTROL
- A. Independent Testing Agency: Cooperate with the Independent Testing Agency engaged by the Owner for field quality control activities for the Work of this Section. Refer also to Section 01 40 00, QUALITY REQUIREMENTS.
 - B. Cooperate with field quality control personnel. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
 - C. Additional inspections and retesting of materials which fail to comply with specified material and installation requirements shall be performed at the Contractor's expense.
- 3.15 CLEANING
- A. Concrete surfaces shall be cleaned of objectionable stains as determined by the Architect. Materials containing acid in any form or methods which will damage "skin" of concrete surfaces shall not be employed, except where otherwise specified.

END OF SECTION

SECTION 03 54 40

CEMENTITIOUS UNDERLAYMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. This Section includes cement-based, polymer-modified, self-leveling underlayment for interior finish flooring including the following:
 - 1. Provide cementitious underlayment where required to provide slope or substrate for new flooring, as indicated or as scheduled.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 02 41 25, SELECTIVE DEMOLITION.
 - 2. Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Plans indicating substrates, locations, and average depths of cement-based underlayment based on survey of substrate conditions.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer (applicator) who is acceptable to manufacturer, who has completed cement-based underlayment applications similar in material and extent to that required for this Project, and whose work has resulted in construction with a record of successful in-service performance.
- B. Mockups: Before installing underlayment, apply mockups to demonstrate qualities of materials and execution. Comply with the following requirements, using materials indicated for the completed Work:
 - 1. Architect will select one area or surface to represent surfaces and conditions for application on each substrate required.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be applied.
 - 3. Obtain Architect's approval of mockups before starting underlayment application.
 - 4. Maintain mockups, during underlayment application and until installation of finish flooring, in an undisturbed condition as a standard for judging the completed Work.
 - 5. Approved mockups may become part of the completed Work if undisturbed when finish flooring is installed.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.
- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written recommendations for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting underlayment performance.
- B. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.

1.08 COORDINATION

- A. Coordinate cement-based underlayment with requirements of finish flooring products, including adhesives, specified in Division 9 Sections.
- B. Before installing surface sealers recommended by underlayment manufacturer, if any, verify compatibility with finish flooring installation adhesives.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. K-15 Premium Self-Leveling Underlayment Concrete; Ardex, Inc.; or approved equal.

2.02 PRODUCTS AND MATERIALS

- A. Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in uniform thicknesses from 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, Portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - 2. Compressive Strength: Not less than 4100 psi (28 MPa) at 28 days when tested according to ASTM C 109.
 - 3. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm), or coarse sand as recommended by underlayment manufacturer.
 - 1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

- C. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).
- D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
- E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of underlayment including substrate moisture content. Begin underlayment application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions for substrate indicated. Provide clean, dry, neutral-pH substrate for underlayment application.
 - 1. Treat nonmoving substrate cracks to prevent cracks from telegraphing (reflecting) through underlayment according to manufacturer's written recommendations.
 - 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond according to manufacturer's written instructions.
- C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.03 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
 - 1. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
 - 2. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
 - 1. Apply a final layer without aggregate if required to produce smooth surface.
 - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- E. Do not install finish flooring over underlayment until after time period recommended by underlayment manufacturer.

- F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.04 FIELD QUALITY CONTROL

- A. Slump Test: If slump testing is recommended in writing by manufacturer, test underlayment for slump as it is placed for compliance with manufacturer's written recommendations.
- B. Field Samples: Take at least three molded-cube samples from each underlayment batch. Test samples according to ASTM C 109 for compliance with compressive-strength requirements. When requested, provide test results to Architect.

3.05 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION

SECTION 03 60 00

GROUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Work consists of furnishing all labor, material, and equipment necessary for installation of non-shrink grout at the following locations:
 - 1. Under bearing plates.
 - 2. All “drypack” work specified on the Drawings.
- B. Alternates: Refer to Section 01 23 00, ALTERNATES.
- C. Items To Be Installed Only: Not Applicable.
- D. Items To Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Masonry grouting: Section 04 50 00, MASONRY AND STONE RESTORATION.

1.03 QUALITY ASSURANCE

- A. Testing Agency:
 - 1. Testing and inspection will be made by an approved testing laboratory selected and paid by the Owner. The Contractor shall furnish Testing Agency access to work, facilities and incidental labor required for testing and inspection. Retention by the Owner of an independent testing agency shall in no way relieve the Contractor of responsibility for performing all work in accordance with the contract requirements.
 - 2. Furnish the Testing Agency with the following:
 - a. A complete set of shop and erection drawings.
 - b. Minimum 48 hour advanced notice as to time and placement of all grout under this section.
 - c. Full and ample means and assistance for testing all material.
 - d. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.
 - e. Copy of approved submittal for each product to be used.

1.04 TESTING AND INSPECTION

- A. Prepare test specimens in accordance with the requirements of the governing building code.

- B. For each day's production prepare, test and submit compression test results of one (1) set of three (3) cubes, 2 in. x 2 in., made from each type of grout used in the field.

1.05 SUBMITTALS

- A. Product Data: Submit catalog data on grout proposed for use.

6 DELIVERY, STORAGE AND HANDLING

- A. Deliver in original unopened containers and store in a dry place under cover.

1.06 JOB CONDITIONS

- A. Environmental Requirements: Maintain temperature of 40 degrees F. or above for at least 72 hours following placement.

PART 2 – PRODUCTS

2.01 NON-SHRINK GROUT OR DRYPACK

- A. Acceptable Manufacturer and Products:

1. Non-Metallic Grout: Use one of the following where grout is exposed to view or weathering.

- a. U.S. Grout Corporation "Five Star Grout".
- b. Protex Industries "Propak".
- c. Master Builders "Master Flow 713".
- d. L&M Chemicals "Crystex".
- e. Euclid Chemical Company "Euco NS".
- f. Or approved equal.

- B. Grout shall conform to CRD-C-621, Corps of Engineers "Specifications for Non-Shrinkage Grout."

PART 3 – EXECUTION

3.01 PREPARATION

- A. Remove defective concrete, laitance, dirt, oil, grease, and loose material from surface to receive grout.
- B. Clean bottom of leveling plate, base plate, or bearing plate of all dirt, oil, grease, and loose material; align, level, and support plate in accordance with fabricator's instructions, templates, etc. in its final position. Maintain fixed in that position during grouting and curing.

3.02 INSTALLATION

- A. Completely fill with grout under beam and column bearings, erection blockouts, connection blockouts or pockets, and elsewhere as required. Mix, install, and cure grout according to manufacturer's recommendations.

END OF SECTION

SECTION 04 50 00

MASONRY AND STONE RESTORATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Provide masonry and stone restoration and cleaning work, as indicated on Drawings and as specified herein. Include, but do not limit to:
- B. This Section includes masonry restoration and cleaning, to the extent indicated and as required for the remediation work. Included as part of this work is the following:
 - 1. Removal of existing masonry and stone.
 - 2. Rebuilding of masonry and stone to the extent indicated.
 - 3. Repairing masonry, including replacing damaged units.
 - 3. Repointing of mortar joints including brick to brick mortar, concrete to brick mortar, and precast concrete to precast concrete mortars as indicated.
 - 4. Cleaning exposed masonry and stone surfaces where required.
- C. Perform masonry restoration and cleaning work included in quantity allowances only as authorized. Authorized work includes work required by specifications and only work authorized in writing by Architect.
 - 1. Notify Architect weekly of extent of work performed that is attributable to quantity allowances.
 - 2. Perform work that exceeds quantity allowances only as authorized by Change Orders.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 02 41 25, SELECTIVE DEMOLITION.
 - 2. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 3. Section 05 50 00, METAL FABRICATIONS; Miscellaneous metals for new steel lintels and brick angles to be set in masonry.

1.04 REFERENCED STANDARDS

- A. Brick Industry Association (BIA)
- B. ASTM International (ASTM) as noted herein.

1.05 DEFINITIONS

- A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- B. Medium-Pressure Spray: 400 to 800 psi (2750 to 5500 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- C. High-Pressure Spray: 800 to 1200 psi (5500 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

1.06 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements that is no more than two years old.
- B. Samples for Verification: Before erecting mockup, submit samples of the following:
 - 1. Each type of exposed masonry unit to be used for replacing existing units.
 - a. For each brick type, provide straps or panels containing at least four bricks.
 - 2. Each type of sand used for pointing mortar.
 - a. For blended sands, provide samples of each component and blend.
 - b. Identify sources, both supplier and quarry, of each type of sand.
 - 3. Each type of pointing mortar in the form of sample mortar strips, 6 inches (150 mm) long by 1/2 inch (13 mm) wide, set in aluminum or plastic channels.
 - a. Include with each sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry of each type of sand and brand names of cementitious materials and pigments if any.
 - 4. Each type of masonry patching compound in the form of briquettes, at least 3 inches (75 mm) long by 1-1/2 inches (38 mm) wide. Document each sample with manufacturer and stock number or other information necessary to order additional material.
 - 5. Each type of masonry repair anchor or other specialty anchoring device.
- C. Qualification Data: For restoration specialists including field supervisors and chemical manufacturer.
- D. Restoration Program: For each phase of restoration process, provide detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of restoration work including protection of surrounding materials on building and Project site.
 - 1. Include methods for keeping pointing mortar damp during curing period.
 - 2. If materials and methods other than those indicated are proposed for any phase of restoration work, provide a written description, including evidence of successful use on comparable projects, and a testing program to demonstrate their effectiveness for this Project.
- E. Cleaning Program: Describe cleaning process in detail, including materials, methods, and equipment to be used and protection of surrounding materials on building and Project site, and control of runoff during operations.

1. If materials and methods other than those indicated are proposed for cleaning work, provide a written description, including evidence of successful use on comparable projects, and a testing program to demonstrate their effectiveness for this Project.
- F. Contractor Qualifications: The Masonry Contractor must demonstrate that they have completed large scale, complex masonry restoration projects that show the mason's ability to successfully complete the Project. Provide names of qualifying projects, contact information, date completed, and description of scope as well as duration of the contract. Provide photographs of the completed projects. In addition, the contractor shall:
1. List all masonry restoration projects completed during the last five (5) years where the masonry restoration contract value exceeds \$1,000,000. Provide the names of qualifying projects, contact information, date completed, and description of scope as well as the duration of the contract. A minimum of three (3) successfully qualifying projects must have been completed.
 2. Provide documentation that they have successfully supplied and installed stone units for large scale and complex masonry restoration projects, as well as large scale brick repointing and rebuilding masonry restoration projects. Provide the names of qualifying projects, contact information, date completed, and description of scope as well as the duration of the contract. Provide photographs.
 3. Provide documentation that they have been in business for at least ten (10) years and have successfully completed masonry restoration projects in the Northeast United States.
 4. Provide percentage of annual work for the past five (5) years that consists of historic preservation projects versus new construction."

1.07 QUALITY ASSURANCE

- A. Restoration Specialist Qualifications: Engage an experienced, masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance, for a period of at least five (5) years.
1. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
 2. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that clay masonry restoration and cleaning are in progress. Supervisors shall not be changed during Project except for causes beyond the control of restoration specialist firm.
 3. Restoration Worker Qualifications: Persons having a minimum five years' experience in the restoration work of types they will be performing. When masonry units are being patched, assign at least one worker among those performing patching work who is trained and certified by manufacturer of patching compound to apply its products.
 4. DCAMM Certification: Historic Masonry Restoration certification is required.
- B. Chemical Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, with a minimum five years' experience with similar applications, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.
- C. Source Limitations: Obtain each type of material for masonry restoration (face brick, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.
- D. Preconstruction Testing Service: Masonry Contractor shall engage a qualified independent testing agency to test the following. Provide test specimens and assemblies as indicated.

1. Replacement Brick: For each proposed type of replacement brick, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).
 2. Existing Brick: For each type of existing brick indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove existing bricks from locations designated by Architect.
 3. Analysis of a representative sample of existing mortar from each elevation describing the mix proportions and aggregate (sand) gradation (particle-size distribution).
- E. Mockups: Prepare mockups of restoration and cleaning as follows to demonstrate aesthetic effects and qualities of materials and execution. Prepare mockups on existing walls under same weather conditions to be expected during remainder of the Work.
1. Notify the Architect at least 48 hours before construction of mock-ups so that the Architect may have a representative present during the construction of the sample. Do not start work until the Architect has approved the mock-up. Rebuild mock-ups as many times as required to meet the Architect's approval at no additional cost to the Owner or delay in the project schedule. Approved mock-ups may be incorporated into the work.
 2. Incorporate associated materials and systems including sheet metal flashing and roofing membranes in the mock-ups as detailed.
 3. Reproduce the approved construction procedures, workmanship quality and appearances throughout the project using identical materials, mixtures, and quality of workmanship.
 4. Keep approved sample areas in a cleaned and finished condition throughout the duration of the project.
 5. Construct the following mock-ups:
 - a. Rebuild brick veneer an area approximately 36 inches (900 mm) high by 48 inches (1200 mm).
 - b. Clean an area approximately 25 sq. ft. (2.3 sq. m) in area as indicated for each type of masonry and precast and surface condition.
 - 1). Test cleaners and methods on samples of adjacent materials for possible adverse reactions unless cleaners and methods are known to have deleterious effect.
 - 2). Start with least harsh cleaning processes at heavily stained masonry before using harsh cleaning chemicals on the building.
 - 3). Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
 - c. Rake out joints in two separate areas approximately 36 inches (900 mm) high by 72 inches (1800 mm) wide as indicated for each type of repointing required and repoint one of the two areas.
- F. Contractor Qualifications: The Masonry Contractor must demonstrate that they have completed large scale, complex masonry restoration projects that show the mason's ability to successfully complete the Project. Provide names of qualifying projects, contact information, date completed, and description of scope as well as duration of the contract. Provide photographs of the completed projects. In addition, the contractor shall:

1. List all masonry restoration projects completed during the last five (5) years where the masonry restoration contract value exceeds \$1,000,000. Provide the names of qualifying projects, contact information, date completed, and description of scope as well as the duration of the contract. A minimum of three (3) successfully qualifying projects must have been completed.
2. Provide documentation that they have successfully supplied and installed stone units for large scale and complex masonry restoration projects, as well as large scale brick repointing and rebuilding masonry restoration projects. Provide the names of qualifying projects, contact information, date completed, and description of scope as well as the duration of the contract. Provide photographs.
3. Provide documentation that they have been in business for at least ten (10) years and have successfully completed masonry restoration projects in the Northeast United States.
4. Provide percentage of annual work for the past five (5) years that consists of historic preservation projects versus new construction."

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.
- B. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- E. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.09 PROJECT CONDITIONS

- A. Repoint mortar joints and repair masonry only when air temperature is between and 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least 7 days after completion of work. Follow the guidelines by the BIA and ACI for pointing of masonry.
- B. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing:
 1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures above 40 deg F (4 deg C).
 2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 7 days after repair and pointing.
- C. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above.

- D. Clean masonry surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least 7 days after completion of cleaning.
- E. Protect the building, its contents, new and existing work against damage from the Work of this Section. Do not damage existing materials scheduled to remain.

PART 2 - PRODUCTS

2.01 MASONRY MATERIALS

- A. Face Brick and Accessories: Provide face brick and accessories, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work and to match existing.
 - 1. Provide units with colors, surface texture, size, and shape to match existing brickwork and with physical properties not less than those determined from preconstruction testing of selected existing units.
 - a. For existing brickwork that exhibits a range of colors, provide brick that matches that range rather than brick that matches an individual color within that range.
- B. Building Brick: Provide building brick complying with ASTM C 67, of same vertical dimension as face brick, for masonry work concealed from view.
 - 1. Grade SW where in contact with earth.

2.02 MORTAR MATERIALS

- A. Mortar at Masonry:
 - 1. Comply with ASTM C 270, Standard Specification for Mortar for Unit Masonry, Type N. Proportions by volume 1:1:6 (Portland cement:hydrated lime:mason's sand). Do not use ground limestone or prepared masonry mortar mixes.
- B. Mortar at CMU back-up: ASTM C270, Standard Specification for Mortar for Unit Masonry, Type S. Proportions by volume 1:1/2:4 to 4-1/2 (Portland cement:hydrated lime:mason's sand). Do not use ground limestone or prepared masonry mortar mixes.
- C. Portland Cement: ASTM C 150, Type I.
 - 1. Provide white cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- D. Hydrated Lime: ASTM C 207, Type S.
- E. Quicklime: ASTM C 5, pulverized lime.
- F. Mortar Sand: ASTM C 144, unless otherwise indicated.
 - 1. Color: Provide natural sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
 - 2. For pointing mortar, provide sand with rounded edges.
 - 3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands, if necessary, to achieve suitable match.

- G. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
 - H. Water: Potable.
- 2.03 GROUT MATERIALS
- A. Grout: ASTM C476, fine, 1:0.10:3
 - B. Grout Sand: ASTM C404, size No. 1.
- 2.04 CLEANING MATERIALS
- A. Water for Cleaning: Potable.
 - B. Hot Water: Heat water to a temperature of 140 to 160 deg F (60 to 71 deg C).
 - C. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.
 - D. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate (TSPP), 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.
 - 1. Removal of Lichen and Algae: ProSoCo, Inc. 'Bioclear'.
 - E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, which contains detergents and chelating agents and is specifically formulated for cleaning masonry surfaces.
 - F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
 - G. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no hydrochloric, hydrofluoric, or sulfuric acid; or chlorine bleaches.
 - H. Acidic Cleaner: Manufacturer's standard acidic masonry restoration cleaner composed of hydrofluoric acid blended with other acids, detergents, wetting agents, and inhibitors.
 - I. Two-Part Chemical Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.
 - J. Cleaner Manufacturer(s): Provide products manufactured by one of the following, or approved equal:
 - 1. ProSoCo, Inc.
 - 2. American Building Restoration Products, Inc.
 - 3. Diedrich Technologies Inc.
- 2.05 MISCELLANEOUS MATERIALS
- A. Brick Veneer Ties: Dur-O-Wal, a Dayton Superior Company; DW-10 hot dipped galvanized or stainless steel veneer tie assembly with box wall ties with cavity drip sized to fit the cavity.

- B. Fasteners: Tapcon with Stalguard coating or stainless steel zamac nailin, minimum 1/4 in. diameter, minimum 1.5 in. embedment.

PART 3 - EXECUTION

3.01 RESTORATION SPECIALISTS

- A. Available Restoration Specialist Firms: Subject to compliance with requirements, firms that may provide masonry and stone restoration and cleaning include, but are not limited to, the following:
 - 1. Masonry and stone restoration firm complying with DCAMM certification and acceptable to Owner.

3.02 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.
 - 1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
- B. Comply with chemical cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - 3. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
 - 5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - 1. Cover sills, ledges, and projections to protect from mortar droppings.
 - 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - 3. Immediately remove mortar in contact with exposed masonry and other surfaces.
 - 4. Clean mortar splatters from scaffolding at end of each day.

3.03 BRICK REMOVAL AND REPLACEMENT

- A. Protect building components not scheduled for cleaning from cleaning activities, mask all windows, doors, hardware, and other non-masonry surfaces.

- B. At locations indicated, remove bricks that are damaged, spalled, or deteriorated or where coursing is to be corrected. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - 1. When removing single bricks, remove material from center of brick and work toward outside edges.
- C. Limit the extent of masonry removal to prevent any adverse effects on the structural soundness or weather resistant integrity of the existing masonry. Do not remove continuous lengths of masonry coursing longer than 3 ft and as limited by existing conditions. Do not remove intermediate piers until new piers are installed and have cured three days. The Contractor shall repair any areas suffering any adverse effects as a result of this work; repairs shall be in accordance with these Specifications and to the satisfaction of the Architect.
- D. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- E. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose masonry units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- F. Use hand tools where possible to avoid damaging the existing brick. Do not sawcut beyond immediate areas of removal. Do not break bond between mortar and units scheduled to remain or crack any masonry in areas to remain. Use care during removal to minimize the amount of removal and to maximize the reuse of salvaged masonry.
- G. Except at control joints, remove whole bricks and tooth in rebuilt sections of masonry to the existing.
- H. Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
- I. Mix mortar using quantity of water to ensure good workability. For each batch, measure cement and lime in bags; sand by weight, or measure in suitable calibrated containers, with allowance made for moisture content, bulking, and consolidation. Use volumetric dispenser for color admixtures. Do not use split sacks. Do not use shovel measurements of sand, cement, or lime. Keep mortar in metal pans. Mix by machine only, for at least 3 min. but not more than 5 min. Use mortar within 2 hrs of mixing at temperatures over 74°F, and 2-1/2 hrs at temperatures between 50°F and 74°F. Do not retemper mortar. Discard hardening mortar.
- J. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
- K. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. (30 g/194 sq. cm per min.). Use wetting methods that ensure that units are nearly saturated but surface is dry when laid. Maintain joint width for replacement units to match existing joints.
 - 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
 - 2. Rake out mortar used for laying brick before mortar sets.

- L. Rake out deteriorated mortar joints a minimum 3/4 in. deep and point mortar joints in 1/4 in. lifts, to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
- M. Do not obstruct or reduce cavities by mortar protrusions or droppings, and keep bottom of cavity free of all debris and droppings. Make necessary adjustments promptly during brick laying.
- N. Embed veneer ties at least 2 in. into brick mortar joint, but recess ends of ties at least 3/4 in. from exterior brick surfaces. Place all ties so that they are completely surrounded by mortar. Direct brick-to-tie contact is not permitted. Position anchors and ties to permit the tie at least 1/2 in. of free movement in the vertical plane of the wall. Limit lateral free movement to less than 0.05 in.
- O. Dry brush newly completed masonry and exposed flashing surfaces daily to clean and remove mortar. Clean with potable water only, using a stiff bristle brush with nonmetal bristles. If water alone with a scrub brush is not successful, use a cleaning compound as approved by the Architect.
- P. Clean all masonry work promptly after curing by wetting surfaces and washing with a stiff bristle brush to produce a clean unmarred appearance. Begin cleaning with water only, without chemical cleaners. If water alone with a scrub brush is not successful, as determined by the Architect, use an approved cleaning compound. Dilute the compound with the maximum amount of water that will allow proper cleaning, as approved by the Architect. Test the cleaning compound in a small inconspicuous area before beginning full scale cleaning. Cover all existing exposed metal, glazing and other areas as required before cleaning the masonry with any cleaning compounds. Remove efflorescence, if any, as directed by the Architect. Do not use metal scrapers to clean the masonry. Rinse repeatedly with clean water after cleaning to remove all traces of mortar and debris. Protect all exterior finishes, including glass and metal from any damage or staining caused by this work.

3.04 CUTTING OF CONTROL JOINTS IN BRICK MASONRY

- A. Where indicated provide new vertical or horizontal control joints in masonry wall construction using approved masonry saws capable of provide a neat clean cut of required width and depth with all cutting straight and uniform width. Vertical joints shall be plumb. Horizontal joints shall be level.
- B. Employ diamond carbide tipped saw blades to provide required cutting. Employ appropriate duct collection and water-cooling where required to provide joints indicated. Provide masking or other methods to ensure straight and accurate cutting. Repair or replace brick masonry damaged.
- C. All saw cut joints shall be cleaned of all dirt, dust, debris, and broken masonry and shall be cleaned using compressed air to ensure clean joints suitable to receive backer rod, bond breaking materials, primers, and sealant application.
- D. All saw cut joints will be examined by Owner's Representative for accuracy in cutting required joint width and depths and tolerances for line.

3.05 CLEANING MASONRY AND STONE, GENERAL

- A. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other.

- B. Use only those cleaning methods indicated for each masonry material and location.
 - 1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 - 2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
 - a. Equip units with pressure gages.
 - 3. For chemical cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 - 4. For water spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - 5. For high-pressure water spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
 - 6. For heated water spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
 - 7. For steam application, use steam generator capable of delivering live steam at nozzle.
 - C. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
 - D. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, sealants, mastics, asphalt, and tar.
 - E. Protect building components not scheduled for cleaning from cleaning activities, mask all windows, doors, hardware, and other non-masonry surfaces.
 - F. Schedule general cleaning to avoid areas of new work until it is thirty days old.
- 3.06 MASONRY AND STONE SEALER APPLICATION
- A. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
 - B. Before ordering bulk of material, provide mock-up and obtain Owner's approval of final appearance.
 - C. Test substrates for moisture content to ensure that surfaces are sufficiently dry.
 - D. Protect adjacent non-masonry surfaces, especially windows, and all nearby vehicles, concrete sidewalks, buildings and the like from overspray, spillage or blowover of water repellent coatings.
 - E. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
 - F. Apply a heavy saturation coating using brushes only. Work well into surfaces. Repeat application, complying with manufacturer's instructions for drying time between coats.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.

1. Steel lintels with shop-applied zinc-rich primer at interior locations.
2. Galvanized steel lintels with shop-applied primer at exterior locations.
3. Galvanized shelf angles with shop applied primer at exterior locations.
4. Steel framing and supports with shop-applied primer for countertops.
5. Galvanized steel framing and supports for mechanical and electrical equipment.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections; galvanized at exterior locations and in exterior walls.
7. Miscellaneous steel trim including steel edgings, galvanized at exterior locations and in exterior walls.
8. Galvanized pipe guards with shop-applied primer.
9. Steel supports for overhead toilet partitions and operable panel partitions.
10. Cast gray iron nosings.
11. All other metal fabrications indicated.

- B. Alternates: Refer to Section 01 23 00, ALTERNATES.

- C. Items To Be Installed Only: Not Applicable.

- D. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections

1. Section 03 30 00 - CAST-IN-PLACE CONCRETE:

- a. Lintels, sleeves, anchors, inserts, plates and similar items.

2. Section 04 50 00 - MASONRY AND STONE RESTORATION:

- a. Lintels, miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.

- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 1022 39, OPERABLE PANEL PARTITION.
2. Section 10 21 13, METAL TOILET PARTITIONS.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Seismic Performance: Provide ladders and framing capable of withstanding the effects of earthquake motions as required by Code.
 1. Component Importance Factor: 1.5.
- C. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 degrees F ambient; 180 degrees F material surfaces.

1.4 SUBMITTALS

- A. Product Data: For the following:
 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 2. Metal nosings and treads.
 3. Paint products.
 4. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 2. Provide templates for anchors and bolts specified for installation under other Sections.
 3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the Commonwealth of Massachusetts responsible for their preparation. All costs for professional engineering shall be included in the bid price for the Work of this Section.
 4. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer licensed in the Commonwealth of Massachusetts.

- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the Commonwealth of Massachusetts and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.
- C. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code--Stainless Steel."
- D. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316L at exterior, Type 304 at interior.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L at exterior, Type 304 at interior.

- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- G. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
- H. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- C. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- D. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head, Power-Stud by Powers Fasteners, or equal.
- E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
 - 1. Available Products: Dupont Universal Primer, Keeler and Long Universal Primer, Tnemec Series 394 PerimePrime, or equal.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Available Products: Dupont Ganicin, Keeler and Long Urethane Zinc Rich Primer, Tnemec Series 394 PerimePrime, or equal.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for folding-panel partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; coordinate location of holes.

2.6 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.9 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.10 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.11 PIPE GUARDS

- A. Fabricate pipe guards from 3/8-inch-thick by 12-inch-wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.

2.12 ABRASIVE METAL NOSINGS

- A. Cast-Metal Units: Cast gray iron, Class 20 with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
- B. Drill for mechanical anchors and countersink. Locate not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
- C. Apply isolation coating to concealed bottoms, sides, and edges of cast-metal units set into concrete.

2.13 METAL DOWNSPOUT BOOTS

- A. Provide downspout boots made from cast gray iron in heights indicated with inlets of size and shape to suit downspouts.

2.14 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.15 STEEL PRIMERS AND FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Urethane Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush Off Blast Cleaning."
 - 3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.
 - 4. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 5. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages."
- B. Zinc-Rich Primer: Urethane zinc rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS. Provide primer with a VOC content of 250 g/L (2.8 lb/gal.) or less per OTC and HAPS COMPLIANT STANDARDS PER 2010 standards when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Provide Tnemec Series 394 Primerprime at 3.0 mils DFT, PPG PMC Amercoat 68 MCZ Zinc Rich Primer, or equal by DuPont, Keeler and Long.
- C. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards. The galvanizing bath shall contain high grade zinc and other earthly materials. Fill vent holes and grind smooth after galvanizing.
- D. Hot-Dip Galvanizing And Factory-Applied Primer for Steel: Provide hot-dip galvanizing and factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and local requirements. Apply primer within 12 hours after galvanizing at the galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria:
 - 1. Abrasion Resistance per ASTM D 4060 (CS17 Wheel, 1,000 grams load); 1kg Load: 200 mg loss.
 - 2. Adhesion per ASTM D4541: 1050 psi.
 - 3. Corrosion Weathering per ASTM D5894, 13 cycles, 4,368 hours: Rating 10 per ASTM D714 for blistering; Rating: 7 per ASTM D610 for rusting.
 - 4. Direct Impact Resistance per ASTM D2794: 160 in. lbs.
 - 5. Flexibility per ASTM D522, 180° Bend, 1 inch Mandrel: Passes.
 - 6. Pencil Hardness per ASTM D3363: 3H.

7. Moisture Condensation Resistance per ASTM D4585, 100° F, 2000 hours: Passes, no cracking or delamination
 8. Dry Heat Resistance per ASTM D2485: 250° F.
- E. Hot-Dip Galvanizing and Factory-Applied Urethane Primer and Finish for Steel: Provide factory-applied architectural coating over primed hot-dip galvanized steel matching approved samples.
1. Primer coat shall be factory-applied polyamide epoxy primer. Apply primer within 12 hours after galvanizing at the galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer.
 2. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer.
 3. Coatings shall be certified OTC/VOC compliant and conform to applicable regulations and EPA standards.
 4. Apply the galvanizing, primer, and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
 5. Blast cleaning of the galvanized surface is required, unless galvanizer certifies performance will be met without blast cleaning and coating will be applied within 12 hours of galvanizing.
 6. Primer shall meet or exceed the following performance criteria:
 - a. Abrasion Resistance per ASTM D 4060 (CS17 Wheel, 1,000 grams load), 1kg Load: 200 mg loss.
 - b. Adhesion per ASTM D4541: 1050 psi.
 - c. Corrosion Weathering per ASTM D5894, 13 Cycles, 4,368 Hours: Rating 10 per ASTM D714 for blistering; Rating 7 per ASTM D610 for rusting.
 - d. Direct Impact Resistance per ASTM D2794: 160 in. lbs.
 - e. Flexibility per ASTM D522, 180° Bend, 1 in. Mandrel: Passes.
 - f. Pencil Hardness per ASTM D3363: 3B.
 - g. Moisture Condensation Resistance per ASTM D4585, 100° F, 2000 Hours: Passes, no cracking or delamination.
 - h. Dry Heat Resistance per ASTM D2485: 250° F.
 7. Topcoat shall meet or exceed the following performance criteria:
 - a. Abrasion Resistance per ASTM D 4060, CS17 Wheel, 1,000 Cycles 1kg Load: 87.1 mg loss.
 - b. Adhesion per ASTM D 4541: 1050 psi.
 - c. Direct Impact Resistance per ASTM D2794: >28 in. pounds.
 - d. Indirect Impact Resistance per ASTM D2794: 12-14 in. pounds.
 - e. Dry Heat Resistance per ASTM D2485: 200° F.
 - f. Salt Fog Resistance per ASTM B 117 9,000 Hours: Rating 10 per ASTM D714 for blistering.
 - g. Flexibility per ASTM D522, 180° Bend, 1/8 in. Mandrel: Passes.
 - h. Pencil Hardness per ASTM D3363: 2H.
 - i. Moisture Condensation Resistance per ASTM D4585, 100° F, 1000 Hours: No blistering or delamination
 - j. Xenon Arc Test per ASTM D 4798: Pass 300 hours

2.16 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.

- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING PIPE GUARDS

- A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.5 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07 92 00, JOINT SEALANTS to provide a watertight installation.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- C. Touch-Up and Repair for Galvanized Surfaces: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.
 - 1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Galvanizing repair paint shall have 95 percent zinc by weight. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable.

2. For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel. Touch-up shall be such that repair is not visible from a distance of 6 feet.
3. A touch-up repair kit or touchup instructions shall be provided to the Authority for each type of factory-applied finish.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. This section describes the requirements for materials, fabrications and installation of rough carpentry and associated items including, but not necessarily limited to, the following:
 - 1. Blocking, backing, stripping, furring, sub-bases and nailers.
 - 2. Rough hardware.
 - 3. Wood framing.
 - 4. Insulation stops.
 - 5. Overhead supports for ceiling.
 - 6. Fire retardance.
 - 7. Preservative treatment.
 - 8. Installation of concrete anchors for wood or steel.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE; Placing of inserts and anchors. Epoxy type anchors.
 - 2. Section 06 19 20, PREFABRICATED METAL PLATE CONNECTOR WOOD TRUSSES.
 - 3. Section 06 17 13, LAMINATED VENEER LUMBER.
 - 4. Section 07 27 00, AIR BARRIER MEMBRANE.
 - 5. Section 08 80 00, GLASS AND GLAZING.
 - 6. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.
 - 7. Section 09 91 00, PAINTING; Field painting.
 - 8. Division 23 – HVAC and Division 26 - ELECTRICAL; Hangers, brackets, troughs, guards, and other steel items for support or protection of Mechanical and Electrical work.

1.04 QUALITY ASSURANCE

- A. Pre-Construction Conference:
 - 1. Prior to sheathing shear walls or diaphragms, a pre-construction conference will be held. The following individuals will be present:
 - a. Architect.
 - b. Structural Engineer.
 - c. General Contractor.
 - d. Foreman supervising installation of shear walls, diaphragms and tie-downs.
 - e. Representative of Testing Laboratory.

2. The agenda will include:
 - a. Fasteners and tie-downs to be used.
 - b. Installation criteria.
 - c. Inspection requirements.

- B. In the event of conflict between pertinent codes and regulations, these Specifications and Drawings ask the Architect for clarification.

1.05 REFERENCES

A. Standards:

1. National Design Specification.
2. International Building Code.
3. American Society for Testing and Materials.
4. American Wood Protection Association:
 - a. AWPA T1-10, "Use Category System: Processing and Treatment Standard.
 - b. AWPA U1-10, "Use Category System: User Specification for Treated Wood.

1.06 SUBMITTALS

- A. Prior to commencing Work, submit a sample of the nails and/or staples to be used.
- B. When submitting staples or nails used in nailing guns submit a copy of the applicable ICC report.
- C. Wood Treatment Data: For informational purposes, submit two copies of the chemical treatment manufacturers' instructions for proper use of each type of treated material. Indicate by means of copy of letter of transmittal, that copy of each instruction has been distributed to the installer of the material.
- D. Dip Treatment: For each type specified, include certification by treatment plant, identifying the chemical solutions used, submersion period and conformance with specified standards.
- E. Pressure Preservative Treatment: For each type specified, include certification by the treating plant, identifying the chemicals and process used, net amount of salts retained and conformance with applicable standards. For water borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 15 percent prior to shipment to project site.
- F. Fire Retardant Treatment: Include certification by the treating plant that the treatment materials complies with the governing ordinances and that treatment will not "bleed" through the surface finish materials scheduled to be used.
- G. Review of submittals is of a general nature only, and responsibility for conformance with intent of Drawings and Specifications shall remain with the Contractor. Review does not imply or state that the contract documents have been interpreted correctly.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store all materials flat on dunnage or pallets to prevent warping or distortion.

- B. Cover materials to protect against damage and the weather. Ensure that materials are stored in a manner which also provides proper ventilation and drainage.
- C. Separate all framing lumber by grade and store different grades separately.
- D. Damaged or otherwise non-complying materials shall not be used in the project. Keep all damaged materials clearly identified, and store separately to prevent inadvertent use.
- E. Use extreme care in the off-loading and handling of lumber to prevent damage, splitting, and breaking of materials.
- F. Use all means necessary to protect the installed work and materials of all other trades.
- G. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.
- H. Deliver and store packaged products in original containers or bundles with seals unbroken and labels intact until time of use.

PART 2 – PRODUCTS

2.01 LUMBER

A. General:

1. All lumber shall be s4s unless noted otherwise.
2. Sizes noted are nominal unless shown as net.
3. All lumber shall be free of heart center (FOHC).
4. All lumber shall have a moisture content not exceeding 16 percent for 2x and smaller lumber nor 19 percent for thicker lumber at the time of installation.

B. Protection Against Decay:

1. Wood exposed to earth or weather must be preservative-treated using water-borne preservatives in accordance with AWPA U1 (Commodity Specifications A or F). Specific AWPA Use Categories by application are specified below.
 - a. Where wood joists or the bottom of a wood structural floor without joists are closer than 18 inches to the exposed ground, or wood girders are closer than 12 inches to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation (but neither condition in contact with the ground), the floor framing, including posts, girders, joists, and subfloor, shall be comprised of preservative-treated wood conforming to AWPA Use Category: UC3B.
 - b. Wood framing members, including wood sheathing, that rest on exterior foundation walls and are less than 8 inches from exposed earth shall be comprised of preservative-treated wood conforming to AWPA Use Category: UC4B.
 - c. Wood framing members and furring strips attached directly to the interior of exterior masonry or concrete walls below grade shall be comprised of preservative-treated wood conforming to AWPA Use Category: UC3B.
 - d. Sleepers and sills on a concrete or masonry wall or slab that is in direct contact with earth (wood not in contact with earth), shall be of preservative-treated wood conforming to AWPA Use Category: UC3B.

- e. The ends of above grade wood girders entering exterior masonry or concrete walls shall be provided with a ½-inch air space on the tops, sides, and ends, unless preservative-treated wood is used conforming to AWWPA Use Category: UC3B.
- f. Clearance between wood siding and earth on the exterior of a building shall not be less than 6 inches, except where siding, sheathing, and wall framing are of preservative-treated wood, conforming to AWWPA Use Category: UC4B.
- g. Posts or columns supporting permanent structures and supported by a concrete or masonry slab or footing that is in direct contact with the earth shall be constructed of preservative-treated wood conforming to AWWPA Use Category: UC4B.
- h. The portions of glued-laminated timbers that form the structural supports of a building or other structure and are exposed to weather and not fully protected from moisture by a roof, eave, or similar covering shall be manufactured from preservative-treated wood conforming to AWWPA Use Category: UC4B.
- i. Wooden posts or columns supporting permanent structures that are embedded in concrete that is in direct contact with the earth, embedded in concrete that is exposed to the weather, or in direct contact with the earth shall be preservative-treated wood conforming to AWWPA Use Category: UC4C.
- j. Wood structural members that support moisture-permeable floors or roofs that are exposed to weather, such as concrete or masonry slabs, shall be preservative-treated wood conforming to AWWPA Use Category: UC4C, unless separated from such floors or roofs by an impervious moisture barrier.
- k. Other wood not noted above in an exterior application, and not in contact with ground or water shall be preservative-treated wood conforming to AWWPA Use Category: UC3B.
- l. Other wood members not noted above in contact with ground or fresh water shall be preservative-treated conforming to AWWPA Use Category: UC4B.
- m. Wood members exposed to salt water shall be preservative-treated conforming to AWWPA Use Category: UC5A (North of New Jersey and San Francisco); UC5B (South of New Jersey to Georgia and South of San Francisco); UC5C (South of Georgia, Gulf Coast).
- n. Wood framing in geographical areas where hazard of termite damage is known to be very heavy shall be preservative-treated conforming to the AWWPA Use Category noted above for the appropriate exposure.

C. Fire-Retardant-Treated (FRT) Lumber:

- 1. All lumber specified in the drawings as FRT must be preservative-treated using water-borne preservatives in accordance with AWWPA U1 (Commodity Specifications A or F). Specific AWWPA Use Categories by application are specified below:
 - a. FRT lumber located at the interior of the building and shielded from the weather shall be treated conforming to AWWPA Use Category: UCFA.
 - b. FRT lumber located at the exterior of a building and exposed to the weather shall be treated conforming to AWWPA Use Category: UCFB.

D. Grades:

- 1. All lumber shall be Spruce Pine Fir No. 2 or better unless noted otherwise on the drawings.
- 2. All pressure preservative treated (PT) and fire-retardant-treated (FRT) lumber shall be unincised Southern Pine No. 2 or better unless noted otherwise on the drawings.

E. Grade Marks:

- 1. Lumber and plywood grade marks shall not be exposed in exposed-to-view lumber.

2. Each piece of lumber used for structural framing shall be graded and stamped with the grading and trade mark of the specified lumber grading organization, except that a certificate of grade from such a grading organization may be accepted in lieu of grade and trademarks when approved by the Architect.
3. All preservative-treated lumber must bear an end tag demonstrating conformance to the specified AWPA standards.

2.02 PLYWOOD

- A. Plywood shall be manufactured in accordance with American Plywood Association standards with each sheet grade marked.
- B. All plywood shall have a minimum of 5 ply.
- C. All plywood sheathing exposed to view shall be touch sanded and shall have a C-plugged face or better.
- D. Floor plywood shall be C-D Structural I with exterior glue and shall be 3/4-inch thick and have a Panel Identification Index of 48/24.
- E. Plywood on walls shall be C-D Structural I with exterior glue and shall be 1/2-inch thick.
- F. Roof plywood shall be CD-X Structural I and shall be 3/4-inch thick and have a Panel Identification Index of 48/24.

2.03 CONNECTING HARDWARE

- A. Use hot dip galvanized hardware where exposed to the exterior.
- B. Nails:
 1. All nails shall be standard steel common wire nails with a full head meeting FS FF-N-101.
 2. Nails for exterior work shall be galvanized.
- C. Staples and Non Standard Nails:
 1. Nails that do not conform to the above requirements or staples will be allowed on a case-by-case basis and shall have an ICC report.
 2. The use of powder driven fasteners shall be discontinued if inspection discloses over or under driving.
- D. Screws and Bolts:
 1. Machine Bolts, anchor bolts, and nuts shall be as per ASTM A307, Grade A.
 2. Lag Bolts shall be FS FF-B-561.
- E. Joist Hangers and Framing Connectors shall be as manufactured by Simpson Strong-Tie Co., Inc. Nails to be used with joist hangers and framing connectors shall be largest size recommended by the manufacturer. Use maximum number of nails provided for.
- F. Washers shall be square plate or malleable iron washers.
- G. Powder Driven Fasteners: Each use and fastener type subject to prior approval of Architect.
- H. Expansion Anchors: Kwik-Bolt III as manufactured by Hilti Inc.

2.04 WOOD PRESERVATIVE

- A. Preservative Treatment shall conform to AWPA U1 and AWPA T1, and the specified use categories, using waterborne preservatives.
- B. Chromated Copper Arsenate (CCA) shall not be used as a preservative.

2.05 PRESERVATIVE TREATMENT FIELD TOUCH-UP PRESERVATIVE

- A. Use a preservative compatible with the original preservative, and appropriate for the Use Category, in accordance with AWPA M4.

2.06 HARDWARE USED OUTBOARD OF WATERPROOFING BARRIER AND/OR IN CONTACT WITH PRESERVATIVE-TREATED LUMBER

- A. All hardware and steel connectors used outboard of the waterproofing barrier and/or in contact with preservative-treated lumber shall be hot-dip galvanized, or otherwise noted by the manufacturer as approved for exterior use and for contact with contact with all lumber preservatives, except as follows:
- B. Type 316 stainless steel shall be used for hangers and hardware within 5 miles of the coast.
- C. Care shall be taken not to mix galvanized steel with stainless steel in exterior connections.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
 - 2. Verify that rough carpentry may be performed in strict accordance with the original design an all pertinent codes and regulations.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Architect.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 WORKMANSHIP

- A. All rough carpentry shall produce joints true, tight, and well nailed with all members assembled in accordance with the Drawings and with all pertinent codes and regulations.
- B. Selection of Lumber Pieces:
 - 1. Carefully select all members; select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing or making proper connections.
 - 2. Cut out and discard all defects which will render a piece unable to serve its intended function; lumber may be rejected by the Architect, whether or not it has been installed,

for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

- C. Do not shim sills, joists, short studs, trimmers, headers, lintels, or other framing components.

3.03 TREATED LUMBER

- A. Use treated lumber that is appropriate for the Use Category, as specified in Part 2.
- B. Use appropriate hardware for the preservatives and exposure, as specified in Part 2.
- C. Field-cut ends, notches, and drilled holes of preservative-treated wood shall be treated in the field with compatible preservatives in accordance with AWPA M4.

3.04 GENERAL FRAMING

A. General:

1. In addition to all framing operations normal to the fabrication and erection indicated on the Drawings, install all backing, blocking, nailers, grounds and other similar items required for the work specified in other sections.
2. Set all horizontal or sloped members with crown up.
3. Do not notch, bore, or cut members for pipes, ducts, conduits, or other reasons except as shown on the Drawings or as specifically approved in advance by the Architect.
4. For all framing members to receive a finished wall or ceiling, align the finish subsurface to vary not more than 1/8-inch from the plane of surfaces of adjacent framing and furring members.
5. Apply preservatives to all timbers (existing and new) as noted on the contract documents or where exposure to long term moisture is anticipated (e.g. where joists are supported by perimeter walls, bathroom framing, kitchen framing (framing to mean floor ceiling and/or partition supports)).

B. Bearings:

1. Make all bearing full unless otherwise indicated on the Drawings.
2. Finish all bearing surfaces on which structural members are to rest so as to give sure and even support; where framing members slope, cut or notch the ends as required to give a uniform bearing surface.

- C. Temporary Shoring: Provide all temporary works, shoring and bracing necessary to construct the structure.

3.05 BLOCKING AND BRIDGING

A. Blocking:

1. Install all blocking required to support all items of finish and to cut off all concealed draft opening, both vertical and horizontal, between ceiling and floor areas.
2. Install all fire-blocks as required by code.

B. Bridging:

1. Install solid blocking between joists as noted on plan.
2. Install solid blocking between joists wherever floor plywood is continuous and the plywood is to be blocked.
3. Where existing bridging must be removed, install new bridging.

3.06 STUD WALLS AND PARTITIONS

- A. Make all studs single length, unspliced, and platform framed.
- B. Unless otherwise indicated on the Drawings, frame all corners and intersections with three or more studs and all required bearing for wall finish.
- C. In bearing walls install a stud below each joint or rafter that is not supported directly by a beam.
- D. As a minimum install a 4x or 2-2x's under the end of each 4x or glue laminated beam shown on the Structural drawings.
- E. All top plates shall be lapped a minimum of 8 feet, 0 inches with a minimum of 16d Nails at 6 inches o.c.

3.07 INSTALLATION OF PLYWOOD SHEATHING

- A. Placement:
 - 1. Place all plywood with face grain perpendicular to supports and continuously over at least two supports, except where otherwise specifically shown on the Drawings.
 - 2. Center joints accurately over supports; unless otherwise specifically shown on the Drawings, stagger the end joints of plywood panels to achieve a minimum of continuity of joints. In addition, where support spacing is 24 inches or less plywood shall, as a minimum, be continuous over two spans.
 - 3. Place all roof plywood with best face down.
 - 4. All floor plywood shall be glued to the floor framing in addition to the specified nailing.
 - 5. Place solid blocking under all plywood edges. Blocking shall be same thickness as required studs or joists.
 - 6. When indicated plywood nail spacing is less than 3 inches place nails in two or more rows spaced 1/2-inch apart with the nail spacing in each row not less than 6 inches o.c.
- B. Protect all plywood from moisture by use of waterproof coverings until the plywood has in turn been covered with the next succeeding component or finish.

3.08 FASTENERS

- A. Nails and Staples:
 - 1. Use only common wire nails or spikes of the sizes and quantities as indicated on the Drawings.
 - 2. Do all nailing without splitting wood, preboring as required to a diameter smaller than that of the nails. Replace all split members.
 - 3. Nailing guns:
 - a. When nailing plywood with a nailing gun the nail head shall not crush the plywood, nor shall the nail be under driven.
 - b. Any fastener overdrive shall be considered of no value and shall be replaced with an additional fastener. If the additional nails result in a spacing closer than 1-1/2 inches, if more than 6 fasteners in a row are overdriven, or more than 12 fasteners per piece of plywood are overdriven, the entire piece of plywood shall be removed and replaced.

- c. If plywood is on both sides of wall only the first side may be nailed with a nailing gun.
 - d. Reference to nails shall also infer staples if used.
 - 4. For wood-to-wood joints, the spacing center to center of nails shall be not less than the required penetration. Edge or end distances shall be not less than one half of the required penetration. All spacing and edge and end distances shall be such as to avoid splitting of the wood.
- B. Bolts:
 - 1. Drill holes 1/16-inch larger in diameter than the bolts.
- C. Screws:
 - 1. For lag-screws and wood-screws, prebore holes same diameter as root of thread; enlarge holes to shank diameter for length of shank.
 - 2. Screw, do not drive, any lag and wood screws.
 - 3. Use washers under head of lag-screws where they bear on wood.
- 3.09 JOIST HANGERS
 - A. Joist hangers and framing connectors shall be installed in accordance with the manufacturer's recommendations.
- 3.10 CLEAN UP
 - A. Remove all wood, including form lumber, scrap lumber, shavings and sawdust, in contact with the ground. Leave no wood buried in any fill or backfill.
- 3.11 FIELD QUALITY CONTROL
 - A. General:
 - 1. Notify Architect and Testing Laboratory at least 48 hours prior to start of Work requiring inspection.
 - 2. As a minimum, all testing and inspection shall be per this specification and the International Building Code, latest edition.
 - B. The following are subject to special inspection:
 - 1. Anchor bolts, prior to concreting.
 - 2. Tie-downs.
 - 3. Plywood nailing, when part of diaphragm or shear walls, which will include nail size, spacing, and whether fasteners are flush with sheathing.
 - 4. Expansion anchors.

END OF SECTION

SECTION 06 19 20

PREFABRICATED METAL PLATE CONNECTED WOOD TRUSSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. Furnish all labor, material, equipment and incidentals required and design, fabricate and install prefabricated metal-plate connected wood trusses as shown and as specified herein.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Wood framing except for prefabricated wood trusses.
 - 2. Section 07 31 20, ASPHALT SHINGLE ROOFING.
 - 3. Section 07 46 00, EXTERIOR SIDING AND TRIM.

1.04 REFERENCE STANDARDS

- A. National Forest Products Association (NFPA):
 - 1. National Design Specification for Wood Construction
 - 2. Design Values for Wood Construction
- B. Truss Plate Institute (TPI):
 - 1. BWT-76-Commentary and Recommendations for Bracing Wood Trusses
 - 2. HET-80-Commentary and Recommendations for Handling and Erecting Wood Trusses
 - 3. QSP-88-Quality Standard for Metal Plate Connector Plate Manufacture
 - 4. TPI-85-Design Specification for Metal Plate Connected Wood Trusses
- C. United States Department of Commerce, National Institute of Standards and Technology:
 - 1. PS 20-70-American Softwood Lumber Standard
- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 SUBMITTALS

- A. In addition to product data for truss components submit the following:
 - 1. Shop drawings showing sizes, design values, materials and dimensional relationships of components as well as bearing and anchorage details.

2. Provide shop drawings that have been signed and stamped by professional engineer legally authorized to practice in jurisdiction where Project is located.
3. Design calculations for truss from metal plate connector manufacturer.
4. Product certificate, signed by officer of fabricating firm, certifying that metal-plate-connected wood trusses supplied for Project comply with specified requirements.

1.06 SINGLE-SOURCE ENGINEERING RESPONSIBILITY

- A. Provide trusses engineered by the metal plate connector manufacturer to support superimposed loads indicated, with design approved and certified by a Professional Engineer legally authorized to practice in jurisdiction where Project is located.

1.07 FABRICATOR'S QUALIFICATIONS

- A. A firm that participates in a recognized quality assurance program that involves inspection by SPIB; American Institute of Timber Construction; Timber Products Inspection, Inc.; Truss Plate Institute; or other independent inspection and testing agency acceptable to Engineer.
- B. Handle and store trusses with care and comply with TPI recommendations to avoid damage from bending, overturning or other cause.

1.08 DESIGN CRITERIA

- A. The minimum design loads shall be in accordance with the Commonwealth of Massachusetts State Building Code, and the following:
 1. Dead Load - self weight plus contributing loads from the roof system, ceiling, ductwork etc., as shown on the Drawings.
 2. Live Load - On bottom chord of trusses - 20 PSF.
 3. Snow Load - 35 PSF plus applicable drifting and snow loads.
 4. Wind Load - 12 PSF.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber: Provide dressed lumbar S45, grade marked, complying with PS 20-70, of species and grade included in the NFPA Specification.
- B. Metal Connector Plates: Metals and thickness not less than thickness indicated below:
 1. Hot-Dip Galvanized Sheet Steel: ASTM A446, Grade A, G60, minimum thickness of 0.036-in.
 2. Electrolytic Zinc-Coated Steel Sheet: ASTM A591, Coating Class C, with minimum structural quality equivalent to ASTM A446, Grade A, minimum thickness of 0.047-in.
 3. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Coating Designation AS 50, with structural quality equivalent to ASTM A446, Grade A; minimum coated metal thickness of 0.036-in.
- C. Fasteners: Of size and type required that meet Part 1.07 DESIGN CRITERIA, and comply with the following requirements. Provide hot-dip zinc-coated fasteners per ASTM A153 or AISI Type 304 stainless steel fasteners.
 1. Nails, Wire, Brads and Staples: FS FF-N-105.
 2. Power Driven Fasteners: National Evaluation Report NER-272.
 3. Wood Screws: ANSI B18.6.1

4. Lag bolts: ANSI B18.2.1.
 5. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and where indicated, flat washers.
- D. Metal Framing Anchors: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
- E. Current Evaluation/Research Reports: Provide products for which model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this Project.
- F. Allowable Design Loads: As published by manufacturer and determined from empirical data or by rational engineering analysis and verified through comprehensive testing by a qualified independent testing laboratory.
- G. Galvanized Steel Sheet: Zinc-coated by hot-dip process to comply with ASTM A525, Coating Designation G60, and complying with ASTM A446, Grade A; ASTM A526; or ASTM A527.
- 2.2 FABRICATION
- A. Fabricate and assemble trusses to provide units of configuration indicated, with closely fitted joints and connector plates securely fastened to wood members.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install and brace trusses to comply with TPI referenced standards and other indicated requirements.
- B. Install permanent bracing and related components to enable trusses to maintain design spacing, withstand all loads, and comply with indicated requirements.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. Provide all finish carpentry and millwork as indicated on the Drawings and as specified herein. Include, but do not limit to:
 - 1. Interior standing and running trim, including miscellaneous partition caps, moldings, trim, wall base, and sills. Trim shall include window and door trim and casing, handrail/chair-rail moldings, and all other interior trim.
 - 2. Shelving and hardware including closet shelving, rods, and hardware.
 - 3. Plastic laminate work for countertops.
 - 4. Plastic laminate faced casework and drawers.
 - 5. All other finish carpentry work indicated.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Wood framing, sheathing, blocking, and nailers.
 - 2. Section 08 124 00, WOOD DOORS.
 - 3. Section 08 71 00, DOOR HARDWARE.
 - 4. Section 09 91 00, PAINTING; Field finishing of work of this Section.
 - 5. Division 22 - PLUMBING.
 - 6. Division 26 - ELECTRICAL.

1.04 SUBMITTALS

- A. Certifications: Provide certifications stating that materials and fabrication complies with specification requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide large scale detailed plans, elevations, and details of anchorages, connections and accessory items.
- C. Field Measurements: Take accurate field measurements before preparation of shop drawings and fabrication. Do not delay job progress; allow for field cutting and fitting where taking field measurements before fabrication is not possible.
- D. Verification Samples: Submit at least two fully finished representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches.

1.05 QUALITY STANDARDS

- A. Source: For each material type required for work of this Section, provide primary materials which are product of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.
- B. Installer: A firm with a minimum of three years' experience in type of work required by this Section and which is acceptable to manufacturers of primary materials.
- C. Quality Standard: Provide work complying with applicable requirements of AWI Quality Standards. Where not otherwise indicated, fabricator may choose among options permitted by AWI for grade of work specified.
 - 1. Panel Products: Provide minimum 45 lb. per cubic foot medium density particleboard conforming to ANSI A208.1 or medium density fiberboard (MDF) conforming to ANSI A208.2, as specified herein made with exterior glue complying with specified VOC requirements. Particleboard or fiberboard shall not contain any urea formaldehyde. Do not use hardboard.
 - 2. Fire Performance for Woodwork: Concealed woodwork in this Section shall be UL labeled fire-retardant treated. Exposed woodwork shall have a flame spread of less than 200 when tested in compliance with ASTM E 84.
- D. Catalog Standards: Manufacturer's catalog numbers may be shown on drawings for convenience in identifying certain casework hardware and accessories. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such hardware and/or accessory item
 - 1. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of any other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction, and workmanship.
- E. Mock-ups: Before beginning primary work of this Section, provide mock-ups of the following items of work at locations acceptable to Architect and obtain Architect's acceptance of visual qualities. Protect and maintain acceptable mock-ups throughout the work of this section to serve as criteria for acceptance of this work.
 - 1. Typical interior standing and running trim, including miscellaneous moldings, trim and sills.
 - 2. Typical closet shelving and rods and hardware.
 - 3. Typical plastic laminate countertop including edge and backsplash.
- F. Adhesives, adhesive bonding primers, or adhesive primers used on this Project shall meet or exceed the VOC content limits of the State of California South Coast Air Quality Management District (SCAQMD) Rule #1168 – Adhesive and Sealant Applications'.
- G. Finish carpentry work shall not use composite wood and agrifiber products that contain urea-formaldehyde resin.

- H. Matching of Wood Veneers and Solids: The intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible. Finishes shall match as closely as possible. These requirement shall apply to all wood with transparent finish specified in Section 06 20 00, FINISH CARPENTRY and Section 08 21 10, WOOD DOORS.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products only after wet work has been completed and environmental conditions similar to those of the finished work are established and maintained. Store and handle work to prevent deterioration and damage. Comply with AWI Quality Standards and recommendations. Sequence deliveries to avoid delays, but minimize on-site storage.

1.07 PROJECT CONDITIONS

- A. Substrates: Proceed with work only when substrate construction and penetration work is complete.
- B. Wet Work: Proceed with work of this Section after wet work has been complete and fully dry or cured. Wet work is defined as plaster, gypsum drywall, paint, concrete, etc.
- C. Conditioning: Advise Contractor of temperature and humidity requirements for woodwork installation. Do not install work of this Section until required temperature and relative humidity in areas of installation has been stabilized and will be maintained.
- D. Environmental Limitations: Do not deliver or install millwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- E. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
 - 2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating millwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.08 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that finish carpentry items can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 FINISH CARPENTRY, GENERAL

- A. Do not deliver materials to site until building has been closed in, wet work is completed and sufficiently dry and building is continuously maintained at a temperature above 65°F. Obtain Architect's approval before delivering materials or fabricated items. Store materials off the floor, fully protected from damage.
- B. Provide fasteners and hardware required to complete the work. Use concealed fastenings wherever possible. Provide cadmium plated or zinc chromate plated fasteners at concealed locations; stainless steel or chrome plated at exposed interior locations.
- C. Provide materials and products which meet or exceed the requirements of the indicated AWI Quality Standards specified for each type of work.
 - 1. Transparent Finish: AWI Quality Standards, Premium Grade.
 - 2. Painted Finish: AWI Quality Standards, Custom Grade.
- D. Provide solid lumber, kiln-dried to moisture content of 5% to 10% by weight, with average not to exceed 8%.
- E. Furnish lumber in longest practical lengths. Use single-length pieces wherever possible.
- F. Take necessary field measurements before starting fabrication of built-in work.
- G. Adhesives, adhesive bonding primers, or adhesive primers used on this Project shall meet or exceed the VOC content limits of the State of California South Coast Air Quality Management District (SCAQMD) Rule #1168 – Adhesive and Sealant Applications'.
- H. Finish carpentry work shall not use composite wood and agrifiber products that contain urea-formaldehyde resin.

2.02 FINISH CARPENTRY, MATERIALS - GENERAL

- A. Materials:
 - 1. Plywood for mounting panels at telephone, electrical, and mechanical rooms shall be A-C veneer plywood (A veneer exposed), APA Interior Grade. Where required, provide fire retardant treated panels.
 - 2. Plywood for exposed paint finish shall be paint grade, MDO plywood, veneer core, conforming to AWI Quality Standards for Custom Grade.
 - 3. Fiberboard panel product for exposed painted finish shall be minimum 45 lb. per cubic foot medium density particleboard conforming to ANSI A208.1 or medium density fiberboard (MDF) conforming to ANSI A208.2, as specified herein made with exterior glue complying with specified VOC requirements. Particleboard or fiberboard shall not contain any urea formaldehyde. Do not use hardboard.
 - 4. Solid stock hardwood for exposed painted finish shall be plain sawn/sliced natural birch or white poplar, conforming to AWI Quality Standards for Custom Grade.
- B. Standing and Running Trim: Standing and running trim work includes, but is not limited to, the following:
 - 1. Interior base and trim, and chair rails.
 - 2. Window stools, sills, and aprons.
 - 3. Handrail and chair-rail trim and accessories.

4. Miscellaneous molding and trim.
- C. Quality Standard: Provide AWI Premium Grade materials and workmanship, unless noted otherwise.
1. Finger jointed material will not be permitted.
- D. Wood Species and Cuts: Provide as follows:
1. Painted Work: Poplar or Birch complying with AWI Quality Standards.
 2. Transparent Finished Work: Plain Sliced hardwood matching Architect's sample.
- E. Shop Assembly: Shop assemble casings and frames with accurately mitered joints, pressure glued with lemon shaped splines.
- 2.03 PLASTIC LAMINATE PRODUCTS
- A. Plastic Laminate Manufacturers: Provide plastic laminate materials that meet or exceed specified requirements from one of the following manufacturers, or Architect approved equal:
1. Laminart Decorative Laminates (Lamin-Art)
 2. Lab Designs Laminates (Lab Designs).
 3. Abet-Laminati.
- B. Provide laminate complying with NEMA LD 3, and the following:
1. Horizontal and Vertical Surfaces (except post-formed surfaces): General Purpose Standard Grade, GP-50 (0.050 in. nominal thickness).
 2. Balance Sheet: Backer Type, BK-20 (0.020 in. nominal thickness).
- C. Plastic Laminate Types (PL_): Provide colors and patterns as selected by the Architect and as follows:
1. Plastic Laminate Type 1 (PL-1):
 - a. Lamin-Art; refer to Drawings for pattern, color, and finish.
 2. Plastic Laminate Type 2 (PL-2):
 - a. Lab Designs; refer to Drawings for pattern, color, and finish.
 3. Plastic Laminate Type 3 (PL-3):
 - a. Lab Designs; refer to Drawings for pattern, color, and finish.
- D. Scope: Plastic laminate work includes, but is not limited to:
1. Plastic laminated shelving.
 2. Plastic laminate counters, facing, and related work.
 3. Casework (cabinets).
 4. All other plastic laminate work indicated.

- E. Core:
 - 1. For all plastic laminate counter work where sinks are installed, provide APA B-B Marine Grade plywood.
 - 2. For all other plastic laminate work, provide APA B-B Exterior Grade plywood.
- F. Construction: Provide balancing sheets for all work. Exposed surfaces of core shall be covered with laminate. Exposed-to-view surfaces shall be covered with "face" laminate.
 - 1. Splashes: Provide loose splashes with all six sides covered with laminate.
 - 2. Preparation for Related Work: Prepare countertops for all related appliances and plumbing work. Cut holes to fit templates of appliances and fixtures. Trim openings so that all core materials are covered with laminate.
 - 3. Fabricate countertops with fewest possible seams. Conceal fasteners.
- G. Grommets:
 - 1. Round Grommets: Doug Mockett & Co., No. BG Series, 2-1/2 in. diameter, with covers, clear anodized aluminum finish.

2.04 PLASTIC LAMINATE CASEWORK

- A. Scope: Plastic laminate casework includes, but is not limited to, the following:
 - 1. Wall and base cabinets.
 - 2. Miscellaneous plastic laminate casework items.
- B. Quality Standard: Provide Laminate clad cabinets and drawers conforming to AWI Quality Standards Section 400, meeting the requirements for AWI Premium Grade materials and workmanship.
 - 1. Provide vertical grade high pressure plastic laminate for both sides of swing doors, drawer fronts, and all exposed cabinet ends.
- C. Plastic Laminate Colors, Textures, and Patterns: Refer to Drawings for Laminate Colors and Finishes.
- D. Preparation for Related Work: Prepare casework for all related electrical, telephone, mechanical, and plumbing work.
- E. Cabinets and Casework: Provide casework matching elevations and details indicated. Provide cabinets having the following features and characteristics:
 - 1. Construction/Style: Provide overlay construction with flush doors and drawer fronts, unless otherwise detailed. Provide cabinets with fully finished exposed interior and exterior surfaces. Provide 4 mil vinyl laminated interiors for cabinets, shelves, and drawers.
 - 2. Frames: Provide minimum 3/4 in. thick finger-jointed birch. Provide a minimum 1-1/2 in. and 2 in. rails with 1-1/4 in. stiles. Provide torque screw and glued joint construction. Provide 4 mil vinyl laminate on exposed surfaces, except for faces which shall match door faces.
 - 3. Doors: Provide minimum 3/4 in. high density pine particleboard with both faces laminated to core with p.v.a. adhesives. Provide laminate self-edge on all four edges.
 - 4. Drawers: Provide drawers with all four corners dovetailed and glued construction. Edges shall be radiused. Drawer fronts shall be applied to drawer boxes with drawer front adjusters (Blum Model No. 295.1000).

5. Cabinet Backs: Provide 1/2 in. thick hardboard with 4 mil vinyl laminate on exposed interior surfaces grooved into ends and locked into place with minimum 1/2 in. x 3-1/2 in. stretcher rails on wall cabinets and minimum 1/2 in. x 6-1/2 in. stretcher rails on base cabinets.
 6. Cabinet Tops and Bottoms: Provide minimum 3/4 in. high density particleboard or plywood.
 7. Cabinet Ends: Provide minimum 3/4 in. high density particleboard with 4 mil vinyl laminate on exposed interior surfaces, and with exposed exterior surfaces laminated to core with p.v.a. adhesives. Groove ends to receive front frame, top, bottom and back.
 8. Shelves: Provide minimum 3/4 in. high density particleboard with 4 mil vinyl laminate, unless otherwise noted, on all exposed interior surfaces, top, bottom and edges. All shelves shall be adjustable on concealed standards and shall meet AWI Standards for deflection.
 9. Dust Panels: Provide plywood dust panels in all work.
 10. Casework Joinery: Do not use any exposed fasteners, including finish nails or staples.
- F. Plastic Laminate Casework Hardware: Provide the following or Architect approved equal:
1. Hinges: Provide at least two hinges per door leaf. Install in accordance with manufacturer's recommendations.
 2. Drawer and Door Pulls: 4 in. stainless steel wire pulls by Stanley, Hafele, or approved equal.
 3. Drawer Slides:
 - a. 200 lb. Slides: Full extension, zinc finished, cold-rolled steel, side mounted, with 200 lb. capacity, equal to Accuride Model No. 3640 or equal manufactured by Blum or Hafele.
 - b. All Other Slides: Full extension, zinc finished, cold-rolled steel, side mounted, with 100 lb. capacity, equal to Accuride Model No. 7432 or equal manufactured by Blum or Hafele.
 - c. Slides shall be equipped with carburized steel ball bearings for smooth effortless operation.
 - d. Slide features: positive stop, unhandled, holes located in 32 mm increments, hold-in detent, silenced in both open and closed positions.
 4. Cabinet Locks: Locks located in the same room shall be keyed alike, master keyed, and furnished with two keys per room. Alpha-numerically code locks and corresponding keys. Furnish locks complete, including cylinder rosettes. Provide locks as indicated on Drawings and as follows:
 - a. Cabinet Locks at Single Doors: Timberline Model No. CB-291 with No. SP-185 strike plate. Furnish No. LP-100 lock plugs.
 - b. Cabinet Locks at Pair Doors: Timberline Model No. CB-250 with No. SP-100 and SP-257 strike plates. Furnish No. LP-100 lock plugs.
 - c. Cabinet Locks at Drawers: Timberline Model No. CB-281 with No. SP-185 strike plate. Furnish No. LP-100 lock plugs.
 5. Grommets: Hafele Model No. 429.94. Architect to select diameter and finish from manufacturer's full range.
 6. Drawer Front Adjusters: Blum Model No. 295.1000.
 7. Door Silencers: Glynn Johnson GJ-6, or equal manufactured by Blum or Hafele. Provide resilient pads to silence door and drawer closing.
 8. Adjustable Cabinet Shelving Standards and Supports: Recessed Knappe and Vogt 255 WH standards with 256 WH supports.

9. Wall Shelving Standards and Brackets: Knappe and Vogt No. 85 ANO extra-heavy duty. Shelf bracket shall be No. 185 ANO. Brackets shall be furnished and installed with shelf rests, Knappe & Vogt Model No. 106 ANO. Provide matching K&V top caps for standards.
10. Coat Hooks: Ives #571 or approved equal. Finish shall match finish of door hardware.

2.05 SHELVING AND HARDWARE

- A. Scope: Shelving work includes, but is not limited to, the following:
 1. Paint grade Birch veneer plywood with solid wood nosing.
 2. Plastic laminate shelving.
- B. Quality Standards: Provide AWI Premium Grade materials and workmanship.
- C. Translucent Acrylic Shelving: Provide 1/2 in. thick translucent acrylic material fabricated for shelves as indicated.
- D. Shelf Deflection: Design and brace shelves to limit deflection to 1/4 in. maximum when loaded to 50 lb. per square foot. Space braces not more than 4 ft. on center.
- E. Rods: White metal rods, minimum 1-1/4 inch diameter.
- F. Brackets: Equal to John Sterling RP-0052-WT, or approved equal.
- G. Joinery: Do not use any exposed fasteners, including finish nails or staples.

2.06 FINISHING

- A. Scope: Shop finishing work includes, but is not limited to, the following:
- B. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:
 1. Grade: Premium.
 2. AWI Finish System: TR-4, conversion varnish.
 3. Staining: Match sample.
 4. Wash Coat for Stained Finish: Apply a vinyl wash coat to woodwork made from closed-grain wood before staining and finishing.
 5. Sheen: Satin, 30-50 gloss units.
 6. Finish system shall comply with specified VOC limits.
- C. Painted Finish: Provide prime coat complying with Section 09 91 00, PAINTING.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION REQUIREMENTS

- A. Dressed and sand finish carpentry work free from machine and tool marks, abrasions, raised grain, or other defects on surfaces exposed to view.
- B. Provide tight joints formed to conceal shrinkage. Fit butt joints with concealed spline. Glue and dowel shop miters which are four inches or greater. Glue and spline miters less than 4 in., with spline concealed.

- C. Blind nail finish work to the greatest extent possible. Where surface nailing is used, set and fill nails to match adjacent wood.
- D. Wherever nailing into concrete is done, care shall be taken to protect pipes or conduits embedded in the slab. No puncturing of pipes or conduits will be allowed. Damage to embedded work shall be corrected without further cost to Owner. Inserts and anchor bolts shall be placed before the pouring of concrete.
- E. Secure work to prevent checks or warps. Finish carpentry work shall be properly framed, closely fitted, and accurately set to the required lines and levels and shall be rigidly secured in place.

3.02 PAINTING AND FINISHING

- A. Field painting and finishing is specified under Section 09 91 00, PAINTING. All finish carpentry items shall be primed or sealed, as work of this section, before installation. Paint or seal coats must be dry before items are installed.
- B. Sand all finish work at field joints and where required by installation.

3.03 SPECIFIC INSTRUCTIONS

- A. Important Note: No attempt is made in the following specific instructions to list all elements of finish carpentry required on this project. It is the responsibility of the Contractor to determine for himself from the Drawings the scope and nature of the work required. These specific instructions are intended only to provide additional instructions regarding those portions of the finished carpentry for which information beyond that given on the Drawings or covered in the AWI Quality Standards seems needed to properly describe the work. Where the scope of a category is listed it is done in a general manner to assist the Contractor in determining the general nature of work he shall look for as being required in said category, and not to limit the work.

3.04 FINISH CARPENTRY WORK

- A. Fabricate and install finish carpentry work in accordance with the Drawings, the specifications, and AWI Quality Standards applicable or referenced to this work.
- B. Closet Rods and Shelving: Install per Drawings.
- C. Miscellaneous Items: Install all required standing and running trim and other miscellaneous items throughout, as indicated on the Drawings and as required to satisfactorily complete the entire work, whether or not each and every required piece is specifically indicated on the Drawings. Trim shall be of same material and finish as the larger member to which applied.
- D. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of installation work means Installer's acceptance of substrates and conditions.

3.05 COMPLETION

- A. Just prior to completion of work of this Section, inspect work in the company of Architect and make adjustments and corrections to work leaving operating parts in perfect operating condition, all jointing to adjacent material tight, all surfaces without blemishes or stains, all work properly executed and complete, and all defects and damaged work replaced or corrected.

END OF SECTION

SECTION 06 40 00

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. Provide architectural woodwork as shown on Drawings and specified herein. Work shall include, but not be limited to:
 - 1. Custom cabinetry and casework.
 - 2. Solid surfacing (quartz surfacing) for counters and related areas.
 - 3. Custom cubbies and related items.
 - 4. Wood trim, wood wall cladding, wood panels, and related millwork and finishes as indicated.
 - 5. All other architectural woodwork indicated.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 05 50 00, METAL FABRICATIONS; Miscellaneous metal angle supports and brackets.
 - 2. Section 06 10 00, ROUGH CARPENTRY; Wood blocking and nailers.
 - 3. Section 06 20 00, FINISH CARPENTRY; Plastic laminate counters and plastic laminate faced casework, plastic laminate types.
 - 4. Section 08 124 00, WOOD DOORS.
 - 5. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.
 - 6. Section 09 91 00, PAINTING; Back priming and finishing of millwork.
 - 7. Division 22 - PLUMBING; Sinks and fittings.
 - 8. Division 26 - ELECTRICAL; Electrical work including light fixtures, and equipment wiring.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Shop Drawings: Provide large scale shop Drawings for fabrication, installation and erection of parts of work. Provide plans, elevations, and details of anchorage, connections and accessory items. Provide installation templates for work installed by others. Show interfaces and relationships to work of other trades.
 - 1. Include details and location of anchorage and fitting to floors, walls, and base, including required blocking or back-blocking.

2. Include layout of casework and millwork with relation to surrounding walls, doors, windows, and other building components.
 3. Coordinate shop drawings with other work involved.
 4. Include manufacturer's recommendations for blocking and securing of casework units and fittings and all other woodwork and millwork.
- C. Field Measurements: Take necessary field measurements before preparation of shop Drawings and fabrication. Do not delay progress of job. If field measurements are not possible prior to fabrication, allow for field cutting and fitting.
- D. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- E. Verification Samples: Submit representative samples of each material that is to be exposed in completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.
1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
 2. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.
 3. Specialty metal items.
- F. Verification Samples – Casework Fabrication: Submit the following:
1. One full-size sample of finished base cabinet unit complete with hardware, doors, and drawers, but exclusive of countertop.
 2. One minimum 6-inch by 6-inch sample of each type of solid surfacing specified.
 3. One full-size sample of finished wall-mounted cabinet unit complete with hardware, doors, and adjustable shelves.
 4. One sample each of each door type.
 5. Acceptable sample units will be used for comparison inspections at Project. Unless otherwise directed, acceptable sample units may be incorporated in work. Notify Architect of their exact locations. If not incorporated in work, retain acceptable sample units in building until completion of work and remove sample units from premises when directed by Architect.
 6. Specialty metal items.
- G. Veneer Flitch Samples: Submit samples of veneer flitches to be used for Architect's approval. Do not begin any fabrication of work of this Section until veneer flitches have been approved.
- H. Test Reports: Product test reports from and based on tests performed by a qualified independent testing laboratory evidencing compliance of casework finishes with requirements specified for chemical and physical resistance.
- I. Certificate of Architectural Woodwork Compliance: Fabricator's certificate evidencing compliance of architectural woodwork as fabricated with requirements of this Section. Include the following:
1. Certificate for fire resistance classification for all interior woodwork.

1.05 QUALITY ASSURANCE

- A. Source: For each material type required for work of this Section, provide primary materials which are product of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.
 - B. Installer: A firm with a minimum of three years' experience in type of work required by this Section and which is acceptable to manufacturers of primary materials.
 - C. Quality Standard: Provide work complying with applicable requirements of AWI Quality Standards. Where not otherwise indicated, fabricator may choose among options permitted by AWI for grade of work specified.
 - 1. Panel Products: Provide minimum 45 pounds per cubic foot medium density particleboard. Do not use hardboard.
 - 2. Fire Performance: All concealed work in this Section shall be UL labeled fire-retardant treated. Exposed woodwork shall have a flame spread of less than 200 when tested in compliance with ASTM E 84.
 - D. Catalog Standards: Manufacturer's catalog numbers may be shown on drawings for convenience in identifying certain casework hardware and accessories. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such hardware and/or accessory item
 - 1. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of any other acceptable manufacturer's product or procedures which may be equivalent but are given for purpose of establishing standard of design and quality for materials, construction, and workmanship.
 - E. Veneers and Lumber: AWI Lumber Grade 1 and AWI Grade AA Veneer, Book-Matched, minimum 6 in. face veneer width. Kiln dry 6 to 8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern. Match sample panels available during the bidding process. Requirement shall apply to all wood with transparent finish specified in Section 06 20 00, FINISH CARPENTRY and Section 06 40 00, ARCHITECTURAL WOODWORK.
 - F. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible.
 - G. Architectural woodwork shall not use composite wood and agrifiber products that contain urea-formaldehyde resin.
 - H. Adhesives, adhesive bonding primers, or adhesive primers used on this Project shall meet or exceed the VOC content limits of the State of California South Coast Air Quality Management District (SCAQMD) Rule #1168 – Adhesive and Sealant Applications'.
 - I. Shop-Applied Paints and Coatings: Provide first quality low VOC products meeting that meet or exceed specified requirements.
- 1.06 PROJECT CONDITIONS
- A. Substrates: Proceed with work only when substrate construction and penetration work is complete.

- B. Wet Work: Proceed with work of this Section after wet work has been complete and fully dry or cured. Wet work is defined as plaster, gypsum drywall, paint, concrete, etc.
- C. Conditioning: Advise Contractor of temperature and humidity requirements for woodwork installation. Do not install work of this Section until required temperature and relative humidity in areas of installation has been stabilized and will be maintained.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue, medium density fiberboard (MDF), 48 lb. per cu. ft. minimum, conforming to ANSI A208.2, equal to Medite II (Formaldehyde Free) Medium Density Fiberboard, manufactured by Medite, Medford, OR 97501, or approved equal.
- B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue. medium density, 48 lb. per cu. ft. minimum, phenolic resin, particleboard (Type 1-M-1) core, or approved equal.
- C. Softwood Plywood: DOC PS 1, Medium Density Overlay.
- D. Hardwood Plywood and Face Veneers: HPVA HP-1.
 - 1. Provide the following veneers as indicated:
 - a. Quarter sawn White Oak, matching Architect's sample.
 - 2. Veneer Matching: Book matched.
 - 3. Profile and Details: as indicated.
 - 4. Trim: Matching solid hardwood (quarter sawn White Oak), as indicated.
 - 5. Refer to Drawings Architectural Drawings for elevations and details.
- E. Hardwood Lumber: AWI Premium Grade, Hardwood matching Architect's sample. Unless otherwise indicated, hardwood for transparent finish shall be quarter sawn white Oak.
- F. Fasteners: Unless otherwise indicated, use concealed fasteners in all work of this Section. Fabricate fasteners from metals that are non-corrosive to sign surface materials and mounting substrates.
- G. Anchors and Inserts: Provide non-ferrous metal or hot-dip galvanized anchors and inserts. Provide toothed steel or lead expansion bolt devices for drilled-in place anchors.
- H. Isolation Material: Bituminous-based paint for material isolation shall be cold applied black asphaltic mastic conforming to SSPC Paint 12, with no asbestos fibers. Other isolation material such as prefabricated isolation tape may be used subject to approval of Architect.

2.02 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Lumber and Plywood: Materials impregnated with fire-retardant chemical formulations to comply with AWPA C20 (lumber) and AWPA C27 (plywood), Exterior Type or Interior Type A. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment.
- B. Fire-Retardant Particleboard: Panels made from softwood particles and fire-retardant

chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

- C. Fire-Retardant Fiberboard: ANSI A208.2 medium-density fiberboard panels made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

2.03 SOLID SURFACING MATERIAL FOR COUNTERTOPS AND OTHER SURFACES

- A. Solid Surfacing Material: Provide quartz surfacing manufactured by the following, or approved equal:
 - 1. Caesarstone Engineered Quartz.
- B. Solid Surfacing Type 1 (SS-1):
 - 1. Manufacturer: Caesarstone
 - 2. Color/Pattern: (TBD).
 - 3. Size: As indicated.
 - 4. Thickness: As indicated.
 - 5. Edge Detail: As indicated.

2.04 HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials for a complete installation of architectural woodwork.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, self-closing by Grass, Blum, or Haeefele.
- D. Wire Pulls: Back mounted, 4 inches (100 mm) long, 5/16 inches (8 mm) in diameter by Doug Mockett, Haeefele, or approved equal.
- E. Catches: Magnetic, BHMA A156.9, B03141.
- F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- G. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, by Accuride, Blum, or approved equal.
 - 1. Box Drawer Slides: 100 lbf (440 N).
- H. Door Locks: BHMA A156.11, E07121, by Best Lock, Corbin, or Yale.
- I. Drawer Locks: BHMA A156.11, E07041 by Best Lock, Corbin, or Yale.
- J. Reglets, Reveals, and Channels:
 - 1. Manufacturer: Fry Reglet, Pittcon, MM Systems, or approved equal.
 - 2. Shapes and Profiles: Refer to Drawings.
 - 3. Materials: Stainless steel or aluminum, as indicated.

- K. Round Grommets: Doug Mockett & Co., Inc., BG Series, with covers, black. Refer to Drawings for sizes.
 - L. Exposed Hardware Finishes: Complying with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
 - 2. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.
 - M. Wood Wall Cladding: Refer to Drawings and Finish Schedule for wall cladding, including source, profile, and finish.
 - N. Accessories including brushed aluminum label plates; plates shall be customizable per direction of Owner.
- 2.05 INSTALLATION MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated.
- 2.06 FABRICATION
- A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 - B. Interior Woodwork Grade: Custom complying with the referenced quality standard.
 - C. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs.
 - D. Seal edges of openings in countertops with a coat of varnish.
 - E. Install glass to comply with applicable requirements in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.
 - F. For trim items wider than available lumber, use veneered construction. Do not glue for width.
 - G. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
 - H. Assemble casings in plant except where limitations of access to place of installation require field assembly.
 - I. Wood Cabinets for Transparent Finish:
 - 1. AWI Type of Cabinet Construction: As indicated.
 - 2. Reveal Dimension: 1/2 inch (13 mm).
 - 3. Grain Matching: Run and match grain vertically for drawer fronts, doors, and fixed panels.
 - 4. Matching of Veneer Leaves: Book match.
 - 5. Veneer Matching within Panel Face: Balance match.
 - 6. Semi-exposed Surfaces Other Than Drawer Bodies: Match species and cut indicated for exposed surfaces.
 - 7. Drawer Sides and Backs: Solid-hardwood lumber, same species indicated for exposed surfaces.
 - 8. Drawer Bottoms: Hardwood plywood, same species indicated for exposed surfaces.
 - 9. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above

compartments and drawers, unless located directly under tops.

J. Wood Cabinets for Opaque Finish:

1. AWI Type of Cabinet Construction: As indicated.
2. Reveal Dimension: 1/2 inch (13 mm).
3. Species for Exposed Lumber Surfaces: Any closed-grain hardwood.
4. Panel Product for Exposed Surfaces: Medium-density fiberboard containing no urea formaldehyde.
5. Semi-exposed Surfaces Other Than Drawer Bodies: Match materials indicated for exposed surfaces.
6. Drawer Sides and Backs: Solid-hardwood lumber.
7. Drawer Bottoms: Hardwood plywood.
8. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.07 SHOP FINISHING

- A. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.
- C. Colors and Surface Textures: For exposed to view material that requires selection of materials with integral or applied colors, surface textures, or other characteristics related to appearance, provide color matches as selected by Architect.
- D. Aluminum, Anodized: Where clear anodized finish is indicated, provide AA-M31C21A31 finish (fine satin mechanical finish, with chemical etch, fine matte finish, 0.4 mil thick minimum anodic coating).
- E. Stainless Steel Finish: Provide stainless steel finishes as indicated on Drawings.
- F. Transparent Finish for Architectural Panels and Trim: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:
1. Grade: Premium.
 2. AWI Finish System: TR-4, conversion varnish.
 3. Staining: Match Architect's sample. Match color and finish of trusses.
 4. Wash Coat for Stained Finish: Apply a vinyl wash coat to woodwork made from closed-grain wood before staining and finishing.
 5. Sheen: Satin, 30-50 gloss units.
 6. Finish system shall comply with specified VOC limits.
- G. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.
1. Grade: Custom.
 2. AWI Finish System: OP-6, catalyzed polyurethane.
 3. Color: Match sample.
 4. Sheen: Satin, 30-50 gloss units.
 5. Finish system shall comply with specified VOC limits.

PART 3 - EXECUTION

3.01 WORKMANSHIP - GENERAL

- A. Work of this Section shall conform to design and detail indicated. Where practicable, work shall be finished and assembled at architectural millwork shop.
- B. Work shall be finished smooth and free from machine or tool marks that will telescope through finish.

3.02 INSTALLATION

- A. Pre-installation Meeting: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and coordinate this work with related and adjacent work. Require architectural woodwork manufacturer, Installer, Contractor, and Architect to attend.
- B. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of installation work means Installer's acceptance of substrates and conditions.
- C. Condition woodwork to average prevailing humidity conditions in installation areas prior to installation.
- D. Proceed with installation only when required ambient conditions have been properly maintained, as determined by all attending pre-installation conference.
 - 1. Provide work to sizes, shapes, and profiles indicated on approved shop drawings.
 - 2. Install work to comply with quality standards and tolerances specified for shop work.
 - 3. Color match wood at joints and seams to minimize expression of joints and seams in transparent finished work.
- E. Install architectural woodwork plumb, level, true and straight. Shim as required using concealed shims. Install work, including tops, to a tolerance of $\pm 1/8$ in. in 8 ft. Install all architectural paneling, wood wall cladding trim, and metal paneling and trim as indicated; all work shall be Architectural Quality conforming to referenced standards and AWI Premium Grade.
- F. Scribe and cut architectural woodwork to fit adjoining work. Refinish cut surfaces.
- G. Anchor casework securely in place.
- H. Solid Surfacing: Install each type and finish per manufacturer's recommendations and as indicated on the Drawings.

3.03 REPAIRING AND PROTECTION

- A. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired.
- B. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

END OF SECTION

SECTION 07 00 01

WATERPROOFING, DAMPPROOFING, AND CAULKING

(Filed Sub-bid Required)

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Sub-Bids:
 - 1. Sub-bids for work under this Section shall be for the complete work and shall be submitted through as stipulated in the INVITATION TO BID and the INSTRUCTIONS TO BIDDERS.
 - 2. Sub-bids filed with the AWARDDING AUTHORITY shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the TOWN OF BOXFORD in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- C. Sub Sub-Bid Requirements:
 - 1. Sub bidder's attention is directed to Massachusetts G.L. Chapter 149 Section 44F, as amended, which provides in part as follows.
 - 2. Each sub-bidder shall list in Paragraph E of the "Form for Sub-bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the AWARDDING AUTHORITY that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

<u>CLASS OF WORK</u>	<u>REFERENCE PARAGRAPHS</u>
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- D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:

<u>NUMBER</u>	<u>SHEET NAME</u>
A1.1	FIRST FLOOR PLAN
A1.2	SECOND FLOOR / ATTIC PLAN
A1.3	ROOF PLAN
A2.1	FIRST AND SECOND FLOOR REFLECTED CEILING PLAN

<u>NUMBER</u>	<u>SHEET NAME</u>
A3.1	SOUTH AND EAST ELEVATIONS
A3.2	NORTH AND WEST ELEVATIONS
A5.1	ENLARGED KITCHEN PLANS AND ELEVATIONS
A5.2	ENLARGED TOILET ROOMS PLANS AND ELEVATIONS
A6.1	BUILDING SECTIONS

1.02 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work of Section 07 13 00, SHEET MEMBRANE WATERPROOFING.
 2. All Work of Section 07 16 00, BITUMINOUS DAMPPROOFING.
 3. All Work of Section 07 92 00, JOINT SEALANTS.
- B. Alternates: Refer to Section 01 23 00, ALTERNATES and Document 00 31 00, FORM FOR GENERAL BID and Document 00 35 00, FORM FOR SUB-BID.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 07 13 00

SHEET MEMBRANE WATERPROOFING

(Part of Work of Section 07 00 01 – WATERPROOFING, DAMPPROOFING, AND CAULKING,
Filed Sub-bid Required)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Provide all labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Pre-applied fully-adhered sheet membrane waterproofing system for positive waterproofing.
 - 2. Fully adhered sheet waterproofing membrane against concrete foundation walls.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Division 31 - EARTHWORK; Excavating and backfilling.
 - 2. Section 03 30 00, CAST-IN-PLACE CONCRETE; Concrete foundations.

1.04 SUBMITTALS

- A. Submit manufacturer's product data, installation instructions and membrane samples for approval.
 - 1. Certification by waterproofing materials manufacturer that products supplied comply with local VOC regulations.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Representative: Make arrangements necessary to have a trained employee of the manufacturer on site to review installation procedures at the start of installation and periodically throughout the installation.
- B. Owner's Inspection: Alert Owner in adequate time to allow daily inspections and observations of the Work by an independent representative of the Owner. Do not proceed with Work until unsatisfactory conditions are corrected.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from weather, excessive temperature and construction operations. Remove damaged material in accordance with applicable regulations. Protect stored materials from direct sunlight.

1.07 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used. Proceed with installation only when the substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.08 WARRANTY

- A. Sheet Membrane Waterproofing: Provide written five (5) year material warranty issued by the membrane manufacturer upon completion of work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Pre-applied Sheet Waterproofing Membrane: Bituthene[®] Preprufe[™] 300 Waterproofing Membrane by Grace Construction Products (GCP), a four layer composite sheet membrane consisting of 0.8 mm (0.003 in.) of high density polyethylene film, 0.6 mm (0.025 in.) of specially formulated synthetic adhesive, 0.03 mm (0.001 in.) of protective coating and surface treatment.
- B. Rubberized asphalt self-adhering membrane integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of not less than 56 mils thick, complying with the following:
 - 1. Tensile Strength: 250 psi minimum; ASTM D 412.
 - 2. Ultimate Elongation: 300 percent minimum; ASTM D 412.
 - 3. Brittleness Temperature: Minus 25 deg F (minus 32 deg C); ASTM D 746.
 - 4. Hydrostatic Head Resistance: 150 feet minimum.
 - 5. Water Absorption: Not more than 0.5 percent weight gain after 48 hours' immersion at 70 deg F (21 deg C); ASTM D 570.
 - a. Products: Subject to compliance with requirements, provide the following:
 - (1) Bituthene 4000; GCP (Grace Construction Products).

2.02 AUXILIARY MATERIALS

- A. Adhesives and Joint Tape: Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer for bonding to substrate (if required), for waterproofing seams in membrane, and for waterproofing joints between membrane and flashings, adjoining surfaces, and projections through membrane.
- B. Primers: Provide type of concrete primer recommended by manufacturer of sheet waterproofing material for applications required.

- C. Liquid Membrane: Elastomeric, two-component, liquid, cold fluid-applied, trowel grade or low viscosity as recommended by waterproofing manufacturer for application. Use Liquid Membrane as manufactured by Grace Construction Products or an Architect approved equal.
- D. Flashing Materials: Except as otherwise indicated, provide types of flexible sheet material for flashing as recommended by waterproofing sheet manufacturer.
- E. Protection Board: At vertical applications against foundation wall, provide 1 inch thick extruded polyethylene board except within 4 feet of grade. Within 4 feet of grade use 2 inch thick extruded polystyrene.

PART 3 - EXECUTION

3.01 EXAMINATION OF SURFACES TO BE WATERPROOFED

- A. The installer shall examine the conditions of substrate and other conditions under which the work is to be performed and notify the contractor of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 SUBSTRATES

- A. Concrete substrates shall be clean, smooth, and monolithic with a float finish. Fill gaps or voids greater than 13 mm (0.5 in.). Remove standing water prior to membrane application. Steel surfaces shall be clean and dry.
- B. Vertical substrates shall be smooth and sound. Tie holes shall be filled with mortar. Uneven conditions shall be ground smooth and patched.

3.03 INSTALLATION

- A. For horizontal applications refer to manufacturer's literature for complete installation instructions, but not limited to, the following:
 - 1. Apply membrane with the HDFE film facing the prepared substrate. Remove the release liner during application.
 - 2. Apply succeeding sheets by overlapping the previous sheet 75 mm (3 in.) along uncoated edge of membrane. Overlap the ends of the membrane a minimum of 75 mm (3 in.) and apply Bituthene[®] Preprufe™ Tape centered over the lap. Roll firmly to assure a tight seal.
- B. For vertical applications refer to manufacturer's literature for complete installation, but not limited to the following:
 - 1. On vertical foundation walls chip off projections where necessary to properly place and adhere waterproofing sheet.
 - 2. Apply primer to substrate surfaces at rate recommended by manufacturer of primary waterproofing materials. Prime only area that will be covered by waterproofing membrane in same working day. Reprime areas not covered by waterproofing membrane within 24 hours.
 - 3. Comply with manufacturer's instructions for handling and installing sheet waterproofing materials.
 - 4. Coordinate installing waterproofing materials with associated work to provide complete system complying with combined recommendations by manufacturers and installers involved in Work. Schedule installation to minimize exposure of sheet waterproofing materials.

5. Seal projections through membrane and seal seams. Bond to vertical surfaces and also, where shown or recommended by manufacturer, bond to horizontal surfaces.
 6. Top Edge Seal: Caulk exposed edges with mastic or sealant.
- C. Protection Board (only at vertical applications): Install protection board over completed membrane, complying with manufacturer's recommendations for both waterproofing sheet and protection course materials.

END OF SECTION

SECTION 07 16 00

BITUMINOUS DAMPPROOFING

(Part of Work of Section 07 00 01 – WATERPROOFING, DAMPPROOFING, AND CAULKING,
Filed Sub-bid Required)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.03 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Cold-applied, emulsified-asphalt dampproofing applied to the following surfaces:
 - a. Exterior, below-grade surfaces of concrete and masonry foundation walls.
 - b. Back side of concrete and masonry retaining walls, below grade.
- B. Alternates: Refer to Section 01 23 00, ALTERNATES.
- C. Items To Be Installed Only: Not Applicable.
- D. Items To Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 2. Section 07 13 00, SHEET MEMBRANE WATERPROOFING.
 - 3. Section 07 92 00, JOINT SEALANTS.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.
- B. Material Certificates: For each product, signed by manufacturers.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.06 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Karnak Corporation.
 - 2. BASF Building Systems.
 - 3. Euclid Chemical Company.
 - 4. Henry Company.
 - 5. Meadows, W. R., Inc.
 - 6. Tremco Inc.

2.02 BITUMINOUS DAMPPROOFING

- A. Cold-Applied, Emulsified-Asphalt Dampproofing, Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.03 MISCELLANEOUS MATERIALS

- A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
- B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- C. Patching Compound: Manufacturer's fibered mastic of type recommended by dampproofing manufacturer.
- D. Protection Course: Multi-ply semi-rigid core composed of a mineral-fortified asphalt core formed between two outside layers of asphalt impregnated reinforced mats, manufactured in accordance with ASTM D 6506, 1/8 inch or 1/4 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

- B. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.
- C. Apply patching compound for filling and patching tie holes, honeycombs, reveals, and other imperfections.

3.03 APPLICATION

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 - 1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
 - 2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
 - 3. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.
 - 4. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 5. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.
- B. On Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat.
- C. On Unparged Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat.
- D. On Backs of Concrete and Masonry Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft.

3.04 INSTALLATION OF PROTECTION COURSE

- A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.

3.05 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Cooperate with the Independent Testing Agency engaged by Owner for field quality control activities for the Work of this Section.
- B. Cooperate with field quality control personnel. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

- C. Additional inspections and retesting of materials which fail to comply with specified material and installation requirements shall be performed at Contractor's expense.

3.06 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION

SECTION 07 19 00

VAPOR RETARDERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Furnish and install vapor retarders at areas indicated on Drawings. Vapor retarders shall include furnishing and installing vapor retarders at the following areas:
 - 1. Beneath slab-on-grade floor slabs.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 31 20 00, EARTHWORK; Excavation and backfill.
 - 2. Section 03 30 00, CAST-IN-PLACE CONCRETE; Concrete.
 - 3. Section 07 21 00, THERMAL INSULATION; Vapor barrier at interior of exterior walls.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions including certifications and other data as may be required to show compliance with Contract Documents. Submittals shall include:
 - 1. Independent laboratory test results showing compliance with ASTM and ACI Standards.
 - 2. Manufacturer's installation instructions for placement and seaming.

1.05 SYSTEM PERFORMANCE

- A. General: Provide vapor retarder products that have been produced and installed to establish and maintain continuous seal against moisture migration in concrete floor slab.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Obtain primary materials of each type required from a single manufacturer to the greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Installer: A firm with not less than five vapor retarder projects similar to requirements for this Project with satisfactory in-service performance and which is acceptable to primary vapor retarder materials manufacturer.

- C. Pre-installation Conference: Prior to installing vapor retarder and associated work, meet at Project site with Installer of each component of associated work, inspection and testing agency representatives (if any), and installers of concrete work requiring coordination with vapor retarder work. Review material selections and procedures to be followed in performing work. Notify Architect at least 48 hours before conducting meeting.
- D. The vapor retarder manufacturer shall provide evidence indicating that the specified materials have been successfully utilized on work of similar scope to that shown and specified for this Project. The vapor retarder system examples cited shall have been completed and in use for two years without any evidence of failure.

1.07 PROJECT CONDITIONS

- A. Substrate: Proceed with work after subgrade preparation has been completed and areas are suitable to receive vapor retarder.
- B. Weather: Proceed with vapor retarder and associated work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.
- C. Do not proceed with work during inclement weather. Comply with manufacturer's recommendations for application and curing under specific climatic conditions.
- D. Coordinate application of vapor retarder with work of other trades.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's unopened containers or bundles fully identified with brand, type, grade, date of manufacture, class, lot number, and other qualifying information.
- B. Store materials in original tightly sealed containers or unopened packages. Materials shall be stored out of weather, off the ground, in dry area, in compliance with manufacturer's maximum storage temperature range.

PART 2 - PRODUCTS

2.01 VAPOR RETARDERS

- A. Provide Stego Wrap (15 mil) Vapor Barrier, manufactured by Stego Industries LLC, San Juan Capistrano, CA; telephone 877-464-7834; www.stegoindustries.com. or approved equal.
 - 1. Vapor Barrier must have the following qualities:
 - a. WVTR of 0.006 gr/ft²/hr or less as tested by ASTM E 96.
 - b. ASTM E 1745 Class A.
 - 2. Accessories
 - a. Vapor Retarding Seam Tape: Tape must have the following qualities:
 - 1). Water Vapor Transmission Rate (ASTM E 96): 0.3 perms or lower.

- b. Vapor Proofing Mastic: Mastic must have the following qualities:
 - 1). Water Vapor Transmission Rate (ASTM E 96): 0.3 perms or lower.
- c. Pipe Boots: Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Ensure that subgrade to receive Vapor Barrier/Retarder is approved by Architect or Geotechnical Consultant.

3.02 INSTALLATION

- A. Install vapor retarder in accordance with manufacturer's recommendations and ASTM E 1643.
 - 1. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.
 - 2. Lap Vapor Barrier/Retarder over footings and seal to foundation walls.
 - 3. Overlap joints 6 inches and seal with manufacturer's tape.
 - 4. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 5. No penetration of the Vapor Barrier/Retarder is allowed except for reinforcing steel and permanent utilities.
 - 6. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

3.03 PROTECTION

- A. General: Protect completed membrane during installation of other materials or processes over membrane and throughout remainder of construction period.
- B. Do not allow traffic of any type on unprotected membrane.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. Provide all labor, materials, and equipment necessary to complete the thermal insulation work of this Section. The work of this Section includes, but is not limited to the following:
 - 1. Insulation / finish board for interior finish at exterior walls as indicated.
 - 2. Fiberglas blanket/batt insulation, as indicated.
 - 3. Extruded polystyrene insulation at foundation wall perimeter insulation and under concrete slab.
 - 4. Rigid fiberglass insulation at columns, beams, windows, and other areas indicated.
 - 5. Sprayed-in-place closed-cell insulation as indicated.
 - 6. Spray foam expanding insulation at window and door perimeters and all other penetrations.
 - 7. Vent baffles for venting roof assemblies at exterior wall/roof line.
 - 8. Sill sealer at base of exterior wall.
 - 9. Vapor barrier vat interior side of exterior wall.
 - 10. Accessories for insulation installation.
 - 11. Other building insulation work as may be called for on Drawings and not indicated or specified to be included under other Sections.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 2. Section 06 10 00, ROUGH CARPENTRY; Wood framing, plywood sheathing at roofs and miscellaneous wood blocking.
 - 3. Section 07 27 00, AIR BARRIER MEMBRANE; Air barrier at exterior wall.
 - 4. Section 07 84 00, THROUGH PENETRATION FIRESTOPPING; Firestopping insulation and related work.
 - 5. Section 09 21 16, GYPSUM BOARD ASSEMBLIES; Acoustical and sound attenuation insulation in gypsum board partitions.
 - 6. Divisions 23 – HVAC and 22 – PLUMBING; Insulation for mechanical equipment, ductwork, piping, etc.

1.3 SUBMITTALS

- A. Product Data: Submit product data of materials and systems. Include manufacturer's installation instructions, use limitations, and recommendations for each material used.

- B. Test Reports: Provide certified test reports of each insulation type, showing that materials meet specified requirements of this Section.
- C. Compatibility: Provide certification of compatibility of closed cell spray insulation with materials in direct contact with it.

1.4 QUALITY ASSURANCE

- A. Materials and workmanship shall conform to governing laws and building code.
- B. Thickness: Where R values are indicated, provide thicknesses of insulation materials required to achieve value specified.
- C. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency
 1. Surface-Burning Characteristics: ASTM E 84.
 2. Fire-Resistance Ratings: ASTM E 119.
 3. Combustion Characteristics: ASTM E 136.
- D. Spray-in-place insulation for insulating of wall cavities and other areas using a two-component closed cell expanding type insulation shall be applied by a qualified installer acceptable to the insulation manufacturer with a minimum of five years' experience in the application of sprayed-in-place insulation.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to site in original, unopened packages or containers bearing manufacturer's names, brand names, and types and thicknesses of contents.
- B. Store off floor in interior spaces, adequately protected against damage from all sources.
- C. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Protect plastic insulation as follows:
 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.6 COORDINATION

- A. Work under this section shall be properly coordinated with the work of other sections to assure the steady progress of all the work of the Contract.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:

1. Polyisocyanurate board insulation.
 - a. Dow Corporation.
2. Glass-Fiber Blanket Insulation:
 - a. CertainTeed Corporation.
 - b. Owens-Corning Fiberglas Corporation.
 - c. Johns-Manville Corporation.
3. Rigid Fiberglass Insulation:
 - a. CertainTeed Corporation.
 - b. Owens-Corning Fiberglas Corporation.
 - c. Johns-Manville Corporation.
4. Extruded Polystyrene Insulation:
 - a. "Styrofoam Square Edge" by Dow Chemical Co.
 - b. "Amofoam-CM" by Amoco Foam Products Company.
 3. "Foamular 250" by Owens-Corning, Inc.
5. Sprayed-In-Place Open Cell Spray Polyurethane Foam (SPF):
 - a. Icynene Inc.
6. Sprayed-In-Place Closed Cell High Density Spray Polyurethane Foam (SPF):
 - a. Spray Foam Polymers ThermoSeal 2000 or ThermoSeal 1800.
7. Sill Sealer:
 - a. Pactiv Building Products.

2.2 INSULATION / FINSH BOARD FOR INTERIOR FINISH AT SINGLE WYTHE MASONRY WALLS

- A. Provide insulation / finish board system for interior wall finish at walls as indicated.
- B. Insulation/finish board shall be a factory-fabricated panel with glass-fiber reinforced polyisocyanurate foam core faced with a nominal 16.5 mil embossed white acrylic-coated aluminum sheet laminated to plain 1 mil aluminum on one side and 1 mil plain aluminum on the other side. Panel shall have the following characteristics:
1. Acceptable Manufacturer / Product: Dow Building Materials 'Thermax Heavy Duty Plus (HDP)' Polyisocyanurate Insulation / Finish Board.

2. Properties:
 - a. Impact Resistance (Janka Ball): Heavy 188 lb.
 - b. Washability – Pressure Rating: 2000 psi pressure washing using any spray tip and any distance from surface.
 - c. Bird Attack Resistance: High.
 - d. Strength (Modulus of Rupture, 1 inch thick): 109,200 psi.
 - e. Elasticity (Modulus of Elasticity, 1 inch thick): 106 psi.
3. Size:
 - a. Panel Width: Unless otherwise indicated, provide 48 inch wide panels.
 - b. Panel Length: Full length panels (horizontal joints in installation will not be permitted).
 - c. Panel Thickness: 1.5 inch, nominal (minimum R-value = 9.8).
4. Edge: Joints shall have square edges for butting of adjacent panels.
5. Installation: Approved adhesive or concealed mechanical fastener.
6. Joint Treatment: All vertical joints shall be fully sealed using taped seams using Dow Thermax white foil tape. All taped seams shall be neat and fully adhered and rolled in-place for secure adhesion to panel edges. Where required provide auxiliary adhesive for taped seams.

2.3 RIGID FIBERGLAS INSULATION

- A. Rigid Fiberglas Insulation shall be indicated thickness of rigid industrial insulation "700 Series", manufactured by Owens-Corning Fiberglas Corp., equivalent product manufactured by Johns Manville; CertainTeed; or approved equal.
 1. Material shall conform to ASTM C 612.
 2. Rigid insulation board shall be Type 704, 4.25 lb. per cu. ft. density, 200 psf compressive strength at 10% deformation, and thermal conductivity of 0.230. Inner face shall be complete with 0.0025 in. aluminum foil-reinforced Kraft paper facing, meeting Model Code requirements for exposed locations.

2.4 FIBERGLAS BLANKET/BATT INSULATION

- A. Type 1 Insulation: Unfaced Fiberglas Blanket/Batt Insulation: shall be indicated thickness(es) by full 16-1/8 in. and 24-1/8 in. width (depending of spacing of framing members) unfaced, commercial fiberglas blanket or batt insulation, conforming to ASTM C 665, Type I manufactured by Owens-Corning Fiberglas Corp., Johns Manville Corp., CertainTeed Corp., or approved equal.
- B. Type 2 Insulation: Fiberglas Blanket/Batt Insulation: for applications with no fireproof covering material within 1 in. of insulation shall be Owens Corning Flame Spread 25, mineral (glass) fiber batt or blanket with foil-reinforced kraft fiber reinforced fire retardant vapor barrier, conforming to ASTM C 665, Type III, Class A, manufactured by Owens-Corning Fiberglas Corp., or equivalent manufactured by Johns Manville Corp., CertainTeed Corp., or approved equal. ASTM E 84 surface burning characteristics shall be 25 flame spread and 50 smoke developed.

2.5 PERIMETER AND UNDERSLAB INSULATION

- A. Provide extruded polystyrene insulation, minimum 25 lbs. per sq. in. compressive strength at 0.1 in. deformation, 2.0 lbs. per cu. ft. density "K" factor of 0.185 at 40°F. and 0.20 at 75°F. per in. thickness, water vapor transmission of 1.0 perm, and water absorption by volume of 0.1%. Provide boards with manufacturer's standard square edges. Provide one of the following products, or Architect approved equal:
1. "Styrofoam Square Edge" by Dow Chemical Co.
 2. "Amofoam-CM" by Amoco Foam Products Company.
 3. "Foamular 250" by Owens-Corning, Inc.
- B. Adhesive: As recommended by the insulation manufacturer. Material shall be compatible with dampproofing or waterproofing materials.
- C. Thickness of insulation shall be as indicated on the Drawings.

2.6 SPRAYED-IN-PLACE OPEN CELL LOW DENSITY POLYURETHANE INSULATION

- A. Spray-in-place expanding foam insulation, open cell structure, polyurethane type insulation having the following characteristics:
1. Materials: Open-cell polyisocyanurate containing no formaldehyde, CFCs or HCFCs.
 2. Density: 0.5 lb. density (Light Density).
 3. Thermal Performance:
 - a. Minimum R Value per inch thickness: 3.6.
 - b. Minimum R-Value Installed: R-15.
 4. Burn Characteristics: ASTM E 84, flame spread less than 20; smoke development less than 400; fuel contribution 0.
 5. Water Absorption: Hydrophobic.
 6. Air Permeability: Air barrier with air permeability of core foam as measured by ISSN 0701.5232 of 1.6 liters per square meter at 3 inch (75 mm) thickness at 75 Pascals pressure and 1.0 liters per square meter at 6 inch (157 mm) thickness at 75 Pascals pressure.
- B. Acceptable Products:
1. Icynene; Icynene, Inc.
 2. ThermoSeal 500; Spray Foam Polymers.

2.7 SPRAYED-IN-PLACE CLOSED CELL HIGH DENSITY POLYURETHANE INSULATION

- A. Spray-in-place expanding foam insulation, closed cell structure, polyurethane type insulation having the following characteristics:
1. Materials: Closed cell polyisocyanurate containing no formaldehyde, CFCs or HCFCs.
 2. Density: Minimum 1.8 lb. density (High Density).
 3. Thermal Performance:
 - a. Minimum R Value per inch thickness: 6.
 - b. Minimum R-Value Installed: R-45.
 4. Burn Characteristics: ASTM E 84, flame spread less than 20; smoke development less than 400; fuel contribution 0.

B. Acceptable Products:

1. ThermoSeal 1800; Spray Foam Polymers.

2.8 SILL SEALER INSULATION

- A. Sill sealer shall be a prefabricated product used to fill crevices between top of foundation wall and sill plate around perimeter of exterior walls.
- B. Material shall be continuous, sized to fit wall thickness, and shall provide an effective barrier against air leakage.
- C. Material shall be equal to 'GreenGuard Sill Sealer', manufactured by Pactiv Building Products, Atlanta, GA; or approved equal.

2.9 VAPOR BARRIER

- A. Vapor barrier shall be natural color 6 mil polyethylene film sheet with laboratory-tested vapor transmission rating of 0.13 perms, when tested in accordance with ASTM E 96.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Insulating materials and installation shall be in strict accordance with manufacturer's printed instructions and specific recommendations, and health and safety precautions, for each of project conditions and in accordance with governing laws and building code.

3.2 SILL SEALER INSULATION

- A. Install sill sealer in accordance with manufacturer's recommendations and as indicated on the Drawings.

3.3 INSULATION / FINISH BOARD INSTALLATION

- A. Install full height insulation / finish board system for interior wall finish at single wythe masonry walls as indicated to provide full interior coverage without horizontal joints. Panels shall be attached and installed plumb and at locations indicated. Where required provide factory cut panels or provide field-cut panels to manufacturer's recommendations.
- B. Installation: Install using manufacturer's recommended adhesive or concealed mechanical fasteners in accordance with approved installation methods.
- C. Joint Treatment: All vertical joints shall be fully sealed using taped seams using Dow Thermax white foil tape. All taped seams shall be neat and fully adhered and rolled in-place for secure adhesion to panel edges. Where required provide auxiliary adhesive for taped seams.
- D. Completed installation shall provide full coverage of architectural finish on inside as indicated with all seams fully taped and sealed.

3.4 FIBERGLAS BLANKET/BATT INSULATION

- A. Install blanket/batt insulation, fully filling spaces between steel stud members. Staple through insulation into rear face of sheathing with 9/16 in. long divergent point staples at center and near each corner of blanket/batt. Fit batts tightly together at joints. Pack tightly into corners, and fill double studs and box headers and sills, and other similar voids, with insulation to maintain insulation integrity across entire wall area.
- B. Install continuous application of fiberglass blanket/batt at ceiling areas and at soffit areas to protect interior spaces of building, as indicated. Fit batts tightly together and to framing members, furring strips, penetrations, and abutting construction for positive thermal seal. Carry continuously behind light cans, junction boxes, etc.
- C. Coordinate work with that of other Sections.

3.5 RIGID PERIMETER AND UNDERSLAB INSULATION

- A. Install indicated thickness of rigid perimeter insulation up interior faces of exterior foundation walls and under interior edges of concrete slabs-on-grade, as indicated.
 - 1. At vertical applications secure with daubs of compatible adhesive.
 - 2. At slab edges lay horizontally directly over vapor barrier (vapor barrier by concrete trade), just prior to placement of concrete floor slab.
 - 3. Work shall be in close coordination and cooperation with work of other affected Sections, including excavation and backfilling, and concrete work.
- B. Install uniformly wide, in continuous rows, with joints tightly butted at ends of adjoining panels and at edge(s) where abutting other insulation panels. Provide neat cut-outs at projections through insulation.

3.6 RIGID FIBERGLASS INSULATION

- A. Apply indicated thickness of rigid fiberglass insulation at locations indicated on the Drawings.
- B. Install rigid insulation board into place, mechanically fastening where required to hold insulation in place prior to application of finish wall materials and trim.
 - 1. Stagger joints in insulation.
 - 2. Take special care to cut, fit, and position boards accurately so that joints within work, at perimeters of work, and at projections through work, are tightly butted.
 - 3. Visible gaps will not be permitted. Tape joints with aluminum foil faced tape.

3.7 SPRAY INSULATION

- A. Install spray insulation in accordance with manufacturer's printed instructions to the thicknesses indicated or where thickness is not indicated provide spray insulation to provide insulation equivalent to the following:
 - 1. High Density Spray Insulation: R-45 (HDF).
 - 2. Low Density Spray Insulation: R-15 (SPF).
- B. Provide spray insulation (low density spray insulation) at all cavities around doors and windows and other voids requiring thermal insulation.

3.8 INSTALLATION OF VAPOR BARRIER

- A. Install continuous application of vapor barrier over entire inside face of framed exterior wall to receive gypsum finish. Lap and tape with waterproof tape all joints and edges. Cut neatly at wall openings and carry back into wall returns.
 - 1. Refer to Drawings and details for additional requirements.
 - B. Extend vapor barrier to extremities of areas to be protected from vapor transmission. Secure with adhesives or other anchorage system as indicated. Extend vapor barrier to cover miscellaneous voids in insulated substrates.
 - C. Seal vertical joints in vapor barriers over framing by lapping not less than distance between two wall studs. Fasten to framing at top, end and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 16 in. o.c.
 - D. Seal joints caused by pipes, conduits, electrical boxes and similar items penetrating vapor barriers with cloth or aluminized tape recommended by vapor barrier manufacturer to create air-tight seal.
 - E. Repair tears or punctures in vapor barriers immediately before concealment by other work. Cover with tape or another layer of vapor barrier material.
 - F. At conclusion of vapor barrier installation, request Architect to review installation of vapor barrier installation at walls prior to providing interior finish. Inspection shall be timed to coincide with weekly project meeting.
- 3.9 CLEANING
- A. Upon completion of thermal insulation work in any area, remove rubbish and debris from work area and leave in broom clean condition.

END OF SECTION

SECTION 07 27 00

AIR AND VAPOR BARRIER MEMBRANES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. Provide air and vapor barrier membranes at exterior wall and at locations indicated on Drawings and as specified herein.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 2. Section 06 10 00, ROUGH CARPENTRY; Wood framing, blocking, nailers, and sheathing.
 - 3. Section 07 46 00, EXTERIOR SIDING AND TRIM; Exterior siding and trim.
 - 4. Section 07 92 00, JOINT SEALEANTS; Sealants.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each material. Include standard details, certified test results, installation instructions, and recommendations for sealing penetrations and perimeter.
- B. Samples: Submit three labeled samples of each product, not less than 6 inches by 12 inches in size.

1.4 WARRANTY

- A. Submit manufacturer's warranty that air barrier membranes and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications.

PART 2 - PRODUCTS

2.1 AIR BARRIER AT EXTERIOR WALLS

- A. Subject to complying with requirements, provide the following air barrier:
 - 1. Henry Air Block 31 Liquid Emulsion Vapor Permeable Air Barrier Membrane, manufactured by Henry Company.
- B. Air barrier shall comply with Commonwealth of Massachusetts State Building Code and shall have the following properties:

1. Color: Grey.
2. Solids by Weight: 55%.
3. Weight: 9.2 lb. per gallon.
4. Coverage: 18.6 sq. ft. per gallon.
5. Drying Time (at 50% Relative Humidity, 68 degrees F.):
 - a. Initial Set: 2 hours.
 - b. Set Through: 24 hours.
6. Service Temperature: -40 degrees F. to 158 degrees F.
7. Application Temperature: 40 degrees F. minimum.
8. Tensile Strength (ASTM D 412): 170 psi, typical.
9. Elongation (ASTM D 412): 1000% typical.
10. Peel Strength to Concrete (dry): 1.3 lbf per inch (typical).
11. Water Vapor Permeance (ASTM E 96): 12.3 perms.
12. Air Permeability 0.0002 cfm per sq. ft. at 1.6 lb. per sq. ft.

2.2 ACCESSORY MATERIALS

A. Flashing at Windows and Doors:

1. Henry Blueskin TWF Membrane (self-adhesive thru-wall flashing membrane), manufactured by Henry Company.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACE

- A. Examine substrates, adjoining construction and condition under which Work is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.
- B. Pre-Installation Meeting: Prior to installation of air barrier installation and at the Architect's direction, meet at Project site to review material selections, installation procedures, and coordination of Work with other trades. Meeting shall include Architect's Project Representative, Trade Contractor, Subcontractor, manufacturer's representatives, inspection and testing services (if any), and any other subcontractor whose work requires coordination with this work.
- C. Surfaces to receive air barrier membranes shall be thoroughly dry and free of moisture.
- D. Surfaces shall not contain any grease, oil, or any other contaminants which could affect the complete bonding of membrane to plywood surface.

3.2 GENERAL PREPARATION

- A. Proceed with air barrier installation only after substrate preparation is complete.
- B. Do not install air barrier system over wet substrates.

3.3 INSTALLATION

- A. Strictly comply with air barrier manufacturer's printed instructions, approved submittals and the following:

1. Air barrier shall be applied using conventional air spray equipment in accordance with manufacturer's recommendations.
 2. Apply to a wet film thickness of 90 mils minimum.
- B. Protect installed work from damage due to harmful weather exposures, physical abuse, and other causes.
- C. Repair damage to air barrier caused by construction activities or subsequent work prior to covering.
- D. All flashings at windows and doors shall be installed concurrently with the air barrier as the job progresses. No temporary flashing shall be allowed without the prior written approval of the Architect.

END OF SECTION

SECTION 07 31 00

ASPHALT SHINGLE ROOFING

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. Provide asphalt shingle roofing work as indicated on the Drawings and as specified herein, including, but not limited to the following:
 - 1. Roofing underlayment.
 - 2. Water barrier sheet membrane underlayment.
 - 3. Drip edge, and valley, eave, rake, and step flashing.
 - 4. Ridge vents and eave vents.
 - 5. Related flashing.
 - 6. Asphalt shingles and fasteners.
 - 7. All other asphalt shingle roofing work.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Plywood sheathing.
 - 2. Section 07 21 00, THERMAL INSULATION.
 - 3. Section 07 60 00, FLASHING, AND SHEET METAL; Sheet metal flashing and prefabricated roof accessories, except as specified herein.
 - 4. Division 22 - PLUMBING; Plumbing vents, etc.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- C. Verification Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.
 - 1. Shingles: Submit two shingles of each style and color selected indicating full range of color.
 - 2. Ice and water barrier membrane, 12 in. x 12 in. minimum.
 - 3. Sheet metal for all exposed flashing, minimum 4 in. long.

4. Ridge vent, 12 in. long.
5. Valley Flashing, Step Flashing and Eave Flashing Material: Submit duplicate 12 in. strips of specified material/finish.
6. Drip Edge Material: Submit duplicate 12 in. strips of specified material/finish.

D. Test Reports: Provide certified reports for all specified tests.

1.4 QUALITY ASSURANCE

- A. Source: For each material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.
- B. Installer: A firm with a minimum of three years' experience in type of work required by this Section and that is acceptable to manufacturers of primary materials.
- C. UL Listing: Provide roof system that has been tested and listed by UL as Class A for application indicated.
- D. Manufacturer's Representative: Make arrangements and pay costs to have manufacturer's authorized representative on roof at beginning of roofing work to advise installer of proper procedures and quality control techniques.

1.5 PROJECT CONDITIONS

- A. Substrate: Proceed with shingle work only after roof substrate construction and penetrating work have been completed.
- B. Weather Conditions: Proceed with shingle work only when weather conditions are consistent with manufacturer's recommendations and when substrate is completely dry.
- C. Do not install underlayment or shingles on wet surfaces.
- D. Do not apply shingles when air temperature is below 32 degrees F.
- E. Installers: Installation shall be by qualified roofing subcontractor with sufficient shingle roofing installation experience with projects of similar size and construction.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Store under cover and protect from weather damage.
- B. Store materials to avoid water damage, and store on raised platforms and protect with coverings at outdoor locations.
 1. Do not stack bundles of shingles more than 3 feet high.
 2. Store rolled goods on end.
- C. Comply with manufacturer's recommendations for job-site storage and protection.
- D. Sequence deliveries to avoid delays but minimize on-site storage.

1.7 EXTRA STOCK

- A. Provide one square of shingles as extra stock to the Owner.
- B. Provide specified nails of sufficient quantity for one square of shingles.

1.8 COORDINATION

- A. Conference: Convene a preinstallation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Coordination: Perform work of this Section in coordination with other trades to provide the highest quality work.

1.9 WARRANTY

- A. Asphalt Shingle Warranty: Provide written warranty signed by manufacturer agreeing to repair or replace work which exhibits defects in materials or workmanship for the warranty period indicated below. "Defects" is defined to include, but not limited to, leakage of water, abnormal aging or deterioration, and failure to perform as required.
 - 1. Warranty Period: Minimum 30 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS / PRODUCTS

- A. Acceptable Manufacturers: Roofing shingles shall be manufactured by the following, or Architect-approved equal:
 - 1. CertainTeed (Basis of Design).
- B. Acceptable Products (Basis of Design):
 - 1. Asphalt Shingles: CertainTeed 'Landmark' Shingles.
 - 2. Roof Underlayment: CertainTeed 'DiamondDeck'.
 - 3. Ice and Water Rubberized Membrane: CertainTeed 'Winterguard'.

2.2 REINFORCED UNDERLAYMENT

- A. CertainTeed 'DiamondDeck' is a synthetic polymer-based scrim-reinforced underlayment designed for use on roof decks as a water-resistant layer beneath asphalt roofing shingles.
 - 1. Roll Length (ft.): 250 Roll Width (ft.): 4 Roll Size (Gross sq. ft.): 1000 Roll Coverage (Typical net sq. ft.): 937.5
 - 2. Shipping Weight (approx. lb/roll): 38 Limitations: Between slopes of 2" per foot up to 4" per foot
 - 3. Product Composition: DiamondDeck roofing underlayment is based on a tough woven polyolefin reinforcement laminated between layers of specially formulated UV-stabilized polymer films.
 - 4. Technical Data: DiamondDeck is Classified by UL to be a suitable underlayment for use in any UL Class A, B, or C fire rated shingle system.
 - 5. DiamondDeck is manufactured to comply with physical property requirements of ASTM D226 and ASTM D4869, including resistance to "liquid water transmission."
 - 6. Water Vapor Transmission – ASTM E96 Method A (dry method) < 0.2 Perms Method B (wet method) < 0.4 Perms

2.3 ICE AND WATER BARRIER SHEET MEMBRANE

- A. Cross laminated high density polyethylene film and self-adhesive rubberized asphalt sheet material with a slip resistant top surface meeting the requirements of ASTM D 1970, and the following: minimum thickness shall be 40 mil; minimum tensile strength shall be 250 psi tested in accordance with ASTM D 412; adherence to plywood sheathing shall be 3.0 lb. per inch width when tested in accordance with ASTM D 903. Unless otherwise indicated, minimum width at roof eaves and at valleys shall be 36 in.
- A. Provide the following products, or Architect approved equal: CertainTeed 'Winterguard'.

2.4 ASPHALT SHINGLES

- A. Shingles shall be Granule surfaced self-sealing architectural asphalt shingle with a strong fiberglass reinforced Micro Weave core and StainGuard protection, which prevents pronounced discoloration from blue-green algae through formulation/unique blends of ceramically colored granules. Shingles shall be architectural, two-piece laminated glass fiber mat base styling. Shingles shall conform to UL 790 Class A rated with UL 997 80-mph Wind Resistance Label; ASTM D 7158, Class H; ASTM D 3161, Type 1; ASTM D 3018, Type 1; ASTM D 3462; AC438 compliant; Dade County Approved, Florida Building Code Approved, Texas Dept of Insurance Approved, ICC Report Approval.
- B. Shingle characteristics:
 - 1. Product: CertainTeed 'Landmark'.
 - 2. Size: 13-1/4 in. x 38-3/4 in.
 - 3. Exposure: 5-5/8 in.
 - 4. Nailing: Enhanced Nailing (6 nails per shingle).
 - 5. Shingle shall be UL Class "A".
 - 6. Weight per Square: Minimum 240 lb.
 - 7. Color: As selected by Architect.
- C. Hip and Ridge Shingles: Provide manufacturer's factory manufactured/factory cut hip and ridge shingles, matching color for cap shingles.

2.5 METAL FLASHINGS AND DRIP EDGE

- A. Aluminum Sheet Flashing for Step Flashing and Valley Flashing: Provide sheet aluminum flashing and counterflashing conforming to ASTM B 209, Alloy 3003, Temper H14, painted Kynar finish; minimum 0.050 in. thick (20 gage), except as otherwise indicated.
 - 1. Aluminum drip edge, painted (White): 0.024 in,
 - 2. Aluminum rake edge, painted (White): Minimum 0.019 in,
 - 3. Miscellaneous Flashing: 0.040 in. (unless otherwise noted).
- B. Counterflashing Fabrication:
 - 1. "Z" Flashing: Unless indicated otherwise, provide SMACNA Manual, Plate 56, Figure C for "Z" flashing application.
 - 2. Step Flashing: Unless indicated otherwise, fabricate step flashing to comply with SMACNA Manual, Plate 59, Figure B.
 - 3. Drip Edge: Preformed aluminum drip edge, 26 gage minimum, for edge protection at all rakes and at eaves. Drip edge shall extend a minimum of 3 in. back from roof edge with front of edge factory bent to create a drip and to project over roof edge.

- C. Ridge Vents: Provide prefabricated shingle over type ridge vent manufactured of high-density polypropylene, non-woven modified polyester, or other UV-Stabilized plastic with insect screen liner; free ventilation area (min.) of 18 sq. in./lin. ft.; with end caps. Ridge vent shall be equal to the following, or approved equal:
1. "CertainTeed Ridge Vent: Ridge Filter Shinglevent II", manufactured by Air Vent, Inc., a CertainTeed Company, Peoria Heights, IL; or approved equal.
- D. Nails: Hot-dip galvanized, 11-gage or 12-gage sharp pointed conventional roofing nails with barbed shanks, minimum 3/8 in. diameter head, and of sufficient length to penetrate minimum 3/4 in. into solid decking or to penetrate at least 1/8 in. through plywood sheathing Hot-dip galvanized, 11-gage or 12-gage sharp pointed conventional roofing nails with barbed shanks, minimum 3/8 in. diameter head, and of sufficient length to penetrate minimum 3/4 in. into solid decking or to penetrate at least 1/8 in. through plywood sheathing.
1. The use of roof staples will not be permitted.
- E. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- F. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant.
- G. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00, JOINT SEALANTS.
- H. Adhesives: Type recommended by flashing or sheet metal manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
- I. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
- J. Roofing Cement: ASTM D 4586, asphaltic.
- K. Plumbing Vent Stack Pipe Flashing and Collar: By IPS, Decktite, or Oatey. Sizes as required for each penetration.
- I. Snow Guards:
1. Acceptable Manufacturer:
 - a. Alpine SnowGuards. A Division of Vermont Slate & Copper Services Inc.,
289 Harrell St,
Morrisville, VT 05661
Toll-free 1-888-766-4273
www.alpinesnowguards.com
 2. Acceptable Product:
 - a. Alpine SnowGuards #40 Half Round Pad Style Snow Guard for Asphalt Shingle Roof.
 3. Materials:

- a. Aluminum strap, hood and gusset are 0.032 inch aluminum with Kynar™ 500 or Hylar™ 5000 pre-painted sheet.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer of shingles must examine substrate and conditions under which shingling work is to be performed and must notify Contractor in writing of unsatisfactory conditions.
- B. Do not proceed with shingling work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 PREPARATION OF SUBSTRATE

- A. Clean roof deck of any projections and substances detrimental to shingling work.
- B. Coordinate installation of shingles with flashing, metal edge trim, ridge and soffit vents, and other adjoining work to ensure proper sequencing.
- C. Do not install shingle roofing until all vent stacks, cupola, and other penetrations through roofing have been installed and are securely fastened against movement.

3.3 INSTALLATION

- A. General: Comply with instructions and recommendations of shingle manufacturer, NRCA Application Techniques for Glass Fiber Roofing Felts and Steep Roofing Manual, except to extent more stringent requirements are indicated.
- B. Asphalt Felt Underlayment: Apply one layer of asphalt felt horizontally over entire surface, lapping succeeding courses 2 in. minimum at horizontal joints, and 4 in. side lap at end joints. Asphalt felt shall be lapped 6 in. from both sides over hips and ridges. Asphalt felt shall be fastened with sufficient nails to hold in place until shingle application.
- C. Flashings and Self-Sealing Water Barrier Membrane: Except as otherwise shown on the approved shop drawings or specified herein, the workmanship of sheet metal flashing work, method of forming joints, anchoring, cleating, provisions for thermal movement, etc., shall conform to the standard details and recommendations of the sheet metal producer and those of producer organizations and research institutions and associations governing the sheet metal used, in addition to the standards and details set forth in the SMACNA Manual and the roof shingle manufacturer.
 1. Eave and Rake Flashing: Except where indicated otherwise, nail metal drip edge along bottom edge (eave) 6 in. o.c., before felt is installed, and to the sides (rakes) after the felt is installed. The flange shall be set in and covered completely with flashing cement.
 2. Eave Flashing:
 - a. Apply course of self-adhesive, self-adhesive, self-sealing water barrier membrane to overhang underlayment and metal drip edge or copper water table.
 - b. Extend membrane minimum 24 in. inside interior wall line of building. Any laps must be outside the wall line.
 3. Valley Flashing:

- a. Install shingled strips of self-adhesive, self-sealing membrane directly to decking, to extend 30 in. on each side of valley. Lap felt underlayment over membrane and continuously seal edges.
 - b. Install prefinished aluminum flashing over membrane in one maximum 10 ft. lengths overlapping 6 in. minimum.
 - c. Fold up edges and fasten to roof with cleats nailed to roof at 24 in. o.c.
 - d. Install shingles 6 in. minimum over valley flashing. Do not puncture aluminum with shingle nails.
 - e. Open valley width shall be 4 in. at the top increasing 1/8 in. per foot toward the eaves.
 - f. Nail top of sheets with aluminum nails 3 in. o.c.
4. Miscellaneous Flashings:
- a. Install step flashings as shingling progresses at the intersection of all roofs and vertical surfaces.
 - b. Install vent flashing, curb and cap, and base flashing.
- D. Ridge Vent: Install ridge vent in accordance with manufacturer's recommendations.
- E. Shingles: Install shingles in accordance with shingle manufacturer's recommendation and NRCA Application Techniques for Glass Fiber Roofing Felts and Steep Roofing Manual and in accordance with the Drawings
- 1. Install starter strip of roll roofing or inverted shingles with tabs removed.
 - 2. Use horizontal and vertical chalk lines to ensure straight coursing.
 - 3. Unless otherwise indicated, install shingles with 8 in. exposure and minimum 2 in. headlap.
 - 4. Provide four nails per shingle in accordance with manufacturer's recommendations.
 - 5. All valleys shall be cut on outer course woven on base course.
 - 6. Install field shingles, as indicated.
 - 7. Install hip and ridge shingles as indicated.
- F. Install pad type snow guards in accordance with snow guard manufacturer's recommendations or as indicated on the Drawings.
- 3.4 ADJUST AND CLEAN
- A. Replace all damaged shingles and flashings.
 - B. Remove debris and excess shingles not part of extra stock from Project site.

END OF SECTION

SECTION 07 46 00

EXTERIOR SIDING AND TRIM

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. Provide all labor, materials, and equipment necessary to complete the exterior siding and trim work, including but not limited to the following:
 - 1. Fiber cement board beveled siding for clapboard siding.
 - 2. Fiber cement trim at exterior for soffits, corner boards, door and window trim, and other areas indicated.
 - 3. PVC trim at areas indicated.
 - 5. Draining vertical siding underlayment (Home Slicker).
 - 6. All other work indicated.
 - 7. All other exterior siding and trim work indicated or as necessary to complete the exterior siding and trim work.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 2. Section 06 10 00, ROUGH CARPENTRY; Wood framing, plywood sheathing at walls and roofs and miscellaneous wood blocking and wood nailers.
 - 3. Section 07 21 00, THERMAL INSULATION.
 - 4. Section 07 27 00, AIR AND VAPOR BARRIER MEMBRANES; Air barrier at exterior wall.
 - 5. Section 07 60 00, FLASHING AND SHEET METAL; Sheet metal flashing, except as specified herein.
 - 6. Section 07 92 00, JOINT SEALANTS; Sealants for sealing of joints between siding and trim and other materials.
 - 7. Section 08 52 15, EXTERIOR CLAD WOOD WINDOWS; Exterior windows.
 - 8. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.
 - 9. Section 09 9100, PAINTING; Field-applied coating including painting of cut ends of siding and trim.
 - 10. Division 15 - MECHANICAL; Insulation for mechanical equipment, ductwork, piping, etc.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.

- B. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- C. Verification Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.
 - 1. Bevel Siding: Submit two samples of each style and color selected indicating full range of color.
 - 2. Trim: Submit two samples of each type and each profile.
 - 3. Home slicker, 24 in. length.
- D. Test Reports: Provide certified reports for all specified tests.

1.4 QUALITY ASSURANCE

- A. Source: For each material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.
- B. Mock-Ups: Prior to commencing the primary work of this section, provide mock-ups at locations acceptable to Architect. Obtain Architect's acceptance of visual qualities. Protect and maintain accepted mock-ups throughout the remainder of the work of this section to serve as criteria for acceptance of the work. Approved mock-ups may be incorporated into the finished work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's unopened, labeled containers.
- B. Store materials to avoid water damage, and store on raised platforms and protect with coverings at outdoor locations.
- C. Comply with manufacturer's recommendations for job-site storage and protection.

1.6 JOB CONDITIONS

- A. Substrate: Proceed with exterior siding and trim work only after substrate construction and penetrating work have been completed.
- B. Weather Conditions: Proceed with exterior siding and trim work only when weather conditions are consistent with manufacturer's recommendations and when substrate is completely dry.
- C. Do not install siding on wet surfaces.
- D. Installers: Installation shall be by qualified siding subcontractor with sufficient installation experience with projects of similar size and construction.

1.7 EXTRA STOCK

- A. Provide one square of each siding type as extra stock to the Owner.

1.8 WARRANTY

- A. Material Warranty: Provide siding, soffit, and trim material manufacturer's warranty on installed work, agreeing to pay for repair or replacement of defective material as necessary for 10 years from date of Substantial Completion.
- B. Factory Finish Warranty: Provide prefinished siding with a factory finished warranty equal to the following:
 - 1. Warranty: 15 Year Finish Warranty.

1.9 PROJECT CONDITIONS

- A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within the limits established by manufacturers of the materials and products used.
- B. Substrates: Proceed with work only when substrate construction and penetration work is complete.

1.10 COORDINATION

- A. Conference: Convene a preinstallation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Coordination: Perform work of this Section in coordination with other trades to provide the highest quality work.

PART 2 - PRODUCTS

2.1 EXTERIOR FIBER CEMENT SIDING AND TRIM MATERIALS

- A. Lap Siding: Material made from fiber-cement board that complies with ASTM C 1186, Type A, Grade II; is classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. James Hardie Inc.; 'Hardiplank Lap Siding'.
 - 2. Horizontal Pattern: Boards shall be 6.25 inch wide (for 5 inch exposure) plain style and smooth texture. Provide other board widths required for various exposures indicated.
 - 3. Finish: Factory Finish with 15 year warranty.
 - 4. Color: (TBD)
- B. Trim: Material made from fiber-cement board that complies with ASTM C 1186, Type A, Grade II; is classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. James Hardie Inc.; 'HardiTrim'.
 - 2. Sizes: Include all sizes indicated including 5/4 x 12; 5/4 x 6; 5/4 x 10; lain style and smooth texture. Provide other board widths required for various exposures indicated.

3. Where indicated provide 5/4 inch stock.
4. Finish: Factory primed suitable for field applied finish under Section 09 91 00, PAINTING.

C. Fasteners and Accessories:

1. Screws for Attaching Siding to Wall Sheathing: Equal to ITW Buildex TEKS Self-Drilling Fasteners #12, 1/4 Hex Washer Style head with Climaseal finish.

D. Edge Coater for Field Cut Fiber Cement: James Hardie 'Edge Coater'.

E. Accessory Items for Siding Installation: Provide the following accessory items furnished by the siding manufacturer:

1. HardiTrim Bases for hosebibs, downspout hangers, downspout shoes, light fixtures, electrical outlets, electrical meters.

F. Sealant: Sealant shall be a urethane-based or acrylic-based sealant without silicone.

2.2 EXTERIOR PVC TRIM MATERIALS

A. Cellular PVC Trim Boards for all Trim and PVC grounds.

1. Acceptable Product: AZEK® Trimboards manufactured by Vycom Corporation, 801 Corey Street, Moosic, PA 18507.
2. Provide trim boards fabricated of cellular PVC that is homogeneous and free of voids, holes, cracks, and foreign inclusions and other defects.

- a. Edges must be square and top and bottom surfaces shall be flat with no convex or concave deviation.
- b. Material shall have a uniform surface free from cupping, warping, and twisting.
- c. Material thickness: 5/4 inch stock as indicated.

3. Material: Expanded rigid polyvinyl chloride material with a small-cell microstructure and density of 0.55 grams/cm³. Material shall have the following minimum physical and performance properties:

a. Physical:

- 1). Density, ASTM D 792: 0.55 g/cm³.
- 2). Water Absorption, ASTM D 570: 0.15%.

b. Mechanical:

- 1). Tensile Strength, ASTM D 638: 2,256 psi.
- 2). Tensile Modulus, ASTM D 638: 144,000 psi.
- 3). Flexural Strength, ASTM D 790: 3,329 psi.
- 4). Flexural Modulus, ASTM D 790: 144,219 psi.
- 5). Nail Hold, ASTM D 1761: 35 lbf/inch of penetration.
- 6). Screw Hold, ASTM D 1761: 680 lbf/inch of penetration.
- 7). Staple Hold: ASTM D 1761: 180 lbf/inch of penetration.
- 8). Gardner Impact, ASTM D 5420: 103 in.-lbs.
- 9). Charpy Impact (at 23°C), ASTM D 256: 4.5 ft.-lbs.

c. Thermal:

- 1). Coefficient of Linear Expansion, ASTM D 696: 2×10^{-5} in/in/°F.

- 2). Burning Rate, ASTM D 635: No burn when flame removed.
- 3). Flame Spread Index, ASTM E 84: 20.
- 4). Heat Deflection Temperature, ASTM D 648: 150 degrees F., 264 psi.
- 5). Oil Canning at 140 degrees F., ASTM D 648: Passed.

d. Allowable Tolerances:

- 1). Variation in component length: -0.00 / +1.00 in.
- 2). Variation in component width: $\pm 1/16$ in.
- 3). Variation in component thickness: $\pm 1/16$ in.
- 4). Variation in component edge cut: $\pm 2^\circ$
- 5). Variation in Density -0% + 10%.

2.3 DRAINING UNDERLAYMENT AT WALLS

- A. Underlayment for Exterior Wood Siding: Provide prefabricated UV-stabilized, three dimensional nylon matrix type underlayment specifically formulated to provide a continuous air space beneath siding to eliminate moisture behind siding and minimize potential for water or moisture damage to siding. Underlayment shall be a durable product having a minimum tensile strength of 114 lb. per foot (machine direction) and a minimum break elongation of 62% (machine direction). Underlayment shall be equal to the following:

1. 'Home Slicker Siding Protector', manufactured by Benjamin Obdyke Incorporated, Horsham, PA.

2.4 FINISHING

A. Exterior Siding and Trim:

1. All siding (except for factory finished siding) indicated for solid color stain shall prior to installing be back-primed, and shall receive one finish coat of specified stain finish; refer to Section 09 91 00, PAINTING. Following installation, siding shall be coated with second coat of stain in accordance with Section 09900, PAINTING.
2. All siding (except for factory finished siding) indicated for painted finish shall prior to installing be back-primed, and shall receive one finish coat of specified paint finish; refer to Section 09 91 00, PAINTING. Following installation, siding shall be coated with second coat of paint in accordance with Section 09 91 00, PAINTING.
3. All trim to be painted shall prior to installing receive one finish coat of specified paint finish; refer to Section 09 91 00, PAINTING. Following installation, trim shall be coated with second coat of paint in accordance with Section 09 91 00, PAINTING.
4. Following installation, all damaged finishes of siding and trim including nail heads shall be coated. Final finish coat for trim shall be applied in accordance with Section 09 91 00, PAINTING.

- B. Provide paints and stains per Section 09 9100, PAINTING.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer of exterior siding, soffit, and trim boards must examine substrate and conditions under which exterior siding and trim work is to be performed and must notify Contractor in writing of unsatisfactory conditions.
- B. Do not proceed with exterior siding, trim, and accessories until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 PREPARATION OF SUBSTRATE

- A. Coordinate installation of exterior siding and trim with flashing, air barrier installation and other adjoining work to ensure proper sequencing.
- B. At areas to receive siding install underlayment drainage membrane per manufacturer's recommendations.

3.3 INSTALLATION OF SIDING, TRIM, AND SOFFITS

- A. General: Comply with instructions and recommendations of siding, soffit, and trim manufacturer.
- B. Fiber Cement Siding, Trim, and Accessories: Install per manufacturer's recommendations and as indicated on the Drawings. Fasten using fastening method recommended with fasteners spaced as recommended by the siding or trim manufacturer. Provide 1/8 inch gap between siding and trim items.
 - 1. Provide manufacturer's edge coater for touch-up of all field cut items. Provide touch-up prior to installation.
 - 2. At window surrounds (window trim) provide shimming of fiber cement trim so that trim boards lay flat over window nailing fins and flush with adjacent trim.
- C. Cellular PVC Trim Components: Comply with instructions and recommendations of exterior trim and accessory manufacturer.
 - 1. Comply with manufacturer's product catalog installation instructions and product technical bulletin instructions.
 - 2. Cut boards using carbide tipped blades.
 - 3. Drilling can be accomplished using twist drills recommended for metals.
 - 4. Milling can be accomplished using standard milling machines of various types. Relief Angle 20° to 30°; Cutting speed to be optimized with the number of knives and feed rate.
 - 5. Routing can be accomplished using standard carbide tipped routers used in woodworking.
 - 6. Edge Finishing: Various sanding, grinding or filing tools. Do not allow excessive frictional heat to build up.
 - 7. Linear Thermal Expansion and Contraction: Allow for 1/8 inch movement for each 18 ft. board. Butted joints shall be glued with Bond & Fill to eliminate separation of joint.

3.4 ADJUST AND CLEAN

- A. Replace all damaged siding, trim, soffits, and accessories.
- B. Remove debris and excess materials not part of extra stock from Project site.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. Provide all flashing and sheet metal work as required to complete the work of the Contract. Include, but do not limit to:
 - 1. Exposed metal (Kynar finished Aluminum) flashings.
 - 2. Aluminum gutters and downspouts.
 - 3. Zinc-coated copper flashing for all concealed flashings.
 - 4. Water barrier sheet membrane underlayment.
 - 5. All other flashing and sheet metal work indicated.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Wood blockings, nailers, etc., and plywood backing for work of this Section.
 - 2. Division 23 - HVAC: Sheet metal ductwork.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Show sizes, material gages, profiles, splices and other details. Provide installation templates for work installed by others. Show all interfaces and relationships to work of other trades.
- C. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each flashing material used.
- D. Verification Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.
 - 1. Ice and water barrier membrane, 12 in. x 12 in. minimum.
 - 2. Sheet metal for all exposed metal flashing, 12 in. x 12 in. minimum.

- E. Samples: Submit representative samples of each specified exposed to view metal item including gutter, downspouts, and flashings and including all components and accessories in specified thickness, profile, and metal color and finish.
- F. Coordination Drawings: Drawn to scale and coordinating sheet metal roofing installation with penetrations and roof-mounted items.
- G. Product test reports.
- H. Roll-Forming Equipment Certificate: Issued by UL.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of sheet metal roofing.
- B. Custom-Fabricated Sheet Metal Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate sheet metal.
- C. Roll-Formed Sheet Metal Fabricator Qualifications: An authorized representative of roll-formed sheet metal manufacturer for fabrication and installation of units.
- D. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- E. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" and CDA 'Copper in Architecture Handbook'.
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Build mockup of typical roof eave, including 'built-in zinc-coated copper gutter', fascia, and soffit; approximately 48 inches (1200 mm) square by full thickness, including attachments, underlayment, and accessories.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- G. Preinstallation Conference: Conduct conference at Project site.
- H. Comply with applicable requirements of Revere Copper's 'Copper and Common Sense' and CDA 'Copper in Architecture Handbook'.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials in manufacturer's sealed containers and rolls.
- B. Store indoors or under cover, on raised platforms, fully protected from damage.

1.6 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal (zinc-coated copper) that shows evidence of deterioration of factory-applied finishes within specified warranty period. Warranty period shall be for not less than three (3) years,

PART 2 - PRODUCTS

2.1 SHEET METAL FLASHINGS AND TRIM (FLASHINGS, GUTTERS, RAIN LEADERS)

- A. Aluminum: Provide ASTM B 209, alloy 3003, temper H14 aluminum for aluminum flashing, and related work, where indicated on Drawings. Finish shall be two-coat 70% Kynar 500 or Hylar 5000 (PVDF). Color shall be custom color as selected by the Architect. Unless otherwise indicated, provide the following minimum thicknesses:
 - 1. Miscellaneous Flashing: 0.040 in. (unless otherwise noted).
- B. Accessories: Provide all necessary components for a complete, functional, weathertight installation, including, but not limited to, trim, copings, fascias, mullions, sills, flashings, clips, sealants, closures, and fillers. Match metal materials with panels.
 - 1. Provide end closures for all open ends of metal ribs and hip covers.
- C. Isolation Coating: SSPC Paint 12.
- D. Slip Sheet: Dry rosin coated kraft paper.
- E. Plywood Sheathing: Refer to Section 06 10 00, ROUGH CARPENTRY.
- F. Water Barrier Sheet Membrane: Cross laminated high density polyethylene film and self-adhesive rubberized asphalt sheet material with a slip resistant top surface meeting the requirements of ASTM D 1970, and the following: minimum thickness shall be 40 mil; minimum tensile strength shall be 250 psi tested in accordance with ASTM D 412; adherence to plywood sheathing shall be 3.0 lb. per inch width when tested in accordance with ASTM D 903. Unless otherwise indicated, minimum width at roof eaves and at valleys shall be 36 in. Provide one of the following products:
 - 1. Weather Watch Ice & Water Barrier; GAF Building Materials, Corp.; Wayne, NJ 07470.
 - 2. Vycor Ice & Watershield; Grace Construction Products; Cambridge, MA 02140.
 - 3. Polyguard Deck Guard; Polyguard Products, Inc.; Ennis, TX 75119-0755.
- G. Sealants: Comply with material and installation requirements of Section 07 92 00, JOINT SEALANTS.
- H. Provide screws, bolts, and other accessories of same material and finish as sheet metal with which used.
- I. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- J. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- K. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant.
- L. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00, JOINT SEALANTS.

- M. Epoxy Seam Sealer: Two-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.
- N. Adhesives: Type recommended by flashing or sheet metal manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
- O. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
- P. Roofing Cement: ASTM D 4586, asphaltic.

2.2 FABRICATION

- A. General: Shop fabricate work to the greatest extent possible. Fabricate work straight, plumb, level and square, and to provide the best watertight, weatherproof performance with proper expansion provisions in running work. Comply with referenced SMACNA Manual standards and details and CDA referenced standard.
 - 1. Minimize oil-canning, buckling, tool marks and other noticeable defects.
 - 2. Fold edges to form hems.
 - 3. Make joints watertight.
 - 4. Solder non-moving copper seams and joints.
 - 5. Form moving seams with 12 in. lapped, bayonet-type, sealant filled joints.
 - 6. Isolate dissimilar materials with isolation coating.
- B. Sizes and Profiles: Provide work to sizes, shapes, and profiles indicated.

2.3 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
- B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.
- C. Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
 - 2. Low Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - 1. Exposed Fasteners: Heads matching color of sheet metal roofing by means of plastic caps or factory-applied coating.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

- B. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.
- C. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to produce joints in sheet metal roofing that will remain weathertight.
- D. Expansion-Joint Sealant: For hooked-type expansion joints, which must be free to move, provide non-setting, non-hardening, non-migrating, heavy-bodied polyisobutylene sealant.
- E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.
- F. Plastic Matrix Vent Channel Material for All Vented Locations: Equal to S-400 Strip Vent or PS-400 Strip Vent, manufactured by Cor-A-Vent, Inc. or approved equal. Color (black or white) shall be selected by Architect.

2.5 SHEET METAL FLASHING AND ACCESSORY FABRICATION

- A. Flashing and Trim: Formed from minimum 16 oz. zinc-coated copper sheet. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent sheet metal.
- B. General: Shop fabricate work to the greatest extent possible. Fabricate work straight, plumb, level and square, and to provide the best watertight, weatherproof performance with proper expansion provisions in running work. Comply with referenced SMACNA Manual standards and details.
 - 1. Minimize oil-canning, buckling, tool marks and other noticeable defects.
 - 2. Fold edges to form hems.
 - 3. Make joints watertight.
 - 4. Form moving seams with 12 in. lapped, bayonet-type, sealant filled joints.
 - 5. Isolate dissimilar materials with isolation coating.
- C. Sizes and Profiles: Provide work to sizes, shapes, and profiles indicated.
- D. Counterflashing Fabrication: Unless indicated otherwise, provide SMACNA Manual, Figure 4-3 or Figure 4-4 for reglet application, and Figure 4-5 for "Z" flashing application.
 - 1. Step Flashing: Fabricate step flashing to comply with SMCNA Manual, Figure 4-7.
- E. Fabricated Metals and Roof Specialties: Fabricate all metal work including gutters, downspouts, and flashings in strict accordance with the Drawings and as specified and as required to meet approval of roofing membrane manufacturer's recommendations and the performance standards specified for roof system. Unless otherwise indicated. Provide the following:
 - 1. Hanging Gutters: Fabricate to indicated cross section, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from

same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

- a. Fabricate gutters from zinc-coated copper; minimum 16 oz. per sq. ft., or as indicated on the Drawings.
2. Downspouts: Fabricate round downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - a. Fabricate downspouts from zinc-coated copper; minimum 16 oz. per sq. ft., or as indicated on the Drawings.
3. Conductor Heads: Where conductor head is required, fabricate complete from same material as gutter/downspout, and anchors.
 - a. Unless indicated otherwise, provide SMACNA Manual, Figure 1-25 for conductor head.

PART 3 - EXECUTION

3.1 INSPECTION OF SURFACES

- A. Carefully inspect surfaces to receive flashing and sheet metal work for all conditions affecting sheet metal application and performance. Carefully check wood blockings, inserts, nailers, etc., for adequate anchorage. Defects shall be reported in writing to the Architect and sheet metal work shall not proceed until defects have been corrected.
- B. Beginning of work constitutes acceptance of conditions of surfaces to which this work is to be applied.

3.2 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment and building-paper slip sheet on roof sheathing under sheet metal roofing. Use adhesive for temporary anchorage. Apply at locations indicated on Drawings, in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm)
- C. Apply slip sheet over underlayment before installing sheet metal roofing.

3.3 INSTALLATION, GENERAL

- A. General: Install sheet metal roofing perpendicular to purlins or supports. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
1. Field cutting of sheet metal roofing by torch is not permitted.
 2. Rigidly fasten eave end of sheet metal roofing and allow ridge end free movement due to thermal expansion and contraction. Predrill roofing.
 3. Provide metal closures at rake edges.
 4. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 5. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition.
 6. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.
- B. Fasteners: Use fasteners of sizes that will not penetrate completely through substrate.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of dissimilar metals.
- D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with butyl sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets or straps (to match existing) spaced not more than 36 inches (900 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
- C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
- D. Connect downspouts to cast iron drainage boots as indicated on the Drawings.

3.5 SHEET METAL FLASHING INSTALLATION

- A. Unless otherwise indicated, install sheet metal flashing to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual". Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.
 - B. Install exposed sheet metal work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - C. Roof-Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.
 - D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
 - E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-temper edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pre-tempered surface would show in finished Work.
 - F. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA Standards. Fill joint with sealant and form metal to completely conceal sealant.
 - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
 - G. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - H. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
 - 1. Underlayment: Where installing stainless steel directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.
 - 2. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.
 - I. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches (50 mm) and bed with sealant.
 - J. Strip Vents: Provide strip vents at all vented locations indicated to provide vent channel. Strip vent shall be installed so as to be 'concealed from view'.
- 3.6 CUSTOM-FABRICATED SHEET METAL INSTALLATION

- A. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges, unless otherwise indicated.
1. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
 2. Nail cleats not more than 12 inches (300 mm) o.c. Bend tabs over nails.
- B. Seal joints as shown and as required for leakproof construction. Provide low-slope transverse seams using cleats where backup of moisture may occur.
1. Prepare joints and apply sealants to comply with requirements in Section 07 92 00, JOINT SEALANTS.
- C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.
1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
- 3.7 ACCESSORY INSTALLATION
- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual". Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

END OF SECTION

SECTION 07 84 00

THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Provide all labor, materials, and equipment necessary to complete the work of this Section. The work of this Section includes providing through-penetration firestop systems consisting of a material, or combination of materials, installed to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, or gases through penetrations in fire-rated barriers.

1. Firestops shall be used in locations including, but not limited to, the following:
 - a. Penetrations for the passage of duct, cable, cable trays, conduit, piping, electrical busways, and electrical raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor slabs and floor/ceiling assemblies), and vertical service shafts.
 - b. Construction joints between structurally separate sections of walls or floors.
 - c. Between stories unless within a fire-rated shaft.
 - d. Above walls or partitions extending to underside of ceiling or roof assemblies above.
 - e. Concealed furring spaces behind finishes.
 - f. Where pipes, conduits, ducts, and other items pass through fire-rated assemblies.
 - g. Openings for items mounted on or within fire-rated assemblies.
 - h. Replacing of any firestopping damaged as part of the renovation work.
2. Where specific firestop system is not indicated on the Drawings for a through penetration, the Contractor shall include proposed firestop system designs in submittals.
3. Where there is no specific UL Firestop System available for a particular application, the firestopping contractor shall obtain from the firestop manufacturer a system drawing to be submitted to the Architect for approval prior to installation.
4. All firestopping work required or indicated shall comply with requirements of the Commonwealth of Massachusetts State Building Code and local authorities having jurisdiction.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
1. Section 06 10 00, ROUGH CARPENTRY; Wood framing and blocking.
 2. Section 07 21 00, THERMAL INSULATION.
 3. Section 07 92 00, JOINT SEALANTS; Sealants except firestopping sealants.
 4. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.

5. Division 23 - HVAC; Pipe and duct insulation.
6. Division 26 - ELECTRICAL; Conduit, wiring, etc.

1.04 SUBMITTALS

- A. Submit product data and MSDS for each type of firestop products to be used.
 1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
- B. Submit Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.
 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating items.
 2. Submit in accordance with recommendations contained in IFC 'Firestopping Manual of Practice'.
 3. Where project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration approved by firestopping manufacturer's fire protection engineer with modifications marked.
- C. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.
- D. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.
- E. Schedule: Submit a schedule of through penetrations which indicates the firestop system to be utilized for each different firestopping application.
 1. Schedule shall indicate construction of the wall or floor assembly; size, number, and material of penetrating items; firestop system designation; required F-rating, T-rating, and remarks, where applicable.
- F. Submit complete list of all firestop systems and materials to be utilized, including documentation of UL Classifications or approved third party testing.
 1. Include all of the individual materials required for each complete system.
 2. Indicate manufacturer's product name and number for each material.
- G. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of engineers and owners, and other information specified.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases. Include the following:

1. Firestop all penetrations passing entirely through fire resistance rated wall and floor assemblies and other locations as indicated on the Drawings.
 2. Provide and install complete through-penetration firestopping systems which have been tested and approved by UL, FM, or third party testing agency.
 3. Provide and install complete through-penetration firestopping systems which are designed and approved for the specific through-penetrations to be firestopped.
 4. Provide and install firestop materials of thickness, width, and density, as required for the fire resistive ratings specified herein and/or as indicated on the Drawings.
 5. The installation of the correct firestop system is as important as the firestop system itself.
- B. F - Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
- C. T - Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:
1. Where firestop systems protect penetrations located outside of wall cavities.
 2. Where firestop systems protect penetrations located outside fire-resistive shaft enclosures.
 3. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
 4. Where firestop systems protect penetrating items larger than a 4 in. diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
- D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119 or UL 2079, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.
- E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 2. For floor penetrations with annular spaces exceeding 4 in. or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- F. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.
1. For firestopping exposed to view, provide systems which result in a finished appearance similar to adjacent surfaces.
- 1.06 QUALITY ASSURANCE
- A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
 2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.
 3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 or UL 2079, under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:
 - a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
 - b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.
- B. Installer Qualifications: Engage an experienced Installer who is certified by and listed in the FM Directory. Submit qualifications of individuals certified by FM testing as "Designated Responsible Individual".
1. The installer shall have the necessary experience, staff, and training to install classified firestopping systems with documented experience and references.
 2. It is the intent that all firestopping be performed by one contractor as a sole source.
- C. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
1. Materials of different manufacture shall not be intermixed.
- D. Field-Constructed Mockup: Prior to installing firestopping, erect mockups for each different through-penetration firestop system indicated to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final installations.
1. Locate mockups on site in locations indicated or, if not indicated, as directed by Architect.
 2. Notify Architect one week in advance of the dates and times when mockups will be erected.
 3. Obtain Architect's acceptance of mockups before start of final unit of Work.
 4. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work.
 - a. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of Work.

- E. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
 - F. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
- 1.07 DELIVERY, STORAGE, AND HANDLING
- A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.
 - B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- 1.08 PROJECT CONDITIONS
- A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
 - B. Ventilation: Ventilate firestopping per firestopping manufacturer's instructions by natural means or, where this is inadequate, by forced air circulation.
- 1.09 SEQUENCING AND SCHEDULING
- A. Notify Owner's inspection agency at least one week in advance of firestopping installations; confirm dates and times on days preceding each series of installations.
 - 1. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction, if required, have examined each installation.
- 1.10 DEFINITIONS
- A. "Through-Penetration Firestop" is a material, device, or construction installed to resist, for a prescribed time, the passage of flame, heat, and gases through openings which penetrate the entire fire resistive construction in order to accommodate penetrating items. Incorporating the use of specific products installed in a specific manner, they shall only be installed in configuration for which they have been specifically tested and listed by Underwriters Laboratories (UL) and/or Factory Mutual (FM) as per UL 1479 and/or ASTM E 814.
 - B. "F-Rating" is the time period that a through penetration firestop limits the spread of flame and hot gases through the fire resistive construction, including the penetrating elements, when tested in accordance with the time-temperature curve defined in ASTM E 119.
 - C. "T-Rating" is the time period that a through-penetration firestop limits temperature rise through the fire resistive construction, including the penetrating elements, when tested in accordance with the time-temperature curve defined in ASTM E 119.
- 1.11 ENVIRONMENTAL REGULATIONS
- A. All materials shall be asbestos free and non-carcinogenic.

- B. Firestop materials shall contain no flammable or toxic solvents and shall not produce toxic or flammable outgassing during the drying or curing process.
- C. Firestop materials used shall not require solvent based chemicals for clean-up purposes.
- D. If required, hazardous disposal of firestop materials shall be strictly observed as noted on the individual MSDS.
- E. Water-based firestop materials shall be considered preferable over silicone or solvent based materials.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials including the following:
 - a. Semi-refractory fiber (mineral wool) insulation.
 - b. Ceramic fiber.
 - c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - d. Fire-rated formboard.
 - e. Joint fillers for joint sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.
- C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.
- D. Materials shall conform to UL 1479 AND ASTM E 814.
- E. Self-extinguishing damming materials shall be used, as specified by the manufacturer, as part of the designated firestop system.
- F. Firestop materials used shall be suitable and compatible with the penetrating item(s) including the surrounding materials.
- G. Firestop material which contains solvents that would attack plastics are not to be used.

2.02 FIRE-SAFING BOARD INSULATION

- A. Provide material tested, listed and labeled by UL and listed by UL in designs similar to

applications indicated. Provide semi-rigid, non-asbestos mineral fiber board, rated noncombustible when tested according to ASTM E 136:

1. k-Value: 0.25 at 75°F.
 2. Thickness: 4 in., unless otherwise indicated, and not less than thickness necessary to obtain required fire-rating.
 3. Density: Nominal 4 pcf.
 4. Product: Thermafiber, Thermafiber Safing Insulation; Partek Insulation, Inc., Paroc Safing Insulation; Fibrex, Inc., FBX Fire Safing Insulation; or approved equal.
- B. Intumescent Tape: Pemko Hot Smoke Seal, adhesive-backed intumescent, Item HSS2000, manufactured by Pemko Mfg. Co., Memphis, TN, or equivalent manufactured by Dow Corning or Bio Fireshield.
- C. Light Gage Bent Metal Retainer: Provide 14 gage galvanized steel bent angle with 1 in. upturned leg set, continuous, as indicated to retain safing insulation and intumescent tape.

2.03 MINERAL WOOL

- A. Provide loose mineral wool, rated noncombustible when tested in accordance with ASTM E 136, free of asbestos and glass fiber, and suitable for in-place density of 6 pcf to 12 pcf.
1. Hilti Mineral Wool; Hilti Corp.

2.04 CAULK AND PUTTY

- A. Provide one of the following products, or Architect approved equal, that meet or exceed specified requirements:
1. Biostop 500+; Bio Fireshield.
 2. Fire-Barrier Series; 3M Fire Protection Products.
 3. Flamesafe; W.R. Grace.
 4. CLK Adhesive Firestop; Nelson Firestop.
 5. STI SpecSeal S100.
 6. Hilti FS - One High Performance Sealant, Hilti CP 617 Firestop Putty Pad, or Hilti CP 618 Firestop Putty Stick; Hilti Corp.

2.05 FIRESTOP MORTAR

- A. Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.
- B. Provide one of the following products, or Architect approved equal, that meet or exceed specified requirements:
1. Novasit K-10; Rectorseal Corp.
 2. KBS Mortar Seal; International Protective Coatings Corp.
 3. CMP Firestop Compound; Nelson Firestop.
 4. STI SpecSeal Mortar.
 5. Hilti CP 637 Firestop Mortar; Hilti Corp.

2.06 FIRESTOP COLLARS

- A. Provide premanufactured fire protective pipe sleeves equal to one of the following products, or Architect approved equal, that meet or exceed specified requirements:

1. Bio-Fireshield Firestop Collars; Rectorseal Corp.
2. STI SpecSeal Firestop Collars.
3. Hilti CP 643N Firestop Collar or CP 644 Firestop Retaining Collar for Plastic Pipe; Hilti Corp.

2.07 FIRESTOP BAGS/PILLOWS

- A. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
- B. Provide one of the following products, or Architect approved equal, that meet or exceed specified requirements:
1. Firestop Pillows; Rectorseal Corp.
 2. KBS Sealbags; W.R. Grace.
 3. PLW Firestop Pillow; Nelson Firestop.
 4. STI SpecSeal Pillows.
 5. Hilti FS 657 – Fire Block; Hilti Corp.

2.08 WRAP STRIPS

- A. Single-component, elastomeric sheet with aluminum foil on one side. Provide one of the following products, or Architect approved equal, that meet or exceed specified requirements:
1. Biostop Wrap Strip; Bio Fireshield.
 2. SpecSeal Wrap Strip; STI.
 3. Fire Barrier FS195 Wrap Strip; 3M.
 4. Hilti CP 648E Endless Wrap Strip or CP 648S Single Wrap Strip; Hilti Corp.

2.09 COMPOSITE BOARDS

- A. Provide one of the following products, or Architect approved equal, that meet or exceed specified requirements:
1. Barrier Sheet Material; 3M or equivalent product by Johns Manville or Firetemp.
 2. Hilti CP 675T Firestop Board; Hilti Corp.

2.10 FIRE FOAM SEALANT

- A. Provide the following products that meet or exceed specified requirements:
1. Hilti CP 620 Fire Foam; Hilti Corp.

2.11 DAMMING/FORMING MATERIALS, FASTENERS, AND ANCHORAGE ACCESSORIES

- A. Provide damming/forming materials in accordance with manufacturer's recommendations.
- B. Provide fasteners and anchorage accessories complying with UL designs and other components and accessories as needed and as recommended by the firestopping material manufacturer.

2.12 MIXING

- A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
 - 1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 - 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.03 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
 - 1. Coordinate with fire protection and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire rated construction have been permanently installed prior to installation of firestops and smoke seals.
 - 2. Schedule and sequence the work to assure that partitions and all other construction which would conceal penetrations are not erected prior to the installation of firestop and smoke seals.
 - 3. 1 hr. and 2 hr. rated columns and beams and wall assemblies enclosed in gypsum board shall be firestopped where gypsum board meets structure above.
 - 4. Provide minimum 1 hour rating for penetrations, expansion joints, and slab edge conditions at non-rated floor slabs.
 - 5. Comply with manufacturer's requirements regarding maximum size for annular spaces

and materials to be used.

- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

- A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.
- D. Tool non-sag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.05 FIELD QUALITY CONTROL

- A. Inspecting agency employed and paid by Owner will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.
- B. Inspecting agency will report observations promptly and in writing to Contractor and Architect.
- C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.
- D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.06 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. Caulk and seal joints as indicated on the Drawings and as specified. Include, but do not limit to:
 - 1. Sealing of joints in exterior construction including concrete, exterior siding and trim, and aluminum storefront and aluminum curtain wall systems.
 - 2. Sealing of joints between perimeter of exterior door frames, window frames, and metal vents, louvers, and other items occurring in openings in exterior walls, and the surrounding construction, including bed sealing of thresholds.
 - 3. Sealing of interior perimeter joints at door frames, window frames, vents, louvers, and other wall openings.
 - 4. All other exterior and interior sealing called for, or reasonably inferred from the Drawings, and as required to provide weathertight conditions in exterior assemblies.
- B. The work of this Section contains remedial work which necessitates compatibility of new materials to adhere or otherwise attach to existing building envelope materials. It is the Contractor's responsibility to test or otherwise ensure compatibility of materials used as part of the joint sealant work with existing construction.
- C. Areas which require separate barriers or isolation from dissimilar materials shall be identified and these areas shall be specifically reviewed and approved by the Architect prior to remedial work.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 2. Section 07 84 00, THROUGH PENETRATION FIRESTOPPING; Firestopping including fire resistive sealants.
 - 3. Section 08 11 00, STEEL DOORS AND FRAMES.
 - 4. Section 08 91 15, METAL WALL LOUVERS.
 - 5. Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each sealant material used including all primers, joint backing, and bond breaker tapes. Provide certifications that sealant materials comply with specified requirements.

- B. Initial Selection Samples: Submit samples manufacturer's color charts showing complete range of colors, textures, and finishes available for each material used.
- C. Verification Samples: Submit actual representative samples of each sealant material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide sealant manufacturers standard cured sealant samples having minimum size of 4 in. long.
- D. Test Reports: Provide certified reports for all specified tests.
- E. Surface Preparation and Sealant Recommendations: Prior to starting the work, the Contractor shall submit the following additional data:
 - 1. Recommendations for proper surface preparation for each substrate, type of primer if required, and sealant(s) to be used for each joint to be sealed.
 - 2. Sealant manufacturer's approval of materials to be used and surface preparation procedures.

1.4 COMPATIBILITY

- A. Provide sealant and sealant joint backing materials suitable for the use intended and compatible with the materials with which they will be in contact. Compatibility of sealant and accessories shall be verified by the sealant manufacturer.

1.5 QUALITY ASSURANCE

- A. Source: For each sealant material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.
- B. Installer: A firm with a minimum of five years' experience in type of work required by this Section and which is acceptable to the manufacturers of the primary materials.
- C. Mock-Ups: Prior to commencing the primary work of this Section, provide mock-ups at locations acceptable to Architect. Obtain Architect's acceptance of visual qualities. Protect and maintain accepted mock-ups throughout the remainder of the work of this section to serve as criteria for acceptance of the work. Mock-ups shall include the following:
 - 1. Surface preparation of joint to be sealed based on approved recommendations.
 - 2. Location, size shape, color, and depth of joints complete with back-up material, primer, and new sealant. Mock-up may be part of finished work.
 - 3. Joint width conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application intended.
 - 4. Joint substrate conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.
- D. Alternate Materials: Should the Contractor wish to use alternate sealant types, sealant compositions, or other materials other than those specified, the Contractor shall submit product data of alternative material or products indicating location of use, reason for recommending the material, advantages of material over that specified, and other criteria to evaluate proposed substitution(s).

- E. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- F. Preconstruction Field-Adhesion Testing: Prior to installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.
- G. Preconstruction Testing: for Staining (Stain Resistance): ASTM D 2203, ASTM C 510, or ASTM C 1248; determine sealants will not stain joint substrates.

1.6 PROJECT CONDITIONS

- A. Perform work of this Section only when existing or forecasted weather conditions are within the limits established by manufacturers of the materials and products used.
 - 1. Do not install primers or sealants when atmospheric temperatures or joint surface temperatures are less than 40 degrees F (4 degrees C).
- B. Substrates: Proceed with work only when substrate construction and penetration work is complete.
- C. Coordinate sealant work and preparation of substrate to receive sealants and backing with work of other trades providing remedial or replacement work.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials under this Section shall be delivered to, and stored at, the job site in unbroken factory sealed containers with labels intact.

1.8 WARRANTY

- A. Furnish joint sealant manufacturer's written single-source performance warranty that joint sealant work will be free of defects related to workmanship or material deficiency for five years from date of Substantial Completion of the Project.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Before installation check each sealant for compatibility with adjacent materials and surfaces and with indicated exposures. Select sealers which are recommended by manufacturer for each application indicated. Where exposed to pedestrian or vehicular traffic, provide sealants which are non-tracking and are strong enough to withstand the traffic without damage.
- B. Provide colors as selected by Architect from manufacturer's standard and special colors. Where specifically requested, provide custom color matches.

2.2 SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Sealant Types: Provide the following sealants:

1. Sealant Type 1: Single component, medium modulus, neutral cure silicone sealant meeting the specified requirements of ASTM C 920 Type S, Grade NS, Class 50, Use NT, M, G, A, O and CAN/CGSSB-19.13-M87, equal to one of the following:
 - a. Spectrem 2 by Tremco Inc.
 - b. SilPruf SCS 2000 by General Electric Company.
 - c. Dow Corning 791 Silicone Weatherproofing Sealant by Dow Corning Corporation.
2. Sealant Type 2: Single component, ultra-low modulus, silicone sealant meeting the specified requirements of ASTM C 920 Type S, Grade NS, Class 100/50, Use NT, M, G, A, O and CAN/CGSSB-19.13-M87, equal to one of the following:
 - a. Spectrem 1 by Tremco Inc.
 - b. SilPruf LM SCS 2000 by General Electric Company.
 - c. Dow Corning 790 Silicone Weatherproofing Sealant by Dow Corning Corporation.
3. Sealant Type 3: Single or multi-component self-leveling or slope grade polyurethane sealant meeting the requirements of ASTM C 920, Type S, M, Grade P, Use T, M, A, O, equal to one of the following:
 - a. Tremco Inc. (Urethane) Vulkem 45 Class 25, slope rated Vulkem 45SSL Class 50, THC 900 up to 5 percent, THC 901 up to 10 percent slope Class 25.
 - b. Sikaflex 1c SL by Sika Corporation.
 - c. Sonneborn SL2 by BASF Chemical Company.
4. Sealant Type 4: Multi-component polyurethane sealant meeting the requirements of ASTM C 920, Type M, Grade NS, Class 50, Use T, NT, I, M, A, O and CAN/CGSB-19.24-M90, equal to one of the following:
 - a. Dymeric 240/240FC by Tremco Inc.
 - b. Sikaflex 2a by Sika Corporation.
 - c. Sonneborn NP2 by BASF Chemical Company.
5. Sealant Type 5 - Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
6. Sealant Type 6 - Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.3 PREFORMED JOINT FILLER

- A. Preformed, pre-compressed, self-expanding, open-cell foam sealant manufactured from high-density urethane foam impregnated with a non-drying, water repellent agent; and factory produced in pre-compressed sizes in roll to fit joint covered with a protective wrapping; develops a watertight and airtight seal when compressed to degree specified by manufacturer, equal to one of the following:
 1. Illmod 600 by Tremco Inc.
 2. Emseal Backerseal by Emseal Joint Systems Ltd.
 3. Willseal 600 by Willseal USA.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Provide primer recommended by sealant manufacturer for surfaces to be adhered to. Provide all testing required for compatibility of primer and sealants and primer to substrate applications.
- B. Bond Breaker Tape: Provide polyethylene or other plastic tape recommended by sealant manufacturer to prevent three-sided adhesion.
- C. Backer Rod: Provide compressible rod of durable non-absorptive material recommended by sealant manufacturer for compatibility with sealant. Provide products of one of the following manufacturers:
 - 1. Backer Rod Manufacturing and Supply Co.
 - 2. Dow Chemical Co.
 - 3. W. R. Meadows, Inc.
 - 4. Williams Products, Inc.
- D. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- E. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
- F. Provide miscellaneous materials of type that will not bleed through sealant, discolor surface, or produce other deleterious effects. Select size to provide compression to approximately 2/3 original width when in place. Provide backing material profile concave to the rear of the sealant and equipped with a bond-breaking film.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Installer shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of sealant work means Installer's acceptance of joint surfaces and conditions.

3.2 PREPARATION

- A. Strictly comply with sealant manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this Section.
 - 1. Unless otherwise indicated, use of sealants shall conform to ASTM C 962.
- B. Clean joint surfaces immediately before installation of sealants, primers, tapes and fillers.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
 - a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean,

- sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
- b. Remove laitance and form-release agents from concrete.
 - c. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - d. Remove paints from joint surfaces except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer.
 - e. Remove wax, oil, grease, dirt film residues, temporary protective coatings and other residues by wiping with cleaner recommended for that purpose. Use clean, white, lint-free cloths and change cloths frequently.
2. Blow out dust, loose particles, and debris with moisture and oil-free compressed air. Remove any pieces of caulk and backer rod lodged in joint.
- C. Tape or mask adjoining surfaces to prevent spillage and migration problems.
1. Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears.
 2. Apply tape so as not to shift readily.
 3. Remove tape immediately after tooling without disturbing joint seal.
- D. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- ### 3.3 BACKER ROD AND BOND BREAKER - INSTALLATION
- A. Backer Rod: Provide joint backer material uniformly to depth required by sealant manufacturer for proper joint design using a blunt instrument.
1. Fit securely by compressing backer material 25 percent to 50 percent so no displacement occurs during tooling.
 2. Avoid stretching or twisting joint backer.
- B. Bond Breaker: Provide bond-breaker where indicated or recommended by sealant manufacturer, adhering strictly to the manufacturer's installation requirements.
- ### 3.4 INSTALLATION OF SEALANTS
- A. Provide the approved sealant system where shown on the Drawings, and in strict accord with the manufacturer's recommendations as approved by the Architect.
- B. Install sealants immediately after joint preparation.
- C. Mix and apply multi-component or single component sealants in accord with manufacturer's printed instructions.
- D. Install sealants to fill joints completely from the back, without voids or entrapped air, using proven techniques, proper nozzles and sufficient force that result in sealants directly contacting and fully wetting joint surfaces.

- E. Install sealants to uniform cross-sectional shapes with depths relative to joint widths that allow optimum sealant movement capability as recommended by sealant manufacturer.
- F. Tool sealants in manner that forces sealant against back of joint, ensures firm, full contact at joint interfaces and leaves a finish that is smooth, uniform and free of ridges, wrinkles, sags, air pockets and embedded impurities.
 - 1. Dry tooling is preferred; tooling liquids that are non-staining, non-damaging to adjacent surfaces and approved by sealant manufacturer may be used if necessary when care is taken to ensure that the liquid does not contact joint surfaces before the sealant.
 - 2. Provide concave tooled joints unless otherwise indicated to provide flush tooling or recessed tooling.
 - 3. Provide recessed tooled joints where the outer face of substrate is irregular.
- G. Remove sealant from adjacent surfaces in accord with sealant and substrate manufacturer recommendations as work progresses.
- H. Protect joint sealants from contact with contaminating substances and from damages. Cut out, remove and replace contaminated or damaged sealants, immediately, so that they are without contamination or damage at time of substantial completion.

3.5 EXTENT OF SEALANT WORK

- A. General Extent: Seal joints indicated, and all exterior joints, seams, and intersections between dissimilar materials.
- B. Exterior Sealing: Without limitation, the work of this Section includes sealing the following:
 - 1. Concrete to metal joints.
 - 2. Concrete to concrete joints.
 - 3. Metal to metal joints.
 - 4. Perimeter of openings or penetrations.
 - 5. Joint fillers for all joints including backer rods, bond breaking tape, and accessories.
- C. Schedule of Sealants to be used for Applications:
 - 1. Sealant Type 1 - Single Component Neutral-Curing Medium Modulus Silicone Sealant: Sealant Type 1 shall be used for the following:
 - a. Control and expansion joints in cast-in-place concrete.
 - b. Joints between materials listed above and frames of doors and windows.
 - c. Other joints as indicated.
 - 2. Sealant Type 2 - Single Component Moisture Curing Low-Modulus Silicone Sealant: Sealant Type 2 shall be used for the following:
 - a. Metal panels.
 - b. On film side of poly facers of peel-n-stick self-adhered membranes.
 - c. Other panel systems where high movement is expected.
 - 3. Sealant Type 3 - Single or Multi Component Self-Leveling or Slope Grade Polyurethane Sealant: Sealant Type 3 shall be used for the following:

- a. Exterior horizontal non-traffic and traffic isolation and contraction joints in cast-in-place concrete slabs
4. Sealant Type 4 - Multi-Component Non-Sag Polyurethane Sealant: Sealant Type 4 shall be used for the following:
 - a. Control, expansion, and isolation joints in non-building envelope conditions
 - b. Other joints as indicated
 5. Sealant Type 5 - Butyl Sealant: Sealant Type 5 shall be used for the following:
 - a. Metal to metal joints subject to movement.
 - b. Other joints as indicated.
 6. Sealant Type 6 - Epoxy Seam Sealer: Sealant Type 6 shall be used for the following:
 - a. Metal to metal joints where panels are fixed and no movement will occur.
 - b. Other joints as indicated.

3.6 CURING

- A. Cure sealants in strict compliance with manufacturers' instructions and recommendations to obtain highest quality surface and maximum adhesion. Make every effort to minimize accelerated aging effects and increase in modulus of elasticity.

3.7 CLEANING AND PROTECTION

- A. Remove smears from adjacent surfaces immediately, as the work progresses. Exercise particular care to prevent smearing or staining of surrounding surfaces which will be exposed in the finished work, and repair any damage done to same as result of this work without additional cost to Owner.
- B. Remove and replace work that is damaged or deteriorated.
- C. Clean adjacent surfaces using materials and methods recommended by sealant manufacturer. Remove and replace work that cannot be successfully cleaned.
- D. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protection immediately before final acceptance.

END OF SECTION

SECTION 08 11 00

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. Provide steel doors and frames and related items as indicated on Drawings and as specified herein. Include, but do not limit to, the following:
 - 1. Interior and exterior flush doors.
 - 2. Exterior steel frames for doors.
 - 3. Interior steel frames and mullions for doors, transoms, sidelights, interior glazed panels.
 - 4. Door and frame assemblies of the following type.
 - a. Labeled and fire rated.
 - b. Thermal rated (insulated).

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 2. Section 06 10 00, ROUGH CARPENTRY; Wood blocking.
 - 3. Section 07 92 00, JOINT SEALANTS; Sealing of door frame perimeter.
 - 4. Section 08 14 00, WOOD DOORS; Wood doors to be set in steel frames.
 - 5. Section 08 41 00, EXTERIOR ALUMINUM ENTRANCES AND FRAMING.
 - 6. Section 08 71 00, DOOR HARDWARE; Templates and hardware schedules, including power door operator hardware.
 - 7. Section 08 80 00, GLAZING; Glazing of steel doors and frames.
 - 8. Section 09 91 00, PAINTING; Field finishing of metal doors and frames indicated to be painted.

1.3 SUBMITTALS

- A. Product Data: Submit, for each type of door and frame specified, manufacturer's illustrated literature, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation of steel frames and of custom steel doors. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

1. Note glass thickness and setting method to confirm that glazing frames and stops have been coordinated with glass and glazing requirements.
 - C. Door Schedule: Use same reference designations indicated on Drawings, in Door Schedule, and in the Door Hardware Schedule in preparing schedule for doors and frames.
- 1.4 QUALITY ASSURANCE
- A. Source: Provide doors and frames by a single manufacturer for the entire project.
 - B. For doors and frames installed in fire-rated assemblies and where indicated or required by authorities having jurisdiction, provide door and frame assemblies that comply with NFPA 80, and which have been tested, listed and labeled in compliance with ASTM E 152 by an independent agency acceptable to authorities having jurisdiction.
- 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products in accordance with Section 01 60 00, PRODUCT REQUIREMENTS.
 - B. Provide doors, frames, and related items properly packaged and protected during shipping, handling, and storage to prevent damage.
 - C. Store materials indoors under cover on raised platforms, fully protected from dirt and moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide standard steel doors and frames by one of the following:
 1. Amweld Building Products
 2. Ceco Corp.
 3. Curries Company.
 4. Republic Builders Products.
 5. Steelcraft Manufacturing Co.

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.
- D. Sound-Deadening Fill in Door Frames:
 1. Plaster: ASTM C 28 gypsum neat plaster with sand aggregate, for hand application; equal to United States Gypsum Company "Red Top" or "Structo-Base," regular type.
 2. Grout: ASTM C 476, Fine Grout.

2.3 FLUSH STEEL DOORS

- A. General: Provide doors of sizes, thicknesses, and designs indicated.
- B. Interior Doors: ANSI 250.8 Level 2, heavy-duty, .042-inch- (1.3-mm-) minimum thickness cold-rolled steel faces, Model 2 (seamless), and ANSI A250.4 for Physical Performance Level B (Heavy Duty).
- C. Exterior Doors: ANSI 250.8 Level 3, extra heavy-duty, 0.053 inch (1.3 mm) minimum thickness steel before galvanizing, Model 2 (seamless), and ANSI A250.4 for Physical Performance Level A (Extra Heavy Duty).
 - 1. Core Construction: Foamed polyurethane insulation; U-value 0.067 or less.
 - 2. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- (1.3-mm-) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.
- D. Single-Acting, Door-Edge Profile: Square edge, except where beveled edge is required for fire-rated doors.
- E. Vision Lite Systems: Manufacturer's standard kits consisting of glass pane moldings to accommodate glass thickness and size of vision panel indicated. Locate removable stops on the secure side of the door. Fabricate from 20 gauge minimum steel in profile shown on drawings. Prime-paint same as door. Furnish with countersunk, tamper-proof screws.
- F. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.4 PRESSED METAL FRAMES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated. For exposed fasteners, provide countersunk flat head screws and bolts.
- B. Interior Welded Frames: Fabricate frames from cold-rolled steel, with corners mitered, coped, welded and ground smooth.
 - 1. Fabricate frames for Level 2 doors from 0.053-inch (1.3 mm) thick cold-rolled steel.
 - 2. Fabricate frames for wood doors from 0.053-inch (1.3 mm) thick cold-rolled steel.
- C. Exterior Frames: Fabricate frames from metallic-coated steel sheets of thickness indicated below, with corners mitered, coped, welded and ground smooth. Touch-up metallic coating at welds.
 - 1. Fabricate frames for Level 3 doors from 0.067-inch (1.7 mm) thick steel.
- D. Reinforce frames at finish hardware locations as specified in the Fabrication article.
- E. Door Silencers: Except on weatherstripped frames, drill stops to receive three (3) silencers on strike jambs of single-door frames and two (2) silencers on heads of double-door frames.
- F. Plaster Guards: Provide 0.016-inch- (0.4-mm-) thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

- G. Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.
 - 1. Wall Anchors in Masonry Construction: 0.177-inch- (4.5-mm-) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.
- H. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D, as applicable.

2.5 FABRICATION

- A. Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance and free from defects including warp or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site.
- B. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel.
- C. Clearances, Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between non-fire-rated pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
- D. Clearances, Fire Doors: Provide clearances according to NFPA 80.
- E. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C 236 or ASTM C 976 on fully operable door assemblies.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U factor of 0.10 Btu/(hr. x sq. ft. x deg. F.) or better.
- H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
 - 1. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with DHI "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames" and ANSI A205.8; where there is a conflict between these two standards, consult the Architect.
 - 2. Reinforce doors and frames at finish hardware locations with steel reinforcing plates complying with ANSI A205.8-1998 for minimum thicknesses and dimensions.
 - a. Hinges: 0.123 inch (12 MSG)
 - b. Lock Face, Flush and Surface Bolts: 0.067 inch (14 MSG)
 - c. Surface-Applied Closers, Hold-Open Arms, and Exit Devices: 0.067 inch (14 MSG)
 - d. Pull Plates and Bars: 0.053 inch (16 MSG) on door only.
 - e. Floor checking hinges and pivot hinges: 0.167 inch (7 MSG)
 - f. Kick & Push Plates: Reinforcing is not required.

- g. Other Surface-Mounted Hardware: 0.053 inch (16 MSG).
 - h. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
 - 3. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with DHI "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames" and ANSI A205.8; where there is a conflict between these two standards, consult the Architect.
- J. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.
 - 1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
 - 2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.
 - 3. Drill stops and frame to receive countersunk flat-head machine screws spaced uniformly not more than 12 inches (304.8 mm) on center. Furnish flat head machine screws of appropriate size for fastening stops to frame.
- K. Transom and Sidelight Panels: Fabricate transom panels of same construction as door panels.

2.6 FINISHES

- A. Shop Painting, General: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
- B. Preparation: Clean steel surfaces to remove mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
- C. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's installation instructions, and these specifications.
- B. Preparation: For frames which are to be installed in openings in gypsum board construction, fill frame full with plaster before erecting. For frames which are to be installed in openings in masonry construction, fill frame solid with grout before erecting.
- C. Placing Frames: Comply with provisions of SDI-105 unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 1. Place frames prior to construction of enclosing walls and ceilings.
 - 2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
 - 3. In existing concrete or masonry construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding

- heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
4. In metal stud partitions, provide at least three wall anchors per jamb; install adjacent to location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
 5. At in-place drywall partitions install knock-down slip-on drywall frames
 6. Install fire-rated frames in accordance with NFPA 80.
 7. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.
- D. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
1. Install fire-rated doors with clearances specified in NFPA 80.
 2. Smoke-Control Doors: Install to comply with NFPA 105.
- E. Transom and Sidelight Panel Installation: Clean glazing rabbets. Set solid panels into the openings using setting blocks and edge blocks as necessary to center the panel in the framed opening and allow room for thermal expansion and contraction. Secure in place with the metal stops furnished with the frame.
- 3.2 ADJUSTING AND CLEANING
- A. Prime Coat Touch-up: Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- B. Final Adjustments: Just prior to final inspection, check and readjust operating hardware. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable. Leave steel doors and frames undamaged and in proper operating condition.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. The work of this section includes, but is not limited to, the following:
 - 1. Solid core flush interior wood doors with veneer faces, transparent finish.
 - 2. Factory finishing of wood doors.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 06 20 00, FINISH CARPENTRY; Plastic laminate work.
 - 2. Section 08 11 00, STEEL DOORS AND FRAMES; Steel door and frame assemblies including steel frames for wood doors.
 - 3. Section 08 71 00, DOOR HARDWARE.
 - 4. Section 08 80 00, GLASS AND GLAZING.
 - 5. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.
 - 6. Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Shop Drawings: Submit drawings indicating location and size of each door, details of construction, swings, undercuts, bevels, glass and glazing, elevations for each door type, location and extent of hardware blocking, fire ratings, and other pertinent data.
- B. Samples: Submit cutaway door samples to Architect for approval showing core construction, cross banding, and face veneer of each door type including finish, joinery, and material qualities of typical stile, rail, molding, and panel design.
 - 1. Transparent Finished Wood Doors: Submit samples of door faces representing typical range of color and grain, and specified finish. Also submit strips of solid wood 3 in. x 1 in. of species to be used for exposed edges, trim, moldings (sticking), panels, and other solid wood components.
- C. Product Data: Submit complete manufacturer's product data to Architect for approval, consisting of complete product description and specifications, details of core and edge construction, fire test results, trim for openings and louvers profiles, finishes, complete installation instructions, and other pertinent technical data required for complete product and product use information.

- D. Certificate of Product Compliance: Manufacturer's certificate evidencing compliance of flush wood doors and stile and rail wood panel doors with requirements of this Section.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each door type from one source and by a single manufacturer.
- B. Flush wood doors shall conform to ANSI/NWWDA I.S. 1 and AWI Quality Standards Section 1300.
 - 1. Mark each flush door with WDMA Wood Flush Door Certification Hallmark certifying compliance with ANSI/NWWDA I.S. 1.
- C. Manufacturing of doors shall not use composite wood and agrifiber products that contain urea-formaldehyde resin.
- D. Adhesives, adhesive bonding primers, or adhesive primers used on this Project shall meet or exceed the VOC content limits of the State of California South Coast Air Quality Management District (SCAQMD) Rule #1168 – Adhesive and Sealant Applications'.
- E. Door manufacturer shall be responsible for insuring that all coatings and the application of all coatings conform to all federal, state, and local regulations, including VOC/VOS rules at the time of application.
 - 1. Paints and coatings must meet or exceed VOC and chemical component limits of Green Seal's Paint Standards GS-11 and GC-03.
- F. Product Certification: Door manufacturer shall provide certification that doors comply with specified requirements including those of referenced door standard.

1.5 FIRE-RATING REQUIREMENTS

- A. Doors indicated or scheduled on Drawings to receive Underwriters' Laboratories (UL) label shall bear a UL label of Class and hour-rating scheduled on Drawings.
- B. Fire-rated doors and frame assemblies shall conform to requirements of NFPA 80. Provide certification that labeled doors provide maximum heat transmission of 250^oF. in 30 minutes. Test methods shall conform to ASTM E 152.
- C. Provide certification that labeled doors provide maximum heat transmission of 250 degrees F. in 30 minutes.

1.6 PRODUCT STORAGE AND HANDLING

- A. Doors shall be properly packaged and wrapped by manufacturer and fully protected during shipment, unloading, and storage, in conformance with National Wood Window and Door Manufacturer's Association (NWWDA) 'How to Store, Handle, Finish, Install, and Maintain Wood Doors'.
 - 1. Comply with requirements of referenced standard and manufacturer's instructions.
- B. Doors shall not be delivered to job site until building has thoroughly dried out. Doors shall be stored flat, above floors, in dry area(s) until installation. Doors shall be stored and hung in buildings that maintain a humidity range of between 30% and 60%.

- C. Identify each door with individual opening numbers which correlate with shop drawing designation system for doors, frames, and hardware, using temporary removable or concealed markings.

1.7 PROJECT CONDITIONS

- A. Conditioning: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
 - 1. Maintain a humidity range of between 30% and 60%.

1.8 WARRANTIES

- A. Provide written manufacturer's warranties in Owner's name for materials furnished under this Section where such guarantees are offered in published product data, in addition to, and not instead of, other liabilities established by law and other provisions of Contract Documents. Include, but do not limit to, standard manufacturer's warranties as follows:
 - 1. Life of installation for solid core flush interior doors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Interior Flush Wood Doors: Flush-type solid wood doors with crossbanded particleboard core and wood veneer face shall be as manufactured by one of the following manufacturers that comply with specified requirements:
 - 1. Algoma Hardwoods Inc.
 - 2. Eggers Industries, Architectural Door Division
 - 3. Marshfield Door Systems.
 - 4. VT Industries.

2.2 SOLID CORE FLUSH WOOD DOORS

- A. General: AWI PC-5 construction as specified in AWI Quality Standards Section 1300, Custom Grade for painted doors and Premium Grade for transparent finished doors. Core, stiles, and rails shall be glued together before sanding. Wood for stiles and rails shall be thoroughly seasoned, kiln-dried stock with 5% to 8% moisture content.
 - 1. Core for non-fire-rated doors shall be 28 to 32 lb./cu. ft., Grade 1-L-1 crossbanded particleboard conforming to ANSI A208.1, consisting of wood particles bonded together with synthetic resins, except as specified otherwise.
 - 2. Crossbands shall be 1/16 in. thick hardwood, full width of door, with grain at right angle to face veneer grain.
 - 3. Veneers for transparent finishes: Veneer shall be Plain Sliced Select White Maple, at least 1/50 in. thick, adhered to 1/16 in. hardwood crossband, core, rails, and stiles by hot press method.
- B. Provide loose glazing stops as required for use under Section 08 80 00, GLASS AND GLAZING.

2.3 FABRICATION

- A. Prefit and premachine wood doors at factory.

- B. Comply with tolerance requirements of AWI Quality Standards for prefitting. Machine doors for hardware requiring cutting of doors with templates provided under Section 08 71 00, DOOR HARDWARE. Comply with final hardware schedules and door frame submittals and other information required to ensure proper fit of doors and hardware.
- C. Take accurate field measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in factory. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels:
 - 1. Fitting Clearances for Non-Fire-Rated Doors: Provide clearances of 1/8 in. at jambs and heads; 1/16 in. per leaf at meeting stiles for pairs of doors; and 1/8 in. from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 in. clearance from bottom of door to top of threshold.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
- D. Glazed Openings: Comply with requirements in Section 08 80 00, GLASS AND GLAZING.

2.4 FACTORY FINISHING

- A. Scope: Shop finishing work includes, but is not limited to, the following:
 - 1. Transparent Finished Work (Solid Core Wood Doors): Provide complete shop finishing of work indicated for transparent finish, including necessary field touch up after installation.
- B. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect and sheen.
 - 1. AWI Grade: Premium.
 - 2. Finish: AWI System TR-5.
 - 3. Staining: To match Architect's sample.
 - 4. Effect: Open finish.
 - 5. Sheen: Satin-medium rubbed effect.
 - 6. Finish system shall comply with specified VOC limits.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Examine door frame installations. Verify that frames meet tolerances and other requirements of wood door manufacturer, for type, size, and swing characteristics.
- B. Submit list of conditions detrimental to wood door installation and do not begin door installation until such conditions are corrected.

3.2 PREPARATION

- A. Condition doors to ambient temperature and humidity at points of installation before hanging.
- B. Undercut: Unless otherwise indicated, provide the following undercuts for wood doors:
 - 1. Toilet room doors: 1 in.

3.3 INSTALLATION

- A. Installations shall conform to approved submittals, including manufacturer's published instructions, to AWI Quality Standards, and to WDMA 'How to Store, Handle, Finish, Install, and Maintain Wood Doors'.
- B. Hang doors plumb and true. Apply door hardware so that opening and closing movement of doors is smooth and free.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

3.4 ADJUSTMENT AND CLEANING

- A. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from doors.
- B. Final Adjustments: Check and readjust operating finish hardware items, leaving doors and frames undamaged and in complete and proper operating conditions, in coordination with work of Section 08 71 00, DOOR HARDWARE.

3.5 CLEAN-UP

- A. Remove cartons and debris as work progresses and leave work areas in broom clean conditions at completion of work of this Section.

3.6 COMPLETION

- A. Before completion of work of this Section inspect work in company of Architect. Make adjustments and corrections to work leaving operating parts in perfect operating condition, jointing to adjacent material tight, surfaces without blemishes or stains, work properly executed and complete, and defects and damaged work replaced or corrected.
- B. Rehang or replace doors that cannot be made to operate properly, as directed by Architect.

END OF SECTION

SECTION 08450

CLAD WOOD EXTERIOR DOORS AND FRAMES

PART 1 - GENERAL

1.00 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.01 WORK INCLUDED

- A. Section Includes: Wood-framed aluminum-clad hinged wood door as scheduled including door, frame, glazing, and hardware provided by door manufacturer. Work of this Section shall include factory preparation of door and frame to receive mortise lockset.

1.02 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Wood framing and blocking.
 - 2. Section 07 46 00, EXTERIOR SIDING AND TRIM.
 - 3. Section 07 60 00, FLASHING AND SHEET METAL.
 - 4. Section 07 92 00, JOINT SEALANTS; Sealant and joint filler requirements including sealing perimeter of frames to adjoining construction.
 - 5. Section 08 14 00, WOOD DOORS; Interior wood doors.
 - 6. Section 08 71 00, DOOR HARDWARE; Door hardware except hardware indicated to be provided by door manufacturer. Include all templates required for preparation of door to receive hardware.

1.03 REFERENCES

- A. General: Standards listed by reference form a part of this specification section. Standards listed are identified by issuing authority, abbreviation, designation number, title or other designation. Standards subsequently referenced in this Section are referred to by issuing authority abbreviation and standard designation.
- B. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 450 - Voluntary Performance Rating Method for Mullled Fenestration Assemblies.
 - 2. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
 - 3. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 4. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - 5. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 - 6. NAFS - North American Fenestration Standard/Specification for windows, doors and skylights (AAMA/WDMA/CSA/101/I.S.2/A440).

- C. U.S. Department of Justice: Americans with Disabilities Act (ADA).
- D. Andersen E- Series Product Installation Guides.
- E. ASTM International (ASTM):
 - 1. ASTM C1036 - Standard Specification for Flat Glass.
 - 2. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - 3. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 4. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
 - 5. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
 - 6. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
 - 7. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
- F. Building Code Compliance Office of Miami-Dade, Florida. Florida Building Code Test Protocol for High-Velocity Hurricane Zones:
 - 1. TAS 201 - Impact Test.
 - 2. TAS 202 - Uniform Static Air Pressure Test.
 - 3. TAS 203 - Cyclic Wind Pressure Loading Test.
- G. Forest Stewardship Council (FSC): FSC Chain-of-Custody Certification.
- H. Insulating Glass Certification Council (IGCC): Insulating Glass Unit Certification.
- I. Insulating Glass Manufacturers Alliance of Canada (IGMAC) and Canadian General Standards Board (CGSB): Insulating Glass Units Standard CAN/CGSB 12.8-97.
- J. International Standards Organization (ISO): ISO 14021 - Environmental Labels and Declarations -- Self-Declared Environmental Claims (Type II Environmental Labeling).
- K. National Fenestration Rating Council (NFRC):
 - 1. NFRC 100 - Procedure for Determining Fenestration Product U-Factors.
 - 2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- L. Texas Department of Insurance: Product Evaluation WIN-1875 for compliance with wind loads specified in the International Residential Code (IRC) and the International Building Code (IBC).
- M. U.S. Environmental Protection Agency (EPA): ENERGY STAR.
- N. Window and Door Manufacturers Association (WDMA):
 - 1. WDMA Hallmark Certification Program for Manufacturers.
 - 2. WDMA I.S.4 - Industry Specification for Preservative Treatment for Millwork.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance Requirements:

1. Comply with requirements of NAFS.

B. Windborne Debris Performance Requirements:

1. Florida Building Code Test Protocol: TAS 201, TAS 202 and TAS 203.
2. ASTM E1886 and ASTM E1996.
3. Texas Department of Insurance: Comply with requirements of Texas Department of Insurance, Product Evaluation WIN-1875.

1.05 SUBMITTALS

A. Product Data: For each type of product required.

B. Shop Drawings: Showing methods of installation, plans, sections, elevations and details of walls, specified loads, flashings, vents, sealants, and interfaces with all materials not supplied by the patio door manufacturer, and identification of proposed component parts and finishes.

C. Samples: Selection and verification samples for finishes, colors and textures. Submit two complete sample sets of each type of material required.

D. Certificates: Signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.

E. Test and Evaluation Reports: Showing compliance with specified performance characteristics and physical properties.

F. Manufacturer's Instructions: Manufacturer installation, storage, and other instructions.

G. Qualification Statements: For manufacturer and installer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Member in good standing of the Insulating Glass Certification Council (IGCC).
2. Hallmark Certified Manufacturer and member in good standing of the Window and Door Manufacturers Association (WDMA).
3. Member in good standing of U.S. Green Building Council.
4. U.S. ENERGY STAR Partner.
5. Capable of demonstrating an extended history of window and door design, production and innovation.

B. Installer Qualifications:

1. Minimum five years' experience in the commercial installation of products required for the Project.
2. Experience on at least five projects of similar size, type and complexity as the Project.
3. An entity utilizing workers competent in techniques required by manufacturer for product types and applications indicated.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Deliver materials to Project in manufacturer's original unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials and accessories protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer off ground, under cover and not exposed to weather and construction activities.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's transferrable, non-prorated limited warranty.
 - 1. Warranty Period, Glass: 20 years.
 - 2. Warranty Period, Non-Glass Parts: 10 years.
- B. Special Warranty: Installer's standard form in which installer agrees to repair or replace clad wood patio doors that fail due to poor workmanship or faulty installation within the specified warranty period.
 - 1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Provide products from one of the following manufacturers:
 - 1. Marvin Windows and Doors (Marvin)
 - 2. Andersen Corporation (Andersen)
100 4th Ave. N.
Bayport, MN 55003-1096.
Phone: (800) 299-9029.
Fax: (800) 752-9230.
E-mail: technicalsupport@andersenwindows.com.
www.andersenwindows.com.
Local contact: Peter Kodys; pkodys@andersencorp.com

2.02 MANUFACTURED UNITS

- A. General: Provide clad exterior doors (double and single configurations) complying with the performance requirements indicated and tested according to NAFS.
- B. Basis-of-Design Product: Subject to compliance with requirements provide Andersen Corporation:
 - 1. Marvin Ultimate Commercial Doors, or approved equal.

2.03 MATERIALS

- A. Construction:

1. Cladding: Extruded aluminum, minimum thickness 0.050 inch (1.27 mm).
 2. Stiles and Rails: Preservative treated (WDMA I.S.4) laminated veneer lumber (LVL) with wood veneer, kiln dried and suitable for stain or painted finish on interior.
 3. Interior Exposed Frame: Preservative treated (WDMA I.S.4) lumber, kiln dried and suitable for stain or painted finish.
- B. Wood Species: Pine.
- C. Interior Finish:
1. Painted: Factory-applied before assembly, Color to be selected by Architect.
- D. Exterior Finish:
1. Painted Frame: Factory-applied baked-on silicone polyester enamel, in compliance with AAMA 2604; color as selected from manufacturer's standard colors.
 2. Painted Panel: Factory-applied baked-on silicone polyester enamel, in compliance with AAMA 2604; color as selected from manufacturer's standard colors.
- 2.04 HINGED DOOR
- A. Patio Door Type and Performance Requirements: Hinged patio door CFDIS-CP2.
1. Inswing Single-Panel Hinged Patio Door, Performance Class and Grade, Non-Impact-Resistant: CW-PG45 (40 x 120 inches).
- B. Environmental Certifications:
1. ENERGY STAR performance requirements.
 2. Indoor air quality performance.
- C. Hinged Patio Door Weatherstrip Type and Material:
1. Frame: Urethane foam with Q-Lon skin.
 2. Panel: Urethane foam Q-Lon skin.
- D. Installation Flange: Extruded vinyl.
- E. Hardware:
1. Factory prepare door to receive mortise lockset; template for hardware will be provided to door manufacturer. Refer to Section 08 71 00, DOOR HARDWARE.
- F. Divided Lights:
1. Type: Finelight grille, factory-installed between glass.
 - a. Pattern: As shown in Drawings.
 - c. Width, Shape and Color: 1 inch, contoured, 1-tone match patio door.
 - d. Material: Aluminum.
- G. Sills:
1. Type and Color: Inswing with oak threshold, aluminum with drainage channel, removable top plate, polyurethane thermal barrier, dark bronze

2. Type, Jamb Depth and Color: Inswing, low-threshold (ADA-compliant), 6-9/16 inches aluminum with polyurethane thermal barrier, with dark bronze anodized finish.

H. Exterior Trim and Accessories: None.

2.4 NON-IMPACT-RESISTANT GLAZING

A: Thermal Transmission (U-Factor), NFRC 100:

1. Inswing: 0.32 with grilles.

B. Solar Heat Gain Coefficient (SHGC), NFRC 200:

1. Inswing: 0.21 with grilles.

C. Visible Light Transmittance (VLT), NFRC 200:

1. Inswing: 0.35 with grilles.

D. Sound Transmission Class (STC)/Outdoor Indoor Transmission Classification (OITC), ASTM E90:

1. Single-Panel Inswing: 31/26.

E. Glass Units: Provide insulating glass units certified through Insulating Glass Certification Council as conforming to the requirements of IGCC and ASTM E2190.

1. Manufacturer Designation: High-Performance Low-E4 Glass (Solarban) ½ in. thickness).
2. Glazing Configuration: Dual-pane.
3. Tint: None.
4. Seal and Spacer Type: Dual sealed insulating glass units with polyisobutylene primary seal, silicone secondary seal and stainless steel spacers.
5. Glass Type: Fully tempered glass, ASTM C1048.
6. Opacity: None.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Provide all access doors and frames required for mechanical and plumbing work as indicated on Drawings and as specified. Refer to MEP Drawings for locations and sizes required.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 1. Section 09 21 16, GYPSUM BOARD ASSEMBLIES; Installation of access doors.
 2. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC).
 3. Division 26 - ELECTRICAL.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Show all interfaces and relationships to work of other trades.

1.05 QUALITY ASSURANCE

- A. Source: For each material type required for the work of this section, furnish primary materials which are the product of one manufacturer. Furnish secondary or accessory materials which are acceptable to the manufacturers of the primary materials.

1.06 TESTS

- A. Fire Resistance Ratings: Where fire resistant ratings are indicated or required by authorities having jurisdiction, provide materials and construction which are identical to assemblies whose fire resistance ratings have been tested in compliance by independent agencies acceptable to the Architect and authorities having jurisdiction. Provide U.L. labeled assemblies.

PART 2 - PRODUCTS

2.01 METAL ACCESS DOORS AND PANELS

- A. Furnish metal access doors and panels for access to valves, damper controls, pipes, conduits, switches, regulators, etc., to the proper trades for building into the work, except that any access panels specifically specified under the Mechanical or Electrical Sections of the Specifications to be furnished by those trades are excluded from the work of this Section.
- B. Furnish flush-type access doors, specially designed for each type of wall and ceiling finish and construction with which used, with factory-applied prime finish, as manufactured by J.L. Industries, Babcock-Davis, Karp Associates, Inc., or equal approved by Architect. Refer to Architectural, Mechanical, and Electrical Drawings for locations, sizes, and materials with which used.
 - 1. Where installed at fire-rated walls or ceilings access panels shall be of fire-resistive construction and shall bear the U.L. 2-hr. label.
 - 2. Where installed in Toilet Rooms and in areas finished with ceramic tile, access panels shall be AISI Type 304 stainless steel with No. 4 finish.
 - 3. Where installed in gypsum board walls, access panels shall be taped flange frame types, to finish flush with finished wall surface.
 - 4. Typical sizes shall be 12 in. by 12 in. and 24 in. by 24 in., except where noted otherwise.
- C. Access Doors and Panels - Types: Unless otherwise indicated, provide the following access panel types:
 - 1. Access Door (For use in Acoustical Ceilings and Gypsum Wallboard Ceilings): Recessed access panel, 16 gage steel frame, 16 gage steel door, piano hinge, and screwdriver operated cam type latch, equal to J.L. Industries Model TM.
 - 2. Access Door (For use in Gypsum Board Partitions): Recessed access panel, 16 gage steel frame, 16 gage steel door, concealed piano hinge, and screw driver operated cam type latch, equal to J.L. Industries Model WB.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All items furnished under this Section shall be delivered to site and turned over to the subcontractor for installation by other appropriate trades. Refer to Division 23 - HVAC and Division 26 - ELECTRICAL.

END OF SECTION

SECTION 08 51 69

INTERIOR STORM WINDOWS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Provide all interior storm windows at scheduled Cummings House windows as indicated on the Drawings and as specified herein, including:
 - 1. Monumental windows with operable awnings. Existing window is comprised of two sections and is approximately xx inch x xxx inch in size overall.
- B. Interior storm windows shall be aluminum framed magnetic one-lite operating type specifically designed for installation at interior of existing windows and providing lift out frame, divided lites, operable bottom lite, and operating interior screen. Provide the required types and sizes including all necessary hardware, fasteners, and miscellaneous equipment required for complete installation at each of the locations indicated.

1.03 RELATED REQUIREMENTS

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 07 92 00, JOINT SEALANTS; Perimeter sealing of windows.
 - 2. Section 08 59 50, EXTERIOR WINDOW RESTORATION.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: Provide representative sample showing all components of interior storm windows including all trim in specified finish.

1.05 QUALITY ASSURANCE

- A. Interior Storm Window Fabricator/Manufacturer Qualifications: A firm or individual with a minimum five (5) years documented experience; and demonstrated previous experience on a minimum of three (3) buildings or structures that are listed in the National Register of Historic Places or the equivalent.
- B. Mockups: Provide full size mock-up of installation for Architect's review.
 - 1. Approved mockups shall become part of the completed Work if undisturbed at time of Substantial Completion.

- C. Historic Preservation Guidelines: Except as otherwise directed, comply with published standards and guidelines published by the U.S. Secretary of the Interior and the National Park Service (NPS) Heritage Preservation Services.
- D. Field Measurements: Prior to ordering of each storm window unit, take accurate field measurements of each installation location to ensure that installed windows fit each opening for its intended use.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original and unopened containers, labeled with description of contents and name of manufacturer, and suitably wrapped to prevent damage to glass or finish.
- B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements for material/product storage.

1.07 WARRANTY

- A. Manufacturer shall provide a five (5) year warranty against faulty materials, paint and workmanship.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER / BASIS OF DESIGN

- A. Acceptable Manufacturer:
 - 1. Allied Window, Inc.
11111 Canal Road
Cincinnati, OH 45241
Telephone: 1-800-445-5411; 513-559-1212
Fax: 513-559-1883
Website: www.alliedwindow.com or www.invisiblestorms.com
- B. Basis of Design: Allied Window "MOL-OP" MAGNETIC ONE LITE - OPERATING.

2.02 MATERIALS

- A. Alloys: Aluminum shall be of commercial quality and of proper alloy for window construction free from defects impairing strength and durability. All straight extruded sections shall be of 6063-T5 alloy and temper and shall have a minimum ultimate tensile strength of 22,000 psi and a yield of 16,000 psi.
- B. Window Members: All sash members shall be of extruded aluminum with a 3/8 inch x 1 inch dimension. All extrusions shall be of sufficient strength to perform as designed. Window members shall have a nominal wall thickness of not less than 0.062 inch. All corner keys shall be of extruded aluminum. High-energy foam-backed magnetic tape shall be applied to jamb rails of removable panel/assembly.
- C. Fasteners: All screws and other miscellaneous fastening devices incorporated shall be zinc plated, cadmium plated or other non-corrosive metals compatible with aluminum.

- D. Hardware/Magnetic Seal: Head receptor to be extruded aluminum U-channel with dimensions of 1/2 inch x 5/8 inch and with nominal wall thickness of not less than 0.046 inch. The magnetic seal is accomplished by the use of one (1) of these jamb stop alternatives:
1. Foam-backed steel tape applied to U-channel noted above.
 2. Foam-backed steel tape applied directly to prime window frame system.
 3. Foam-backed steel tape applied to aluminum angle.
 4. Steel angle or channel.
- E. Weatherstripping:
1. Bottom rail of panel/assembly shall incorporate flexible 'sill-seal' weatherstripping.
 2. Operating track jamb members shall be lined with pile weatherstripping equal to Stan-pro #525-160, or approved equal.
- F. Glass and Glazing:
1. Glass: Glass shall be not less than 'B' quality. Standard factory glazing shall be 'DSB' (1/8 inch). Optional use of 5/32 inch, 3/16 inch, or tempered glass shall be dictated by size of panels, code requirements, or project specifications.
 2. Glazing Material. Glass shall be held in place with removable and reusable vinyl glazing splines. Vinyl shall be manufactured from virgin polyvinyl chloride. All corners shall be neatly mitered.
- G. Screens:
1. Provide extruded screen insert frame(s) (3/8 inch x 1-1/16 inch) with extruded aluminum corner keys.
 2. Provide standard or optional screen cloth for storm window screen units securely held in frame with vinyl spline. Standard screen cloth is charcoal aluminum 18 x 16 mesh (fiberglass, black aluminum, bright aluminum, or bronze screen wire optional).

2.03 CONSTRUCTION / FABRICATION

- A. Assembly: All windows shall be assembled in a secure and workmanlike manner. The master frame and insert frame(s) shall be of mitered head and sill. Frame rails and stiles shall be neatly joined together using extruded aluminum corner keys staked in place.
- B. Sash: The operable bottom sash shall be removable and be equipped with a full bottom rail lift handle. Heavy-duty spring-loaded latches shall be provided for variable sash positions for ventilation.

2.04 FINISH

- A. The exposed surfaces of all aluminum members shall be clean and free from serious surface blemishes. Standard finishes shall be mill finish or electrostatically applied baked acrylic enamel in white, colonial white, beige, black or bronze. Painted finish shall meet AAMA 603.6. Optional custom color finish to be two-part polyurethane paint (air dried). Clear anodized, bronze anodized and Kynar finishes are available under appropriate circumstances.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The installer shall securely fasten windows in place to a straight, plumb and level condition, without distortion of the windows and shall make final adjustments for proper operation in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 08 59 50

EXTERIOR WINDOW RESTORATION

PART 1 - GENERAL

1.00 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.01 SCOPE OF WORK

- A. Restoration of windows where identified:
 1. Remove all existing storm windows and applied storm window panels.
 2. Strip paint from all window sashes, sand smooth all wood. (The Contractor shall assume that existing paint contains lead, and shall manage work according, and legally dispose of residue).
 3. Inspect and repair wood with epoxy consolidant and filler.
 4. Provide and install replacement wood parts as identified on the drawings Window schedule.
 5. Re-glaze windows with putty.
 6. Remove all existing exterior wood sills and provide and install replacement wood sills.
 7. Prime and paint with two finish coats (or as required to cover) sash, frames, sills. No paint should be applied at operable sash edges and pockets.
 8. Provide new sash cord, and hardware parts as identify on the window schedule.
 9. Clean all glass at completion of work

1.02 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 1. Section 06 10 00, ROUGH CARPENTRY; Wood framing and blocking.
 2. Section 08 80 00, GLASS AND GLAZING.
 3. Section 09 91 00, PAINTING.

1.03 SUBMITTALS

- A. Submit for approval product data and samples of each product.

1.04 QUALITY ASSURANCE

- A. Employ only workers with at least five (5) years documentable experience with use of materials and methods outline herein. Window restoration specialist must have successfully completed a minimum of three (3) similar restoration projects. The Contractor shall submit to the Architect the names, addresses, Architect and contact person for at least three projects.
 1. Acceptable Window Restorer: The Window Woman – Alison Hardy.

1.05 MANUFACTURER'S DATA

- A. Provide four (4) copies of manufacturer's data for all materials.

1.06 MOCK-UP

- A. Following the requirements of this section, perform complete repair of one window. Obtain Architect's approval of mock-up before proceeding with the restoration of remaining windows.

1.07 SCAFFOLDING, STAGING AND HOISTING

- A. Scaffolding, staging, and hoisting shall be provided by the General Contractor. Window restoration contractor shall coordinate schedule of usage with roofing and masonry contractors.

1.08 ASBESTOS CAULKING

- A. Asbestos caulking has been identified; refer to Section 02 28 20, ASBESTOS REMEDIATION and Appendices A and C of the Project Manual.

PART 2 - PRODUCTS

2.01 MATERIALS FOR RESTORATION

- A. Wood Consolidant: "Liquid Wood" as manufactured by Abatron, Inc., 33 Center Drive, Gilberts, IL 60136; Tel. (708) 426-2200, or approved products by Gougeon (West Systems) or Adhesive Engineering, Inc.
- B. Structural Adhesive Putty: "Wood Epox" as manufactured by Abatron, Inc. as above or approved products by Gougeon (West Systems) or Adhesive Engineering Inc. Fillers or modifiers shall be by epoxy manufacturer. Structural Adhesive Putty shall be of same manufacturer as wood consolidant.
- C. Wood replacement: South American Mahogany, farm harvested FAQ or better. Lumber shall be of sound stock, new, straight, of consistent size, free of stains and mildew, and kiln dried to a moisture content of not more than 12%. Where exposed or semi-exposed, wood members shall be selected
- D. Glazing Compound: "DAP-33" or approved equal.
- E. Paint Stripper: Semi-Paste non-caustic stripper, as needed: NUTEC-002A Industrial Semi-Paste paint stripper or approved equal.
- F. Weatherstripping: Spring Bronze weatherstripping.
- G. Glass: Re-use existing glass. Where replacing missing or broken, use clear plate glass 3/16 in. min. or to match existing thickness.
- H. Sash Locks: Model LKF18, Phelps Company (phone: 802-257-4314).
- I. Sash Cord: #8 Cord, pre-stretched, premium waxed cotton sash cord with inner synthetic stranded cord, by the Phelps Company or equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. Security and Weathertightness: The window restorer shall maintain a weathertight and secure building at all times.
- B. Surface Preparation: The Contractor shall base his bid on the presence of lead-based paint. All existing paint should be stripped using chemical stripper. Containment, collection, and disposal of paint waste shall conform to all Federal, State, and local requirements for handling and disposal. Workers and the public shall be protected in accordance with Federal, State and local requirements.
- C. Window Restoration: Inspect and repair all existing deteriorated wood parts with consolidant and filler. Remove all putty and existing glass. Prime glazing bed with linseed oil. Secure glass with glazier's points. Bed all glass planes in a thin layer of elastic glazing compound. Reglaze all sash with glazing compound. Lightly sand all woodwork to assure good paint adhesion and smooth finish. Prime and paint woodwork. Intent is to reinstall existing glass, providing new glazing for all broken and missing glass lites.
- D. General Wood Repair Standards:
 - 1. The following standards will serve as general guidelines for the conservation and repair process.
 - a. Replace all finish elements in kind, matching profiles and actual dimensions of the stock and the methods of installation. Under no circumstances shall nominal sized lumber be substituted for any existing more fully sized lumber.
 - b. Prime and backprime all architectural and trim elements.
 - c. Take measures to prevent chronic maintenance problems, such as allowing for good ventilation and air circulation, etc.

3.02 MATERIALS PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's directions. Apply only in atmospheric conditions as directed by the manufacturer's instruction.
- B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue. Do not store paint materials inside the building.
- C. Stir materials before application to produce a mixture of uniform density and stir as required during the application of the materials.

3.03 EPOXY WOOD CONSOLIDATION AND PATCHING

- A. Proportioning of Mix: Follow the directions of the manufacturer explicitly with regard to proportioning and mixing of epoxy components.
- B. Addition of Fillers: Follow the directions of the manufacturer explicitly with regard to the addition of either microfibers or microballoons to the epoxy mix. Addition of fillers may be necessary if the epoxy mix is to be used as patching and filling compound.
- C. Use of Epoxy Consolidants: Drill 1/8 in. diameter holes diagonally into deteriorated or punky wood approximately 1 in. on centers both ways in staggered row, and to sufficient depth to

penetrate sound wood. Apply consolidant by injecting it into each hole with a plastic squeeze bottle until absorption ceases.

1. In vertical or diagonal members, begin at top and work downward; in horizontal members begin at one end and work across member. On window sills, it may be possible to brush apply epoxy consolidant onto sill until absorption stops.
- D. Use of Epoxy Patching Compound: Remove all debris from areas to receive patching compound. Remove all paint from wood surfaces. Use patching compound only to fill holes and cracks less than 1/2 in. wide. Apply patching compound with putty knife, forcing it firmly into holes and cracks. Do not strike off compound flush to surface, leave slightly protruding. Plane, shape and sand all consolidated wood elements to conform to original profiles and shapes as closely as possible

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.00 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.01 WORK INCLUDED

- A. Furnish and deliver all finish hardware necessary for all doors, also hardware as specified herein and as enumerated in hardware sets and as indicated and required by actual conditions at the building. The hardware shall include the furnishing of all necessary screws, bolts, expansion shields, drop plates, and all other devices necessary for the proper application of the hardware.

1.02 RELATED WORK

- A. Examine contract documents for requirements that affect work of this section. Other specification sections that directly relate to work of this section include, but are not limited to:
 - 1. Section 08 11 00, STEEL DOORS AND FRAMES.
 - 2. Section 08 14 00, WOOD DOORS.
 - 3. Division 26 - ELECTRICAL.
- B. Security System: Security system will be provided under separate contract with the Owner. Coordinate hardware installation with required security system components.

1.03 SUBMITTALS

- A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 - a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3 and on Drawings.
 - 3. Content: Include the following information:

- a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- a. Samples: Full size samples of lockset and hinge with proposed finish to match satin bronze finish specified.
 - b. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Key to Owner's master key system.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- C. Regulatory Requirements: Comply with provisions of the following:
 1. Where indicated to comply with accessibility requirements and Massachusetts Architectural Access Board (AAB) Regulations and Americans With Disabilities ACT (ADA)
- D. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
- E. Door Closers: Comply with the following maximum opening-force requirements indicated:
 1. Interior Hinged Doors: 5 lbf-applied perpendiculars to door.
 2. Exterior Hinged Doors: 5 lbf applied parallel to door at latch.
 3. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- F. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
- G. NFPA 101: Comply with the following for means of egress doors:
 1. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 2. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
 3. Thresholds: Not more than 1/2 inch high.

- H. Fire Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - I. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system.
- 1.05 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
 - B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
 - C. Deliver keys to manufacturer of key control system.
 - D. Deliver keys to Owner by registered mail or overnight package service or in person.
- 1.06 COORDINATION
- B. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- 1.07 WARRANTY
- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- 1.08 MAINTENANCE SERVICE
- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- PART 2 - PRODUCTS
- 2.01 SCHEDULED DOOR HARDWARE
- A. General: Provide door hardware for each door to comply with requirements in this Section, door hardware sets indicated in door and frame schedule and the Door Hardware Schedule at the end of Part 3.
 - B. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products and products equivalent in function and comparable in quality to named products.
 - C. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

- D. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:
1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
 2. Manufacturers listed first below are products identified in the Hardware Schedule.

2.02 HINGES AND PIVOTS

- A. Manufacturers: Subject to compliance with requirements, provide products of the following:
1. Hinges:
 - a. Hager Companies (HAG).
 - b. Stanley Works.
 - c. McKinney.
- B. Standards: Comply with the following:
1. Butts and Hinges: BHMA A156.1.
- C. Template Hinge Dimensions: BHMA A156.7.
- D. Quantity: Provide the following, unless otherwise indicated:
1. Three Hinges: For doors with heights 61 to 90 inches.
 2. Four Hinges: For doors with heights 91 to 120 inches.
- E. Size: 4--1/2" x 4-1/2" unless otherwise indicated.
- F. Template Requirements: Provide only template-produced units.
- G. Hinge Weight: Unless otherwise indicated, provide the following:
1. Exterior Doors: Heavyweight hinges.
 2. Doors with Closers: Anti-friction-bearing hinges.
 3. Interior Doors: Standard-weight hinges.
- H. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:
- I. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
1. Out-swinging exterior doors.
 2. Out-swinging corridor doors with locks.
 3. Secure interior doors as scheduled.
- J. Corners: Square
- K. Electrified Hinges: Provide hinges with fully concealed through wires for paired openings as scheduled.

L. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head screws. Finish screw heads to match surface of hinges.

2.03 LOCKS AND LATCHES

A. Manufacturer: Subject to compliance with requirements, provide products by the following:

1. Mechanical Locks and Latches:
 - a. Sargent.

B. Standards: Comply with the following:

1. Bored Locks and Latches: BHMA A156.2.
2. Auxiliary Locks: BHMA A156.5.

C. Lock Trim: Comply with the following:

1. Lever: Cast
2. Escutcheon (Rose): Wrought
3. Dummy Trim: Match lever lock trim and escutcheons.

D. Lockset Designs: Provide the lockset design designated below:

1. Bored Locks: Sargent '7 Line Coastal Yarmouth Design'.

E. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule, comply with the following:

1. Bored Locks: BHMA A156.2.
2. Mortise Locks: BHMA A156.13.

F. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Bored Locks: Minimum 1/2-inch latch bolt throw.
2. Deadbolts: Minimum 1-inch bolt throw.

G. Backset: 2-3/4 inches, unless otherwise indicated.

H. Auxiliary Lock:

1. Mortise auxiliary lock: Sargent.

2.04 DOOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Bolts:

- a. Ives.
- b. Burns Manufacturing.
- c. Door Controls International.
- d. Glynn-Johnson.
- e. Rockwood.

B. Standards: Comply with the following:

1. Manual Flush Bolts: BHMA A156.16.
2. Flush Bolts: BHMA Grade 1, unless Grade 2 is indicated, designed for mortising into door edge.

C. Bolt Throws: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Mortise Flush Bolts: Minimum 3/4 in. throw.

2.05 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
2. Adams Rite Manufacturing Company.
3. Von Duprin; an Ingersoll-Rand Company (VD).

B. Standard: BHMA A156.3.

C. Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

D. Outside Trim: Lever or Lever with cylinder; material and finish to match locksets, unless otherwise indicated.

E. Through Bolts: For exit devices and trim on metal doors and fire-rated wood doors.

2.06 CYLINDERS AND KEYING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cylinders: Same manufacturer as for locks and latches.
Arrow Architectural Hardware; Div. of ESSEX Industries, Inc. (AAH).

B. Standards: Comply with the following:

1. Cylinders: BHMA A156.5.

C. Cylinder Grade: BHMA grade as required by lockset type.

D. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six.
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.

3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 4. Bored-Lock Type: Cylinders with tailpieces to suit locks.
- E. Permanent Cores: Manufacturer's standard; finish face to match lockset.
1. All locking devices shall accept interchangeable cores.
 2. Provide permanent cores for each scheduled locking device.
 3. Furnish (6) additional cores for Owner's stock.
 4. Furnish temporary cores for use during the construction period.
- F. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:
1. Coordinate with Owner's masterkey system as directed by the Architect and the Owner.
 2. Cylinders shall be master keyed.
 3. New locks, cylinders and cores shall be keyed to Owner's masterkey keying system.
- G. Keys: Provide nickel-silver keys complying with the following:
1. Quantity: In addition to one extra blank key for each lock, provide the following:
 - a. Grandmasterkeys: Six.
 - b. Masterkeys each level: Six.
 - c. Change Keys: Three per cylinder.
 - d. Core control keys: Four.
 - e. Construction core masterkeys: Six.
 - f. Construction core control keys.
 2. Contractor will install the permanent cores as directed and overseen by the Owner's Representative.
 3. Permanent keys will be sent direct to the Owner via registered mail or in person.

2.07 STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

2.08 CLOSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Surface-Mounted Closers:
 - a. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
 - b. LCN Closers; an Ingersoll-Rand Company (LCN).
 - c. Norton Door Controls; Div. of Yale Security Inc. (NDC).
- B. Standards: Comply with the following:
1. Closers: BHMA A156.4.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

D. Provide checks or hold opens as scheduled.

2.09 PUSH PLATES AND PULLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Push Plates and Pulls:

- a. Rockwood Manufacturing Company (RM).
- b. Burns Manufacturing Incorporated (BM).
- c. Don-Jo Mfg., Inc. (DJO).

B. Push Plates: Unless otherwise indicated, 4 in. x 16 in., 0.050 in. material.

C. Pulls: 1 in. O.D., 8 in. center to center; base plates required.

2.10 KICKPLATES

A. Manufacturers: subject to compliance with requirements, provide products by one of the following:

1. Kickplates:

- a. Don-Jo Mfg., Inc. (DJO).
- b. Rockwood Manufacturing Company (RM).
- c. Burns Manufacturing Incorporated (BM).

B. Standards: Comply with BHMA A156.6.

C. Materials: Provide protection plates fabricated from the following:

1. Satin brass: 1/8 in. thick, beveled 4 sides.

D. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

E. Furnish protection plates sized 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in Door Hardware Schedule.

2.13 STOPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ives: H. B. Ives (IVS).
2. Burns Manufacturing Incorporated (BM).
3. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
4. Rockwood Manufacturing Company (RM).

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.
2. Door Silencers: BHMA A156.16.

C. Stops: Wall stops as scheduled.

2.14 WEATHERSTRIPPING

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Weatherstripping:
 - a. Pemko Manufacturing Co., Inc. (PEM).
 - b. National Guard Products, Inc. (NGP).
 - c. Reese Enterprises, Inc. (RE).
 - d. Zero International, Inc. (ZRO).

2. Door Bottoms:

- a. Pemko Manufacturing Co., Inc. (PEM).
- b. National Guard Products, Inc. (NGP).
- c. Reese Enterprises, Inc. (RE).
- d. Zero International, Inc. (ZRO).

B. Standard: Comply with BHMA A156.22.

C. General: Provide continuous weather-strip gasketing on exterior door where indicated or scheduled. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

E. Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

2.15 THRESHOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pemko Manufacturing Co., Inc. (PEM).
2. National Guard Products, Inc. (NGP).
3. Reese Enterprises, Inc. (RE).
4. Zero International, Inc. (ZRO).

B. Standard: Comply with BHMA A156.21.

2.16 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

2.17 FINISHES

- A. Standard: Comply with BHMA A156.18.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
 - 1. Provide BHMA 606 Satin Brass, Clear Coated, over brass base metal.
 - 2. Thresholds and Weatherstrip: Dark Duranodic finish.
 - 3. Door Closers: Sprayed to match Satin Brass.
 - 4. All finish hardware shall have finish listed above.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 series.
 - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.
- B. Wood Doors: Comply with DHI A115-W series.

3.03 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Thresholds: Set thresholds for exterior door in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- 3.04 ADJUSTING
- A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- 3.05 CLEANING AND PROTECTION
- A. Clean adjacent surfaces soiled by door hardware installation.
 - B. Clean operating items as necessary to restore proper function and finish.
 - C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.
- 3.06 HARDWARE SCHEDULE
- A. Hardware listed is for one (1) opening.
 - B. Master Key to Owner's existing master key system.
 1. Provide 3 keys per lock
 2. Interchangeable cores with SC4 keyway
 - C. Hardware Sets: Refer to Drawings.

END OF SECTION

SECTION 08 80 00

GLASS AND GLAZING

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. Section Includes: Work of this Section consists of installing all materials furnished under this Section, including all equipment, labor, services, and incidental items required to complete work as shown on Drawings and specified in this Section.
- B. Include, but do not limit to glass and glazing for the following:
 - 1. Tempered insulated safety glass for exterior doors, vestibule doors, and sidelights.
 - 2. Insulated glass for windows.
 - 3. Tempered safety glass for interior doors and sidelights.
 - 4. Tempered safety glass or laminated glass for interior windows.
 - 5. All other glass and glazing called for, or reasonably inferred from the Drawings.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 06 20 00, FINISH CARPENTRY.
 - 2. Section 08 11 00, STEEL DOORS AND FRAMES.
 - 3. Section 08 14 00, WOOD DOORS; Wood doors to be glazed.
 - 4. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Initial Selection Samples: Submit samples of each glass and glazing material showing complete range of colors, textures, and finishes available for each material used.
- C. Verification Samples: Submit representative samples of each glass and glazing material that is to be exposed in completed work. Show full color ranges and finish variations expected. Provide glass samples having minimum size of 144 sq. in. and 6 in. long samples of sealants and glazing materials.
- D. Test Reports: Provide certified reports for specified tests.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Insulating Glass Units:

1. Design Criteria:

- a. Condensation Requirements: Glazed aluminum system shall be of thermal-break construction tested in accordance with AAMA 1502.7 and certified by manufacturer to provide min. 68 condensation resistance factor (CRF).
- b. Condensation Resistance:

- 1). Where framing systems are thermal-break construction, provide units tested for thermal performance in accordance with AAMA 1503.
- 2). Provide thermal modeling for frame and glass to determine the inside frame temperature using the following criteria:

Criteria 1:

Indoor Air Temperature	=	68°F
Relative Humidity	=	30%
Outside Air Temperature	=	0°F
Wind Speed	=	15 MPH

Criteria 2:

Inside Air Temperature	=	68°F
Relative Humidity	=	50%
Outside Air Temperature	=	0°F
Wind Speed	=	15 MPH

In addition, provide the dew point temperature of the metal frame and glass and; at what outside air temperature can we expect condensation to occur on the frame and/or glass.

- c. Minimum Frame CRF = Min. 68.
- d. Minimum Glazing CRF = 70.

2. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below.

- a. Monolithic-Glass Lites: Properties are based on units with lites 1/4 inch thick.
- b. Insulating-Glass Units: Properties are based on units with lites 1/4 inch with low "E" coating on glass surface and nominal 1/2 in. wide interspace utilizing a 1/2 inch "Azon" warm lite thermally broken glazing spacer.
- c. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/sq. ft. x H x deg. F (W/sq. m x K). Min. U-value = 0.20.
- d. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
- e. Solar Optical Properties: NFRC 300.

1.5 QUALITY ASSURANCE

- A. Source: For each glass and glazing type required for work of this Section, provide primary materials which are products of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.
- B. Installer: A firm with a minimum of three years' experience in type of work required by this Section and which is acceptable to manufacturers of primary materials.

1.6 TESTS

- A. Fire Resistance Rated Glass: Provide products which have been tested in compliance with ASTM E 152 and ASTM E 163, UL-listed, and acceptable to local authorities having jurisdiction and which are labeled or listed by independent agencies acceptable to Architect. Glass shall conform to State of Massachusetts Building Code.
- B. Preconstruction Sealant Test: Submit samples of materials to be used to glazing sealant manufacturer to determine sealant compatibility. Include samples of glass, gaskets, glazing materials, framing members, and other components and accessories of glazing work. Test in accordance with ASTM C 794 to verify what type of primers (if any) are required to ensure sealant adhesion to substrates.
 - 1. Submit minimum of nine pieces of each type and finish of framing member, and nine pieces of each type, class, kind, condition, and form of glass, including monolithic, laminated, and insulating glass for adhesion tests.
 - 2. Provide manufacturer's written report and recommendations regarding proper sealant choice and use.

1.7 PROJECT CONDITIONS

- A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within limits established by manufacturers of materials and products used.
- B. Temperature Limits: Install sealants only when temperatures are within limits recommended by sealant manufacturer, except, never install sealants when temperatures are below 40°F.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations and GANA Manual.
 - 1. Protect materials from moisture, sunlight, excess heat, sparks and flame.
 - 2. Sequence deliveries to avoid delays but minimize on-site storage.

1.9 COORDINATION

- A. Work under this section shall be properly coordinated with the work of other sections to assure the steady progress of all the work of the Contract.

1.10 WARRANTY

- A. Provide a written warranty, signed by the manufacturer, installer, and Contractor, agreeing to repair or replace work which exhibits defects in materials or workmanship. "Defects" is defined to include, but not limited to, leakage of water, abnormal aging or deterioration, failure of hermetic seals, edge separation or delamination of laminated glass, peeling, cracking, or crazing of metallic coatings, and failure to perform as required. Include requirement for removal and replacement of covering and connected adjacent work. Provide warranty periods standard with the manufacturer.
- B. Manufacturer's Special Project Warranty on Insulating Glass:
1. Provide written warranty signed by manufacturer of insulating glass agreeing to furnish FOB point of manufacture, freight allowed Project site, within specified warranty period indicated below, replacements for those insulating glass units developing manufacturing defects.
 2. Manufacturing defects are defined as failure of hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during warranty period.
 3. Warranty Period: Manufacturer's standard minimum 10 years after date of Substantial Completion.
 4. This warranty shall be in addition to and not limitation of other rights Owner may have against Contractor under Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/FABRICATORS

- A. Glass: Provide glass products of one of the following manufacturers/fabricators that meet or exceed the requirements of these specifications:
1. Cardinal Industries.
 2. Guardian Industries.
 3. Pilkinton / LOF.
 4. PPG Industries.
 5. Viracon, Inc.

2.2 GLASS MATERIALS AND PRODUCTS

- A. Clear Float Glass: ASTM C 1036, Type I-Transparent, Flat, Class 1-Clear, Quality q3.
- B. Clear Heat Strengthened Glass: ASTM C 1048, Condition A-Uncoated, Type I-Transparent, Flat, Class 1-Clear, Quality q3, Kind HS.
- C. Clear Tempered Safety Glass: ASTM C 1048, Condition A-Uncoated, Type I - Transparent, Flat, Class 1-Clear, Quality q3, Kind FT, complying with ANSI Z97.1. Thickness 1/4 in. unless otherwise indicated as required.
- D. Laminated Safety Glass: Provide two glass panes of equal thickness, laminated together with a polyvinyl butyl interlayer, conforming to ASM C 1172, and as follows:
1. Interlayer Color: Clear.

2. Interlayer Material: Provide Monsanto "Saflex" or DuPont "Butacite", 0.030 in. thick at vertical applications.

E. Sealed Insulating Glass Units:

1. General: Provide preassembled units consisting of organically sealed panes of glass enclosing hermetically sealed dehydrated air space and complying with ASTM E774 for performance classification indicated and with other requirements specified for glass characteristics, air space, sealing system, sealant, spacer material, corner design, and desiccant.
 - a. Properties of Individual Glass Panes Making up Units: Refer to product requirements specified elsewhere in this Section applicable to types, classes, kinds, and conditions of glass products indicated.
 - b. Provide heat-treated panes of kind and at locations indicated or, if not indicated, provide heat-strengthened panes where recommended by manufacturer for application indicated and tempered where indicated or where safety glass is designated or required.
 - c. Performance Characteristics: Nominal values based on manufacturer's published test data for units with 1/4 in. thick glass panes and 1/2 in. thick air space.
 - d. U-values indicated are expressed in number of Btu's per hour per sq. ft. per deg. F. difference.
 - e. Performance Classification per ASTM E774: Class A.
 - f. Thickness of Each Pane: 1/4 in.
 - g. Air Space Thickness: 1/2 in.
 - h. Sealing System: Manufacturer's standard.
 - i. Spacer Material: 1/2 in. "Azon" warm lite thermally broken spacer.
 - j. Desiccant: Manufacturer's standard; either molecular sieve or silica gel or blend of both.
 - k. Corner Construction: Manufacturer's standard.
2. Low-Emissivity-Coated Insulating Glass Units:
 - a. Manufacturer's standard units with one pane of glass coated with durable, neutral-colored, low-emissivity metallic coating, of type and on surface indicated, and complying with following requirements.
 - b. Exterior Pane: Clear float glass, coated on second surface.
 - c. Interior Pane: Clear float glass, uncoated.
3. Performance:
 - a. Interspace Content: Air or argon, as standard with manufacturer.
 - b. Outdoor Lite: Class 1 (clear).
 - c. Low-E Coating: Pyrolytic or sputter-coated Low-E coating on second or third surface.
 - d. Indoor Lite: Class 1 (clear).
 - e. Performance: (Basis of specification is Guardian SunGuard Coating AG 43 High Performance Low E).

Visible light transmittance: 41%.

Solar transmittance: 24%.

U-V transmittance: 23%.

Winter Nighttime U-value: 0.31 Btu/hour x sq. ft x deg. F.

Summer Daytime U-value: 0.30 Btu/hour x sq. ft x deg. F.

Solar Heat Gain Coefficient: 0.29 maximum.

Shading Coefficient: 0.33.

2.3 GLAZING MATERIALS AND PRODUCTS

- A. General: Provide sealants and gaskets with performance characteristics suitable for applications indicated. Ensure compatibility of glazing sealants with laminated glass interlayers, plastic glazing, and with any other surfaces in contact.
- B. General Glazing and Cap Bead Sealant: Provide sealant with maximum Shore A hardness of 50. Provide one of the following:
 - 1. Dow Corning 795.
 - 2. General Electric Silglaze N 2500 or Contractors SCS-1000.
 - 3. Tremco Proglaze.
- C. Weather Seal Sealant: Provide non-acid curing sealant with movement range $\pm 50\%$, ASTM C 719. Provide one of the following:
 - 1. Dow Corning 795.
 - 2. General Electric Silpruf.
 - 3. Tremco Spectrum 2.
- D. Dense Elastomeric Compression Seal Gaskets: Provide molded or extruded neoprene or EPDM gaskets, Shore A hardness of 75 ± 5 for hollow profile, and 60 ± 5 for solid profiles, ASTM C 864.
- E. Cellular, Elastomeric Preformed Gaskets: Provide extruded or molded closed cell, integral-skinned neoprene, Shore A 40 ± 5 , and 20% to 35% compression, ASTM C 509.
- F. Preformed Glazing Tape: Provide solvent-free butyl-polyisobutylene rubber with 100% solids content complying with AAMA A 804.1. Provide preformed glazing tape in extruded tape form. Provide one of the following:
 - 1. Protective Treatments 303 or 606.
 - 2. Tremco Preshimmed 440.
 - 3. Woodmont Chem-Tape 40.
- G. Setting Blocks: Provide neoprene or silicone blocks with Shore A hardness of 80-90. Provide products certified by manufacturer to be compatible with silicone sealants.
 - 1. Shims: For shims used with setting blocks, provide same materials, hardness, length and width as setting blocks.
- H. Edge Blocks: Provide neoprene or silicone as required for compatibility with glazing sealants. Provide blocks with Shore A hardness of 55 ± 5 .
- I. Miscellaneous Glazing Materials: Provide sealant backer rods, primers, cleaners, and sealers of type recommended by glass and sealant manufacturers.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Installer/Glazier shall examine substrates, supports, and conditions under which this work is to be performed. Notify Contractor in writing, outlining conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of installation will be construed as glazier accepting substrates and conditions.

3.2 INSTALLATION

- A. General Installation Requirements: Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this Section. Comply with GANA Manual.
1. Prior to installing glass, clean glazing channels and framing members.
 2. Remove coatings not completely bonded to substrates.
 3. Remove lacquer from metal surfaces where in contact with sealants.
 4. Protect glass from edge damage at all times. Use roller blocks and suction cups.
 5. Replace glass with edge damage or other imperfections which could weaken glass.
 6. Install setting and side blocks in locations recommended by referenced standards, and as required to prevent glass displacement.
 7. Center glass in openings. Provide 1/2 in. minimum glass bite and 1/8 in. edge clearances.
 8. Install glass and glazing in such a manner as to allow for easy replacement of glass and glazing without dismantling of frames.
 9. Install glazing tapes and gaskets.
 10. Prevent metal to glass contact at all times. Protect edges of insulated units from moisture and solvents.
 11. Clean, prime, and install stops.
 12. Cap seal exterior joints between glazing and framing with a uniform fillet of clear, silicone sealant. Slope cap seal from glass to framing. Provide maximum 1/16 in. clearance between top of frame and top of cap seal.

3.3 CLEANING AND PROTECTION

- A. Clean exposed surfaces using manufacturer recommended materials and methods. Remove and replace work which cannot be successfully cleaned. Clean glass and framing members frequently to protect from build-up of harmful construction contaminants.
- B. Touch-up damaged coatings and finishes. Eliminate visible evidence of repair.
- C. Re-clean glass within one week of final acceptance.
- D. Provide temporary protection at all times during course of work, and immediately after completion to ensure work of this Section is not damaged or deteriorated in any way at time of final acceptance. Remove temporary protections and reclean as necessary immediately prior to final acceptance.
- E. Remove and replace broken, chipped, cracked, or otherwise damaged glass.

END OF SECTION

SECTION 08 91 15

METAL WALL LOUVERS

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 WORK INCLUDED

- A. Furnish and install metal wall louvers, as indicated on Drawings and as specified herein. This Section includes the following:
 - 1. Fixed metal wall louver at exterior wall.
 - 2. Blank-off panels for wall louver.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 05 50 00, METAL FABRICATIONS; Miscellaneous metal framing.
 - 2. Section 06 10 00, ROUGH CARPENTRY; Wood framing, blocking, and nailers.
 - 3. Section 07 60 00, FLASHING AND SHEET METAL.
 - 4. Section 07 92 00, JOINT SEALANTS; Perimeter sealing of louver frames.
 - 5. Division 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC); Ductwork.

1.3 SUBMITTALS

- A. Submit shop drawings and samples in accordance with the following:
 - 1. Shop drawings shall include details of fabrication and erection, anchorage, blank-off panels (where required), accessories and finishes.
 - 2. Samples shall include sample louver section which indicates frame corner construction, blade construction, typical welds, and specified finish.
- B. Manufacturer's Product Data: Submit descriptive data of louvers including standard drawings, louver free area, maximum recommended air velocity, blank-off panels (where required), materials and finishes, and installation instructions.
- C. Certification: Provide, when requested by the Architect, testing data indicating compliance with specified AMCA 511.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver louvers to project site, fully identified, and protected by padded blankets, scheduled to arrive at time of erection sequence requirements.
- B. Store louvers off ground, under cover, protected from weather and construction operations.

- C. Handle louvers during transportation and installation in a manner that prevents racking or damage to finish or adjacent construction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS / PRODUCTS

- A. Metal wall louvers and vents shall be the products of one of the following manufacturers, or approved equal:
 - 1. C/S - Construction Specialties Inc., Cranford, NJ 07016.
 - 2. Airolite Company, Marietta, OH 45750.
 - 3. Industrial Louvers, Inc., Delano, MN 55328.
 - 4. Greenheck, Schofield, WI 54476-0410.
- B. Architectural Wall Louver: Drainable fixed louver type matching existing louvers.

2.2 MATERIALS

- A. Aluminum Extrusions:
 - 1. ASTM B 221, alloy 6063-T5.
 - 2. Minimum thickness: 0.081 in.
- B. Attachment Hardware: Stainless steel.

2.3 FABRICATION

- A. Exterior wall louvers shall have 50% minimum free air area and channel frame as indicated.
- B. Construction:
 - 1. Assemble louvers by heli-arc welding.
 - 2. Arrange louvers in full height and width panels without exposed vertical mullions.
 - 3. Heads, sills, and jambs shall be one piece structural members.
 - 4. Louver Blade: Sloped at 45 degree; integral waterstops on blade.
 - 5. Manufacturer shall provide all necessary structural supports and bracing to carry wind load of not less than 25 psf and shall comply with AMCA 511.
- C. Screens: Provide insect screen on interior of louver not connected to ductwork. Provide bird screen on interior of all louvers connected to mechanical equipment.
 - 1. Insect Screen: 16 x 18 mesh, copper wire intercrimp insect screen.
 - 2. Bird Screen: 1/2 in. mesh, 14 gage (0.063 in.) diameter copper wire intercrimp bird screen.
 - 3. Screens shall be secured in removable extruded aluminum frames with reinforced corner construction; screw to louver frame.
- D. Accessories: Provide extruded aluminum sill flashing below louver. Flashing shall be finished to match louver.

2.4 FINISH

- A. Coating on Exterior Aluminum Surfaces: Provide three coat fluorocarbon system consisting of Kynar 500 primer and color finish coat followed by a clear Kynar 500 protective coating conforming to AAMA 2605. Primer and color coat shall be a minimum 1.0 dry film thickness of thermo-cured fluorocarbon coating containing minimum 70% Kynar 500 resin. Properly prepare substrates by inhibited chemical cleaning, conversion coating, and priming in compliance with coating manufacturer's instructions and recommendations.
1. Color: Provide standard, deluxe, or premium color as selected by the Architect.
- B. Coating on Interior Aluminum Surfaces, Screens, and Blank-Off Sheeting: Provide manufacturer's Dark Bronze Duranodic finish.

2.5 BLANK-OFF PANELS

- A. General: Fabricate blank-off panels from materials and to sizes indicated and to comply with the following requirements:
1. Finish: Match finish applied to louver with respect to coating type, except for color, which shall be as follows:
 - a. Color: Black.
 2. Attach blank-off panels to back of louver frames with clips.
- B. Uninsulated, Blank-Off Panels: Aluminum sheet complying with the following requirements:
1. Thickness: 0.050 in., unless otherwise indicated.
- C. Insulated, Blank-Off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets, complying with the following requirements:
1. Thickness: As indicated.
 2. Metal Facing Sheets: Aluminum sheet, 0.032 in. thick.
 3. Insulating Core: Unfaced, rigid, glass-fiberboard insulation complying with ASTM C 612, Class 1 and 2 or foam insulation; 2 in. thick.
 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames 0.081 in. thick, with corners mitered and with same finish as panels.
 5. Seal perimeter joints between panel faces and louver frames with 1/8 in. by 1 in. polyvinyl chloride compression gaskets.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine openings to receive louvers to assure dimensions conform to shop drawings and that openings are free of irregularities which would interfere with installation.
- B. Report unsatisfactory conditions to Architect in writing.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install louvers in accordance with shop drawings and manufacturer's recommended installation instructions.
- B. Install bird screens to louvers at duct connections.
- C. Install insect screens at all other locations.
- D. Isolate aluminum from direct contact with steel.
- E. Install blank-off sheeting as required on areas at perimeter of connected duct.

3.3 ADJUST AND CLEAN

- A. After installation, ensure that units are level and securely anchored.
- B. Verify that screens are installed.
- C. Repair damage to louver finish to match original or replace.
- D. Provide final cleaning of louvers with cleaning materials recommended by louver manufacturer, as specified in Section 01 77 00, CLOSEOUT PROCEDURES.

END OF SECTION

SECTION 08 52 13

WOOD WINDOWS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Work Included: Furnish and install exterior wood windows at building exterior, as indicated on Drawings and as specified herein. Work includes, but is not limited to:
 - 1. Double hung wood window units.
 - 2. Factory glazing of windows.
 - 3. Framed insect screens for operable window units.
 - 4. All related window hardware, anchors, clips, and related items.

1.02 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Wood framing and blocking.
 - 2. Section 06 20 00, FINISH CARPENTRY; Interior wood trim and casing at interior finish of windows.
 - 3. Section 08 11 00, STEEL DOORS AND FRAMES.
 - 4. Section 08 14 00, WOOD DOORS.
 - 5. Section 08 59 10, EXTERIOR WINDOW RESTORATION.
 - 6. Section 08 71 00, DOOR HARDWARE; Door hardware.
 - 7. Section 08 80 00, GLASS AND GLAZING.
 - 8. Section 09 91 00, PAINTING; Painting and finishing of exterior and interior surfaces of windows.

1.03 SUBMITTALS

- A. Product Data: Submit complete manufacturer's product data to Architect for approval, consisting of complete product description and specifications, complete installation instructions, and other pertinent technical data required for complete product and product use information.
- B. Shop Drawings: Submit shop drawings including wall elevations at 1/4 in. scale unit elevations at 3/4 in. scale, and half-size section details of every typical member, including glazing and screens, anchorage component and location, anchor methods, shim methods and materials, hardware, muntins, trim, and installation details including flashing. Shop drawings shall indicate dimensions, relationship to construction of adjacent work, air and vapor seal, and other pertinent details.
- C. Samples: Submit the following samples to Architect for approval:

1. Insulating glass unit as specified.
2. Sample of primed finish for exterior of window.
3. Screen unit.
4. Extension jambs.
5. Window hardware.

- D. Do not order materials or begin fabrication until Architect's approval of submittals has been obtained.

1.04 SYSTEM DESCRIPTION

- A. Design and Performance Requirements: Window shall meet or exceed H-LC40 rating.

1. Air leakage shall not exceed the following when tested at 1.57 psf according to ASTM E 283: 0.30 cfm per square foot of frame.
2. No water penetration shall occur when units are tested at the following pressure according to ASTM E 547: 6.0 psf.
3. Assembly shall withstand the following positive or negative uniform static air pressure difference without damage when tested according to ASTM E 330: 60 psf.

1.05 QUALITY ASSURANCE

- A. Thermal performance shall be rated in accordance with NRFC 100.
- B. Insulating glass units shall conform to IGCC Class CBA when tested in accordance with ASTM E 773 and ASTM E 774. Provide dual sealed units consisting of polyisobutylene primary seal and silicone secondary seal. Metal spacers shall have soldered joints.
- C. Safety Glazing: Comply with safety glazing requirements of CPSC 16CFR 1201, where required by Code.

1.06 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
1. ASTM E 283: Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
 2. ASTM E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtains Walls, and Doors by Uniform Static Air Pressure Difference.
 3. ASTM E 547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
 4. ASTM E 774: Specification for Sealed Insulated Glass Units.
 5. ASTM C 1036: Standard Specification for Flat Glass.
- B. WDMA I.S.4: Industry Standard for Water Repellent Preservative Treatment for Millwork.
- C. American Architectural Manufacturers Association / Window and Door Manufacturers Association (AAMA / WDMA): ANSI / AAMA / NWWDA 101 / I.S.2-97 Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors. and 101 / I.S.2 / NAFS-02 Voluntary Performance Specification for Windows, Skylights and Glass Doors.
- D. Window and Door Manufacturers Association (WMDA): 101 / I.S.2 WDMA Hallmark Certification Program.

- E. Sealed Insulating Glass Manufactures Association / Insulating Glass Certification Council (SIGMA / IGCC).
- F. National Fenestration Rating Council (NFRC): 101: Procedure for Determining Fenestration Product Thermal Properties.

1.07 PRODUCT STORAGE AND HANDLING

- A. Windows shall be properly packaged by manufacturer and fully protected during shipment, unloading, and storage.
- B. Windows shall not be delivered to the job site until the building has thoroughly dried out. Windows shall be stored flat, above floors, in dry area(s) until installation. Windows shall be stored in buildings that maintain a humidity range of between 30 and 60 percent.

1.08 WARRANTY

- A. Windows shall be warranted to be free from defects in manufacturing, materials, and workmanship for a period of ten (10) years from purchase date.
- B. Insulating glass shall be warranted against visible obstruction through the glass caused by a failure of the insulating glass air seal for a period of twenty (20) years from the date of original purchase.

PART 2 - PRODUCTS

2.01 WOOD WINDOWS - GENERAL

- A. General: Windows for exterior shall be wood units, with factory-applied primer on exterior, as specified herein.
- B. Acceptable Manufacturers: Wood windows shall be manufactured by the following, or Architect approved equal.
 - 1. Marvin Windows and Doors.
 - 2. Eagle.
 - 3. Kolbe & Kolbe.
- C. Basis of Design: Wood Ultimate Double Hung, as manufactured by Marvin Windows and Doors, Warroad, Minnesota.
 - 1. Size Configuration and Dimensions: As indicated on the Drawings and as scheduled:
 - 2. The Drawings include a schedule of windows manufactured by Marvin. Reference to Model Numbers correspond with Marvin products. Comparable products of other approved manufacturers will be considered subject to Architect's and Owner's review and approval.

2.02 MATERIALS AND FABRICATION

- A. Frame Description:
 - 1. Finger jointed edge-glued pine, finger jointed, edge-glued Douglas fir, mahogany, vertical grain Douglas fir head and side jambs with interior clear veneer, finger jointed (clear) sill.

- a. Kiln dried to a moisture content no greater than twelve (12) percent at the time of fabrication.
 - b. Water repellent preservative treated in accordance with WDMA I.S.4.
 2. Frame thickness: 11/16 inch (17 mm) head and side jambs, 1-7/16 inches (37 mm) at sill.
 3. Frame width: 4-9/16 inches (116 mm).
- B. Sash Description:
1. Clear pine; Douglas fir, mahogany; vertical grain Douglas fir.
 - a. Kiln dried to a moisture content no greater than twelve (12) percent at the time of fabrication.
 - b. Water repellent preservative treated in accordance with WDMA I.S.4.
 2. Sash thickness: 1-5/8 inches (41 mm).
 3. Removable exterior glazing stops.
- C. Glazing:
1. Select quality complying with ASTM C 1036. Insulating glass SIGMA / IGCC certified to performance level CBA when tested in accordance with ASTM E 774.
 2. Glazing method: Insulated glass.
 3. Glass Type: Clear; Low E II; Argon gas; Tempered.
 4. Glazing Seal: Silicone bedding.
- D. Finish: Interior / Exterior: Treated bare wood.
- E. Hardware:
1. Balance system: Coil spring block and tackle with nylon cord and fiber filled nylon clutch.
 2. Jamb carrier: Vinyl extrusion with wood inserts. Color: Beige.
 3. Lock: High pressure zinc die-cast cam lock and keeper.
 - a. Finish: Oil Rubbed Bronze.
- F. Weather Strip: Continuous leaf weather strip at head jamb parting stop; dual durometer bulb weather strip at check rail; foam bulb type dual durometer weather strip on vertical sash edge; dual durometer bulb weather strip at bottom rail. Color: Beige.
- G. Jamb Extension: Factory installed jamb extension for wall thickness indicated or required.
1. Finish: Match interior frame finish.
- H. Screen: Factory installed full screen.
1. Screen mesh, 18 by 16: Charcoal aluminum wire.
 2. Aluminum Frame Finish: Bronze.
- I. Authentic Divided Lites (ADL)
1. 7/8 inch (22 mm) wide; 1-1/8 inch (29 mm) wide. Pine, Douglas fir, mahogany, vertical grain Douglas fir.
 2. Pattern: Rectangular; Custom lite layout.
 3. Finish: Match sash finish.

- J. Custom Historic Wood Sill.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Before Installation, verify openings are plumb, square, and of proper dimension. Report frame defects or unsuitable conditions to the General Contractor before proceeding.
- B. Acceptance of Conditions: Beginning of installation confirms acceptance of existing conditions.

3.02 INSTALLATION

- A. Assemble and install window unit according to manufacturer's instructions and reviewed shop drawings.
 1. Windows shall be set in proper position. Plumb, align, and brace until permanently fastened.
 2. Fasten windows in place in accordance with the manufacturer's recommendations, securely attached to exterior wall framing.
 3. Windows shall be fastened plumb and true, installed level and free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
 4. Coordinate attachment and seal of air and vapor barrier materials. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
 5. Install perimeter type sealant, backing materials, and installation requirements in accordance with Section 07 92 00, JOINT SEALANTS.

3.03 CLEANING

- A. Remove visible labels and adhesive residue according to manufacturer's instructions.
- B. Leave windows and glass in a clean condition. Final cleaning as required in Section 01 77 00, CLOSEOUT PROCEDURES.

3.04 PROTECTING INSTALLED CONSTRUCTION

- A. Protect windows from damage by chemicals, solvents, paint, or other construction operations that may cause damage.

END OF SECTION

SECTION 09 00 03

ACOUSTICAL TILE

(Filed Sub-bid Required)

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Sub-Bids:
 - 1. Sub-bids for work under this Section shall be for the complete work and shall be submitted through as stipulated in the INVITATION TO BID and the INSTRUCTIONS TO BIDDERS.
 - 2. Sub-bids filed with the AWARDING AUTHORITY shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the TOWN OF BOXFORD in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- C. Sub Sub-Bid Requirements:
 - 1. Sub bidder's attention is directed to Massachusetts G.L. Chapter 149 Section 44F, as amended, which provides in part as follows.
 - 2. Each sub-bidder shall list in Paragraph E of the "Form for Sub-bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the AWARDING AUTHORITY that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

<u>CLASS OF WORK</u>	<u>REFERENCE PARAGRAPHS</u>
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- D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:

<u>NUMBER</u>	<u>SHEET NAME</u>
A1.1	FIRST FLOOR PLAN
A1.2	SECOND FLOOR / ATTIC PLAN
A1.3	ROOF PLAN
A2.1	FIRST AND SECOND FLOOR REFLECTED CEILING PLAN
A3.1	SOUTH AND EAST ELEVATIONS
A3.2	NORTH AND WEST ELEVATIONS

<u>NUMBER</u>	<u>SHEET NAME</u>
A5.1	ENLARGED KITCHEN PLANS AND ELEVATIONS
A5.2	ENLARGED TOILET ROOMS PLANS AND ELEVATIONS
A6.1	BUILDING SECTIONS

1.02 DESCRIPTION OF WORK

A Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 09 51 00, ACOUSTICAL CEILINGS.

B. Alternates: Refer to Section 01 23 00, ALTERNATES and Document 00 31 00, FORM FOR GENERAL BID and Document 00 35 00, FORM FOR SUB-BID.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 09 00 05

RESILIENT FLOORS

(Filed Sub-bid Required)

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Sub-Bids:
 - 1. Sub-bids for work under this Section shall be for the complete work and shall be submitted through as stipulated in the INVITATION TO BID and the INSTRUCTIONS TO BIDDERS.
 - 2. Sub-bids filed with the AWARDDING AUTHORITY shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the TOWN OF BOXFORD in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- C. Sub Sub-Bid Requirements:
 - 1. Sub bidder's attention is directed to Massachusetts G.L. Chapter 149 Section 44F, as amended, which provides in part as follows.
 - 2. Each sub-bidder shall list in Paragraph E of the "Form for Sub-bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the AWARDDING AUTHORITY that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

CLASS OF WORK

REFERENCE PARAGRAPHS

- D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:

<u>NUMBER</u>	<u>SHEET NAME</u>
A1.1	FIRST FLOOR PLAN
A1.2	SECOND FLOOR / ATTIC PLAN
A1.3	ROOF PLAN
A2.1	FIRST AND SECOND FLOOR REFLECTED CEILING PLAN

<u>NUMBER</u>	<u>SHEET NAME</u>
A3.1	SOUTH AND EAST ELEVATIONS
A3.2	NORTH AND WEST ELEVATIONS
A5.1	ENLARGED KITCHEN PLANS AND ELEVATIONS
A5.2	ENLARGED TOILET ROOMS PLANS AND ELEVATIONS
A6.1	BUILDING SECTIONS

1.02 DESCRIPTION OF WORK

- A Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work of Section 09 65 00, RESILIENT FLOORING.
- B. Alternates: Refer to Section 01 23 00, ALTERNATES and Document 00 31 00, FORM FOR GENERAL BID and Document 00 35 00, FORM FOR SUB-BID.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 09 00 07

PAINTING

(Filed Sub-bid Required)

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Sub-Bids:
 - 1. Sub-bids for work under this Section shall be for the complete work and shall be submitted through as stipulated in the INVITATION TO BID and the INSTRUCTIONS TO BIDDERS.
 - 2. Sub-bids filed with the AWARDDING AUTHORITY shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the TOWN OF BOXFORD in the amount of five percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- C. Sub Sub-Bid Requirements:
 - 1. Sub bidder's attention is directed to Massachusetts G.L. Chapter 149 Section 44F, as amended, which provides in part as follows.
 - 2. Each sub-bidder shall list in Paragraph E of the "Form for Sub-bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the AWARDDING AUTHORITY that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

<u>CLASS OF WORK</u>	<u>REFERENCE PARAGRAPHS</u>
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- D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:

<u>NUMBER</u>	<u>SHEET NAME</u>
A1.1	FIRST FLOOR PLAN
A1.2	SECOND FLOOR / ATTIC PLAN
A1.3	ROOF PLAN
A2.1	FIRST AND SECOND FLOOR REFLECTED CEILING PLAN

<u>NUMBER</u>	<u>SHEET NAME</u>
A3.1	SOUTH AND EAST ELEVATIONS
A3.2	NORTH AND WEST ELEVATIONS
A5.1	ENLARGED KITCHEN PLANS AND ELEVATIONS
A5.2	ENLARGED TOILET ROOMS PLANS AND ELEVATIONS
A6.1	BUILDING SECTIONS

1.02 DESCRIPTION OF WORK

A Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 09 91 00, PAINTING.

B. Alternates: Refer to Section 01 23 00, ALTERNATES and Document 00 31 00, FORM FOR GENERAL BID and Document 00 35 00, FORM FOR SUB-BID.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 09 20 00

LATH AND PLASTER REPAIR

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The BIDDING REQUIREMENTS, CONTRACTING REQUIREMENTS, and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Provide lath and plaster work and lath and plaster repair to existing damaged plaster finishes including the following:
 - 1. Gypsum plaster and lath systems for interior walls and ceilings.
 - 2. Remodeling existing lath and plaster finishes in existing house.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Wood framing, nailers.
 - 2. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.
 - 3. Section 09 91 00, PAINTING; Painting of gypsum surfaces including primer and finish coats.

1.04 SUBMITTALS

- A. Submit for approval product data.

1.05 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Performance: Fire, structural, and seismic performance meeting requirements of building code and local authorities.
- C. Field-Constructed Mock-Up: Typical area.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Manufacturers of Gypsum Plaster: National Gypsum Co., United States Gypsum Co. or approved equal.

- B. Manufacturers of Steel Framing and Furring: Dale Industries, Dietrich Industries, Marino Ware, National Gypsum Co., Unimast or approved equal.
- C. Gypsum Plaster:
1. Application: 3 coats over metal lath substrate.
 2. Application: 2 coats over concrete and unit masonry substrate.
 3. Base Coat Plasters: ASTM C 28.
 4. Finish Coat Plasters: ASTM C 28, gypsum gauging plaster] [ASTM C 28, high-strength gypsum gauging plaster] [ASTM C 61, Keene's cement] [ASTM C 59, gypsum casting and molding plaster] [Ready-mixed finish plaster] coat.
 5. Finishing Hydrated Limes: ASTM C 206.
 6. Aggregates: ASTM C 35.
 7. Finish:[Troweled] [Floated] finish.
- D. Lath and Plaster Support Systems:
1. Metal Supports for Suspended and Furred Ceilings: [ASTM C 841 for gypsum plaster] [ASTM C 1063, for portland cement plaster] installations.
 2. Steel Studs and Runners, Non-Load (Axial) Bearing: ASTM C 645, [20 gage (.0329 inch)] [22 gage (.0276 inch)] [25 gage (.0179 inch)] steel studs, [2-1/2 inch] [3-5/8 inch] [4 inch] [6 inch] typical depth.
 3. Vertical Metal Furring: Channel furring and braces, Z-furring members, and furring brackets.
 4. Expanded Metal Lath: ASTM C 847, self-furring diamond mesh or rib lath.
 5. Gypsum Lath: ASTM C 37, plain, foil-backed, and fire-rated types, [3/8 inch] [1/2 inch] thick.
- E. Auxiliary Materials:
1. Corner beads, casing bead, and control joints.
 2. Bonding compounds and agents.
 3. Acoustical sealant.
 4. Sound attenuation blankets, mineral-fiber type.
 5. Thermal insulation, mineral-fiber type.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install gypsum plaster in accordance with ASTM C 842, 3-coat plaster, and in accordance with manufacturer's instructions.
- B. At plaster patching, prepare surface to sound substrate, apply bonding agent and patching materials in accordance with manufacturer's instructions.
- C. Install metal trims at perimeters and joints. At scratch coat form full keys. At second and third coats, ensure tight contact between coats. Tool edges at windows, doors, other openings to small V to control spalling.
- D. Clean adjacent surfaces soiled during installation. Touch-up damaged surfaces. Protect work from damage.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Interior gypsum wallboard.
 - 2. Acoustic insulation in gypsum wallboard assemblies.
 - 3. Non-load-bearing steel framing.
 - 4. Marking and identification for fire- and smoke-partitions.
- B. Alternates: Refer to Section 01 23 00, ALTERNATES.
- C. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
 - 1. Section 21 00 00 - FIRE PROTECTION:
 - a. Access doors in gypsum board assemblies.
 - 2. Section 22 00 00 - PLUMBING:
 - a. Access doors in gypsum board assemblies.
 - 3. Section 23 00 01 - HEATING, VENTILATING, AND AIR CONDITIONING:
 - a. Access doors in gypsum board assemblies.
 - b. Pipe and duct sleeves for placement into gypsum board openings.
 - 4. Section 26 00 00 - ELECTRICAL:
 - a. Access doors in gypsum board assemblies.
- D. Items To Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. (TBD).

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide fire stop tracks capable of withstanding deflection within limits and under conditions indicated.
 - 1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: Full-size Sample in 12-inch-long length for each trim accessory indicated.
- C. Shop Drawings: If materials and systems other than those specified and those indicated on the Drawings are proposed for use, submit shop drawings signed and sealed by a structural engineer licensed in the Commonwealth of Massachusetts certifying proposed systems meet code requirements, project requirements and the following deflection criteria:
 - 1. For gypsum board assemblies without applied rigid finishes L/240; for gypsum board assemblies with applied rigid finishes such as tile, stone, wood paneling L/360. Lateral load 5 ps.f. except greater at shafts. Lateral load at shafts shall be required based on analysis of equipment and systems using shaft.

1.4 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
 - 1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
 - 2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
 - 3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS," or other wording.
- C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- D. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:

- a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 3. Simulate finished lighting conditions for review of mockups.
 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
 1. Deliver and store materials in accordance with Gypsum Association Publications GA-216, GA-238 and GA-801.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 2. Protective Coating: manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Post-installed, expansion anchor.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges with depth as required for span and loading and indicated on Drawings.
- E. Furring Channels (Furring Members): 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0312 inch.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) Steel Network Inc. (The); VertiClip Series.
 - 3) Superior Metal Trim; Superior Flex Track System (SFT).
 - 4) Or equal.

 - C. Fire Stop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness compatible with studs and in width to accommodate depth of studs.
 - 1. Grace Construction Products; FlameSafe FlowTrak System.
 - 2. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 - 3. Metal-Lite, Inc.; The System.
 - 4. Or equal.

 - D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.0312 inch.

 - E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

 - F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base Metal Thickness: 0.0312 inch..
 - 2. Depth: 1-1/2 inches.

 - G. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.

 - H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

 - I. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

 - J. Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.
- 2.4 INTERIOR GYPSUM BOARD
- A. General: Complying with ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. USG Corporation.
 - b. Georgia Pacific Gypsum.
 - c. Lafarge North America.
 - d. National Gypsum Company.
 - e. Or equal.
 - B. Fire-Resistant Type X, ASTM C 1396:
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
 - C. Ceiling Type: ASTM C 1396, manufactured to have more sag resistance than regular-type gypsum board.
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
 - D. Abuse-Resistant Type: ASTM C 1629, manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.
 1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 - E. Impact-Resistant Type: ASTM C 1629, manufactured to produce greater resistance to through-penetration than typical abuse-resistant gypsum wallboard through the use of fiberglass mesh embedded into the core. Must provide Level 2 or Level 3 resistance to soft and hard body impacts per ASTM C1629.
 1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Core: 5/8 inch, Type X.
- 2.5 TRIM ACCESSORIES
- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.
 - B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - d. Or equal.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 1. Interior Gypsum Wallboard: Paper.
 2. Exterior Gypsum Soffit Board: Paper.
 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - c. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 - d. Or equal.
 3. Acoustical Sealant for Concealed Joints:
 - a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
 - b. Pecora Corp.; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.
 - d. Or equal.

2.8 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS

- A. Identification Labels: Vinyl adhesive signs, to comply with applicable local Code.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Wall Signs, Inc.
 - b. My Safety Sign.
 - c. Safety Supply Warehouse.
 - d. Or equal.
 2. Text: "FIRE AND SMOKE BARRIER – PROTECT ALL OPENINGS"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754. Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

- a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within $1/8$ inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on doorframes; install runner track section (for cripple studs) at head and secure to jamb studs.

- a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- D. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:
1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.7 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels to minimize end joints.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.8 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Designer for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.9 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 - 1. GA Level 1: Ceiling plenum areas and concealed areas not exposed to view.
 - 2. GA Level 4: Panel surfaces that will be exposed to view (typical panels).
 - 3. GA Level 5: Where indicated on Drawings.

3.10 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.11 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Work of this Section includes but is not limited to tile indicated on the Drawings and as scheduled.
- B. Tile shall include:
 - 1. Ceramic floor tile and wall tile (CT-1, CT-2, CT-3, CT-4).
 - 2. Porcelain tile (T-1).
 - 3. Marble threshold.
 - 4. Waterproofing (for all tiled floors in wet areas).
 - 5. All specialty trim and all tile shapes as shown.
 - 6. All other tile work indicated.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Preparation of subsurfaces, including leveling and repair of faulty surfaces.
 - 2. Section 03 30 00, CAST-IN-PLACE CONCRETE; Concrete slab.
 - 3. Section 07 92 00, JOINT SEALANTS; Sealing of control joints.
 - 4. Section 09 21 16, GYPSUM BOARD ASSEMBLIES; Gypsum base and cementitious backer board to receive tile.
 - 5. Section 11 40 00, FOODSERVICE EQUIPMENT.
 - 6. Division 22 - PLUMBING; Plumbing.

1.04 SUBMITTALS

- A. Shop Drawings: Submit complete shop drawings to Architect for approval showing all finishes, layout plans, bedding, jointing and details, and the dimensions and setting number of each special piece, such setting number to be applied to the rear of such piece.
- B. Samples: Submit samples of all finish materials specified under this Section to the Architect for selection and approval.
 - 1. Tile: Duplicate samples mounted on rigid panels, at least 12 in. by 12 in., for each requested color or range. Samples shall show full range of color variation that can be expected in the finish work.
 - 2. Tile Base: Duplicate samples for each size, color, shape and finish.
 - 3. Metal Edge Strip: Samples of each type of metal edge strip in specified finish.

4. Marble Threshold: 6 in. long sample showing color variation that can be expected in the finish work.
 5. Grout: Samples showing manufacturer's standard grout colors.
- C. Manufacturer's Product Data: Submit manufacturer's product data for each type of tile and tile accessory, waterproofing, and tile setting/grout materials.
1. Waterproofing Materials: Provide full documentation of each waterproofing system to be used.
- D. If requested by the Architect, furnish in addition to grade seal, master grade certificate stating grade, kind of tile, identification marks for tile packages, and the name and location of Project, signed by the manufacturer and issued before shipment of tile is made.
- E. Do not order materials or begin fabrication until Architect's approval of submittals has been obtained.
- 1.05 QUALITY ASSURANCE
- A. The work of this Section shall conform to the governing laws and building code and the TCNA 'Handbook for Ceramic Tile Installation' (TCNA Handbook).
 - B. Manufacturer of waterproof materials shall have been regularly engaged in the production of these materials for a minimum of ten years and shall have three similar installations with a minimum of five years of service at each installation.
 - C. Tile shall be Standard Grade and containers shall be grade-sealed in accordance with minimum grade specifications of ANSI 137.1; no seconds will be permitted. In addition to grade seal, furnish with Master Grade Certificate Stating grade, kind of tile, identification marks for tile packages, name and location of job, properly signed by manufacturer and tile contractor.
 - D. Waterproofing Systems: Comply with manufacturer's requirements and referenced TCNA Standards.
- 1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING
- A. Tile shall be properly packaged and brought to the site in original unopened containers with grade seals, as specified hereinbelow, intact and unbroken.
 - B. Packaged mortar materials shall be delivered in original, unopened containers marked with type and quality of product.
 - C. Containers, sacks, and bulk storage shall be stored inside the building at area(s) designated by the Contractor, raised above floor level, covered and protected until ready for use.
- 1.07 COORDINATION
- A. Work under this Section shall be properly coordinated with the work of other Sections to assure the steady progress of all the work of the Contract. Obtain complete information regarding wall and ceiling mounted fixtures, grilles, registers, equipment, accessories, etc., to be used on the work from other trades. In no case shall work of other Sections be concealed until it has been inspected.

1.08 JOB CONDITIONS

- A. Maintain temperature at 50 degrees F. minimum during tilework and for seven (7) days after completion.
- B. Vent temporary heaters to outside to avoid carbon dioxide damage to new tile work.
- C. Provide adequate lighting for good grouting and clean-up.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products in accordance with Section 01 60 00, PRODUCT REQUIREMENTS.
- B. Tile shall be properly packaged and brought to the site in original unopened containers with grade seals, as specified hereinbelow, intact and unbroken.
- C. Packaged mortar materials shall be delivered in original, unopened containers marked with type and quality of product.
- D. Containers, sacks, and bulk storage shall be stored inside the building at area(s) designated by the Contractor, raised above floor level, covered and protected until ready for use.

1.10 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, factory sealed, standard cartons and identified with labels clearly describing contents.
 - 1. Furnish not less than one box for each 50 boxes or fraction thereof, of each type, color, and size of tile installed.
- B. Deliver the additional materials to site and place in storage area(s) within the building designated by the Architect.

PART 2 - PRODUCTS

2.01 TILE AND TILE MATERIALS

- A. Quality, Grade and Certificate:
 - 1. Ceramic Tile: Tile shall comply with the requirements of ANSI A137.1. Tile shall be of Standard grade, and all containers shall be grade-sealed in accordance with minimum grade specifications described in above standard specification. If requested by Architect, furnish, in addition to grade seal, master grade certificate stating grade, kind of tile, identification marks for tile packages and the name and location of job, signed by the manufacturer and issued before shipment of tile is made. Deliver containers to site with seals unbroken.
 - 2. Porcelain tile shall comply with the international standards governing porcelain tile. The characteristics of porcelain tile shall include:
 - a. Porcelain tile shall be fabricated of approximately 50% feldspar; the remaining 50% is made up of various high-quality light firing ball clays.

- b. The tile's fired body is white, allowing clear, brilliant colors and through body construction, meaning the color goes all the way through the tile rather than a surface glaze application.
- c. Porcelain tile is pressed under pressure in the range of 6,000 pounds per square inch, resulting in a much denser tile than ceramic tile.
- d. Tile shall be fired at a temperature of 2200° F, resulting in a low rate of absorption (0.5% or less).
- e. Compressive strength of tile shall be 36,000 psi minimum.
- f. Breaking Strength (ASTM C 648): Greater than 450 lb.
- g. Bond Strength (ASTM C 482): Greater than 200 psi.
- h. Chemical Resistance (ASTM C 650): Unaffected.
- i. Frost Resistance (ASTM C 1026): Resistant.
- j. Water Absorption (ASTM C 373): Less than 0.10 percent.
- k. Scratch Hardness (MOH's Scale): 6.
- l. Abrasion Resistance: 5.
- m. Coefficient of Friction - Dry (COF-Dry) (ASTM C 1028): Greater than 0.8.
- n. Coefficient of Friction - Wet (COF-Wet) (ASTM C 1028): Greater than 0.6.

B. Tile:

1. Ceramic Tile Types: (TBD)
2. Porcelain Tile Types: (TBD).

C. Tile Trim Units: Provide porcelain and ceramic tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes, unless indicated otherwise:
 - a. Base for Thinset Mortar Installations: Straight wall base at tile floor.
 - b. Wainscot Cap for Thinset Mortar Installations: Schluter Systems L.P., as detailed on the Drawings.
 - c. External Corners for Thinset Installations:
 - d. Internal Corners: Field-buttet square corners, except use coved base and cap.
3. Specialty Tile Shapes: Provide all specialty tiles of required shapes and sizes porcelain and ceramic tiles match tile.

2.02 MARBLE THRESHOLDS

- A. General: Provide marble which is uniform in color and finish, fabricated to sizes and profiles indicated or required to provide transition between tile surfaces and adjoining finished floor.
- B. Provide marble thresholds complying with ASTM C 503 requirements for exterior use and abrasion resistance.
 1. Provide white, bonded marble complying with MIA Group "A" requirements for soundness.

2.03 SETTING MATERIALS

- A. Latex-Portland Cement Mortar: Shall be prepackaged and presanded, conforming to ANSI A118.4, as manufactured by Bostik Findley, Inc.; Mapei Corporation; Laticrete International, Inc.; or approved equal.

- B. Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Cleanable, Tile-Setting Epoxy Adhesive: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Latex-Portland Cement Joint Grout: Proprietary, factory packaged, precolored latex-Portland cement grout mixes conforming to ANSI A118.6, equal to "Hydroment Ceramic Tile Grout", manufactured by the Bostik Findley, Inc.; equivalent products manufactured by Laticrete International, Inc.; Mapei Corporation; L&M Construction Chemicals, Inc., or equal product by manufacturer licensed by Tile Council of America, as approved by Architect. A selection of at least fourteen standard colors plus black, white, and natural must be available for Architect's selection, and grout-mixes must be complete as packaged, with only addition of acrylic latex grout additive required.
 - 1. Grout materials shall comply with VOC requirements of this Section.
 - 2. A selection of at least fourteen standard colors plus black, white, and natural must be available for Architect's selection, and grout-mixes must be complete as packaged, with only addition of acrylic latex grout additive required.
- E. Water: Clean, potable, from public mains. Free of excessive amounts of salts, acids, alkalis, or other deleterious materials.
- F. Urethane Joint Grout: Proprietary, factory packaged, ready-to-use, premixed colored quartz urethane grout mix equal to equal to StarQuartz Industries, Inc., Quartzlock² Premixed, Ready-to-Use colored quartz based Urethane Grout, manufactured by StarQuartz Industries, Inc., Baltimore, MD 21230; telephone 866-220-4500; www.starquartz.com.
- G. Epoxy Grout: Laticrete Epoxy Grout or approved equal.
- H. Bond Coat: Portland cement paste on plastic bed or latex-Portland cement mortar on cured bed.
- I. Specialty Metal Edge Strips and Transitions: Metal edge trim for edge protection of tile flooring and for transition of tile flooring to resilient flooring shall be equal to those manufactured by Schluter Systems L.P., Plattsburgh, NY 12901.
 - 1. Provide strips of width necessary to set on subbase and be flush with top of floor tile.
 - 2. Provide edge strips with integral provisions for anchorage to concrete subbase or mortar bed.
 - 3. Provide 1/8 in. thick, stainless steel metal edge strip for protection of floor tile edges where indicated.
 - 4. Where tile meets resilient flooring, provide an ADA compliant reducer profile transition edge trim piece equal to Schluter-RENO-U Protective Edge Trim/Reducer. Trim shall be sized to accommodate floor tile thickness including setting bed and resilient tile.
 - 5. All edge trim and transitions shall comply with current ADA and "barrier-free" regulations.
- J. Waterproof membrane shall conform to ANSI A118.10 and shall be equal to Laticrete 9235 Waterproof Membrane, manufactured by Laticrete International, Inc., Woodbridge, CT 06525; Mapei Planicrete W, manufactured by Mapei, Inc.; or approved equal.
 - 1. Waterproof membrane installation shall be for all tile floors in wet areas.

2.04 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

- A. Urethane Waterproofing and Tile-Setting Adhesive: One-part liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

2.05 ELASTOMERIC SEALANT

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealers."
 - 1. VOC Content: Not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES

- A. Initial Preparation under other Sections: Surfaces to receive materials under this Section shall be turned over to this trade, true, plumb, and level (or uniformly sloped to required pitch) and shall be clean, free of loose dirt, and dust, grease, oil, paint, mastics, and other deleterious materials, and sufficiently cured and dried, ready to receive the finish materials.
- B. Final Preparation under this Section: Thoroughly examine all surfaces to receive work of this Section and notify Architect in writing of all conditions which would adversely affect this work. Do not commence work in any area where such notice of adverse conditions has been filed, until corrective work has been completed or waived. Starting of work without issuance of such notice shall constitute acceptance of conditions as being satisfactory to properly receive the work of this Section.
 - 1. Do final cleaning of surfaces just prior to installation of tile, removing all dust, dirt, and other loose particles.

3.02 WATERPROOFING

- A. Surfaces to be waterproofed shall be smooth, clean and free from dirt, grease, concrete sealers or curing compounds.
- B. Apply waterproofing in accordance with manufacturer's recommendations and TCNA Method F121 or TCNA Method F122, as applicable.
- C. Flash waterproofing up the walls at the coves and into drains.

3.03 INSTALLATION/APPLICATION/PERFORMANCE

- A. Layout:
 - 1. Determine locations of all movement joints before starting tile work.
 - 2. Lay out all tile work so as to minimize cuts less than one-half tile in size.
 - 3. Locate cuts in both walls and floors so as to be least conspicuous.
 - 4. Lay out tile wainscots to dimensions shown on Drawings.
 - 5. Align all wall joints to give straight uniform grout lines, plumb and level.
 - 6. Align all floor joints to give straight uniform grout lines, parallel with walls.

7. Make joints between tile sheets same width as joints within sheets so extent of each sheet is not apparent in finished work.

B. Workmanship:

1. Supply first-class workmanship in all tile work except as otherwise indicated or specified. The installation of ceramic tile shall be in accordance with ANSI Standard Specifications cited herein.
2. Use all products in strict accordance with recommendations and directions of manufacturers.
3. Proportion all mixes in accordance with latest ANSI Standard Specifications.
4. Smooth all exposed cut edges.
5. Be sure cut edges are clean before installing tiles.
6. Fit tile carefully against trim, also around pipes, electric boxes and other built-in fixtures so that escutcheons, plates and collars will completely overlap cut edges.
7. Be sure all tile work is free of grout film upon completion.
8. Where floor drains occur, slope slab-on-grade to drains as indicated on Drawings.
9. Locate toilet room accessories specified in other sections as indicated on Drawings or as directed by Architect.

3.04 INSTALLATION

A. Install and grout tile in accordance with the provisions of the standard specification and published details hereinbefore listed, generally as follows, in accordance with TCNA "Recommended Uses":

1. Floor Tile in Scheduled Areas over Concrete: Latex Portland Cement Mortar TCNA Method F115, with Epoxy Grout.' Install floor tile at 45 degree angle as indicated.
2. Floor Tile in Scheduled Areas over Concrete Slab-on-Grade (Thinset): Latex Portland Cement Mortar TCA Method F113, with Proprietary Latex-Portland Cement Commercial Grout.
3. Floor Tile in Scheduled Areas over Concrete Slab-on-Grade (Thickset): Latex Portland Cement Mortar TCA Method F112, with Proprietary Latex-Portland Cement Commercial Grout.
4. Floor Tile in Scheduled Areas over Concrete Slab-on-Grade with Waterproofing: (Thin-Set): Latex Portland Cement Mortar TCA Method F122, with Proprietary Latex-Portland Cement Commercial Grout.
5. Floor Tile in Scheduled Areas over Concrete Slab-on-Grade with Waterproofing: (Thick-Set): Latex Portland Cement Mortar TCA Method F121, with Proprietary Latex-Portland Cement Commercial Grout.
6. Wall Tile and Base Tile applied to Cementitious Backer Board Base in Scheduled Areas: Latex-Portland Cement Mortar, TCA Method W244, with Proprietary Latex-Portland Cement Commercial Grout
7. Ceramic Wall Tile applied to Coated Glass Mat Water Resistant Gypsum Backer Board in Kitchens and Toilet Rooms and Other Areas Indicated (using G-P DensArmor Plus tile backer board): Latex-Portland Cement Mortar, TCNA Method W245, with Proprietary Latex-Portland Cement Commercial Grout.
8. Ceramic Tile applied to Water Resistant Gypsum Backer Board (other than Kitchens and Toilet Rooms: and Other Areas Indicated: Latex-Portland Cement Mortar, TCNA Method W243, with Proprietary Latex-Portland Cement Commercial Grout.

B. Room temperatures where ceramic material are installed shall be maintained at temperatures of not less than 40°F. for a period of at least 48 hours prior to commencement of tile work, during the tile work, and from that time until completion of Project.

- C. Where possible, lay out work so that no tiles less than half size occurs. Maintain plumb and true finish surfaces. Maintain joints straight, true, level, plumb. All joints shall be straight and continuous in both directions.
 - D. Make tile cuts straight and true. Discard improperly cut tile. Maintain consistent joint width, including joints between adjoining sheets and joints at cut tile. Maintain true and proper planes, levels, and slopes. Remove and replace all tile work which does not comply with specification requirements.
 - E. Control Joints: Provide control joints where tile meets restraining surfaces (walls, curbs, columns, pipes, etc.); directly over control or expansion joints in subsurfaces; and not farther than 24 ft. each way, located as indicated on the Drawings or as directed by Architect. Control joints are not required where tile dimension perpendicular to joint is 12 ft. or less. Work shall conform to TCNA Method EJ171.
 - 1. Form control joints neat, straight, and uniform in width. Cut tile neatly and to accurate radius at exposed junction with pipes, etc. Control joints shall be full width of control joint in subsurfaces, and full width or normal tile joint at other locations, and full thickness of tile and setting bed.
 - 2. Keep open joints free of grout and debris. Upon completion of tile work, install non-contaminating temporary joint filler to maintain joints in clean condition until installation of joint backing and sealant under Section 07 92 00, JOINT SEALANTS.
 - F. Protective Metal Edge Strips and Transition Edge Trim: Install all protective edge strips and transition strips in accordance with edge trim manufacturer's recommendations.
 - 1. Install transition strip where tile meets resilient flooring.
 - 2. Install transition strip where tile meets concrete.
 - G. Remove all work not conforming to specification requirements and replace with acceptable work.
- 3.05 MARBLE THRESHOLDS
- A. Install marble thresholds at locations indicated; set in same type of setting bed as abutting field tile unless otherwise indicated. Set thresholds in thinset mortar for locations where mortar bed would otherwise be exposed above adjacent non-tile floor finish.
- 3.06 CLEANING
- A. After grout has set, polish tile free of all dirt and mortar or grout stains with clean, white cloths, using sponges and clean water. Rinse thoroughly and polish with clean, white cloths. Leave work clean and spotless. Acid cleaners will not be permitted.
- 3.07 PROTECTION AND FINAL CLEANING
- A. After the placing, curing, and initial cleaning, of the work of this Section, the work shall be protected from damage until time of Substantial Completion of the Project. Provide all necessary protective barriers, non-staining protective covers, etc., as required to carry out such protection.
 - B. Final Cleaning: Final cleaning shall be done by Contractor at time of Substantial Completion in accordance with Section 01 77 00, CLOSEOUT PROCEDURES.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

(Part of Work of Section 09 00 03 – ACOUSTICAL TILE Filed Sub-bid Required)

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Acoustical ceiling panels.
 - 2. Suspension systems, grid systems and ceiling hangers.
 - 3. Acoustical sealant at edge moldings at acoustical ceilings.
- B. Alternates: Refer to Section 01 23 00, ALTERNATES.
- C. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
 - 1. Section 21 00 00 - FIRE PROTECTION:
 - a. Access doors in acoustical tile.
 - 2. Section 22 00 00 - PLUMBING:
 - a. Access doors in acoustical tile.
 - 3. Section 23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING:
 - a. Access doors in acoustical tile.
 - 4. Section 26 00 00 - ELECTRICAL:
 - a. Access doors in acoustical tile.

- D. Items To Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 09 21 16 - GYPSUM BOARD ASSEMBLIES for gypsum board ceilings and soffits.
 - 2. Section 21 00 00 - FIRE PROTECTION for fire-suppression components located in ceilings.
 - 3. Section 23 00 00 - HEATING, VENTILATING AND AIR CONDITIONING for air handling and distribution components located in ceilings.
 - 4. Section 26 00 00 - ELECTRICAL for light fixture and alarm system components located in ceilings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension members.
 - 2. Method of attaching hangers to building structure. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Minimum Drawing Scale: 1/4 inch = 1 foot.
 - 5. Seismic Compliance: For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the Commonwealth of Massachusetts responsible for their preparation. All costs for professional engineering shall be included in the bid price for the Work of this Section.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6 inch square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch long Samples of each type, finish, and color.
- D. Asbestos Certification: Manufacturer's written certification that acoustical ceiling products contain no asbestos (0.0000%). Product labels indicating that it is the user's responsibility to test the products for asbestos are unacceptable and sufficient cause for rejection of the product on site.
- E. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Acoustical Ceiling Panels: Obtain each type through one source from a single manufacturer.

2. Suspension Systems: Obtain each type through one source from a single manufacturer.
 - B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to Code.
 1. Component Importance Factor: 1.5.
 - C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 2. Surface-Burning Characteristics: Provide acoustical panels complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 1. To set quality standards for installation, install mockup of each type of each material.
 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
 - B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
 - C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.
- 1.6 PROJECT CONDITIONS
- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
 - 3. Hold-Down and Seismic Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Products: Subject to compliance with specified requirements, provide one of the following products for each type indicated.
- B. ACT-1:
 - 1. Manufacturer and Model Number (Basis of Design):
 - a. Armstrong Ceilings.
 - b. Armstrong Item Number: 8360PB LYRA PB, Square Tegular, Smooth Surface Fiberglass Ceiling Panel (Plant Based) with Acoustically Transparent Membrane meeting ASTM E 1264 Classification: Type XII, Form 2, Pattern E.
 - 2. Other Acceptable Manufacturers:
 - a. USG.
 - b. CertainTeed.
 - c. Or equal.
 - 3. Panel Specifications:
 - a. Panel Size: 24 inches by 24 inches by 1 inch.
 - b. Panel Mounting: Square tegular edge, lay-in.
 - c. Noise Reduction Coefficient (NRC): 0.95.
 - d. Light Reflectance (LR): 0.88.
 - e. Ceiling Attenuation Class (CAC): N/A.
 - f. Articulation Class: 190.
 - g. Color: White.
 - h. Grid Material: Painted steel.
 - i. Grid Face Width: 15/16 inch, exposed Tee.

2.2 METAL SUSPENSION SYSTEMS

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
1. Manufacturer: Armstrong, USG, CertainTeed, Chicago Metallic, or equal.
 2. Structural Classification: Intermediate-duty system.
 3. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 4. Face Design: Flat, flush.
 5. Cap Material: Steel or aluminum cold-rolled sheet.
 6. Color: White, prefinished.
 7. Grid Face Width: 15/16 in. as specified with ACT type.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
1. Anchors in Concrete: Anchors with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency; zinc-plated for Class SC1 service.
 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 diameter wire.
- D. Hold-Down Clips: At vestibules and areas subject to wind uplift, provide manufacturer's standard hold-down clips spaced 24 inches on all cross tees.
- E. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

2.3 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements and fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
- B. Trim at Penetrations and Light Fixtures: Include metal trim as required for proper transitions at penetrations and light fixtures.

2.4 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636, seismic design requirements as applicable and per manufacturer's written instructions.
1. The layout and installation of acoustical panel ceilings and suspension systems shall be coordinated with other work penetrating the ceiling. This includes, but is not limited to, light fixtures, HVAC diffusers and equipment, and fire suppression system components.
 2. Acoustical panels shall be cut and fit around light fixtures, HVAC diffusers and equipment and fire suppression system components to set flush or recessed as recommended by manufacturer.
- B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 6. Do not attach hangers to steel deck tabs.
 7. Space hangers not more than 48 o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 2. Install hold-down and seismic clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Cooperate with the Independent Testing Agency engaged by the Owner for field quality control activities for the Work of this Section.
- B. Special Inspections: Periodic inspections according to ASCE/SEI 7 will be conducted during the installation of suspended ceiling grids.

- C. Additional inspections and retesting of materials which fail to comply with specified material and installation requirements shall be performed at Contractor's expense.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 55 00

WOOD FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Furnish and install wood flooring, as indicated on Drawings and as specified. Wood flooring shall include:
 - 1. Cutting and patching of existing wood flooring.
 - 2. Installing new wood flooring to match existing.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Wood framing.
 - 2. Section 06 20 00, FINISH CARPENTRY; Wood base.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- C. Verification Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Specialized wood flooring firm, with at least five years successful experience in installation and field finishing of the types specified, and acceptable to the wood flooring manufacturer.
- B. Manufacturer: Obtain flooring from a single manufacturer or source, to ensure match of quality, color, pattern, and texture.
- C. Wood flooring materials shall meet or exceed the fire hazard requirements of the State of Massachusetts fire marshal and authorities having jurisdiction, including flame spread and smoke developed requirements contained in Commonwealth of Massachusetts State Building Code.

- D. Wood flooring materials as installed shall conform to the Commonwealth of Massachusetts State Building Code and ADA.
- E. Association Standards: Strictly comply with the recommendations of NOFMA: The Wood Flooring Manufacturers Association.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect wood flooring from excessive moisture during shipment, storage, and handling. Deliver in unopened bundles and store in a dry place, with adequate air circulation. Do not deliver materials to building until "wet work" such as concrete, masonry, and plaster have been completed and cured to a condition of equilibrium.

1.07 JOB CONDITIONS

- A. Do not proceed, deliver, or install wood flooring until after the spaces to receive flooring have been enclosed and are dry and maintained at approximately the same humidity and temperature conditions as planned for occupancy.
- B. Condition wood flooring materials by placing in the rooms or spaces to be floored, seven days in advance of the start of installation. Open packages of wood flooring which are sealed (if any) to permit natural adjustment of moisture content.
- C. Maintain ambient temperatures in range of 65°F. to 75°F. prior to, during, and after the installation of wood flooring.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wood Flooring: Provide wood flooring as follows:
 - 1. Species: To match existing.
 - 2. Grade: Clear Grade.
 - 3. Cut: Quarter Sawn.
 - 4. Back Channeling: Provide manufacturer's standard channeling on back face of each strip.
 - 5. Matching: Tongue and groove and end-matched.
 - 6. Thickness: To match existing.
 - 7. Face Width: To match existing.
 - 8. Lengths: Provide standard random length strips, complying with applicable grading rules.
 - 9. Seasoning: Manufacture wood strip flooring from kiln-dried lumber.
- B. Fasteners: As recommended by manufacturer.
- C. Cork Expansion Strip: Composition cork expansion strip complying with Fed. Spec. HH-C-576, Type I-B, Class 2.
- D. Wood Base: Provided under Section 06 20 00, FINISH CARPENTRY.
- E. Edge Strip: 3/8 in. wide bronze angle strip.

- F. Plywood Underlayment Materials: Provide APA rated, C-D, Exposure 1, Exterior Glue plywood, 3/4 in. thick.
- G. Underlayment Paper: Rosin paper.

2.02 FINISHING MATERIALS

- A. Stain: Penetrating type non-fading wood stain of color required to match Architect's sample. Stain shall be first quality products equal to Bona Woodline DS-Stains, manufactured by BonaKemi USA or approved equal.
- B. Urethane Finish System:
 - 1. Type: Water based (waterborne) polyurethane coating system, specially formulated for heavy traffic commercial and residential hardwood floor.
 - 2. Floor Sealer: Pliable, penetrating type equal to BonaTech Bonaseal (for unstained natural floor), manufactured by BonaKemi USA.
 - 3. Finish Coats: Formulated for multi-coat application on wood flooring equal to BonaTech Traffic, manufactured by BonaKemi USA.
 - 4. Finish: Color and finish shall match existing.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine substrates on that wood flooring will be installed and conditions under which work will be performed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. General: Comply with flooring manufacturer's instructions and recommendations, and with NOFMA recommendations.
- B. Expansion Space: Provide expansion space at walls and other obstructions and termination of flooring, not less than 1/2 in. unless otherwise indicated on Drawings. Unless fully concealed by trim, fill expansion space with flush cork expansion strip. Nail shoe molding or other trim to baseboard, rather than to flooring.
- C. Apply rosin-sized paper over plywood subfloor as recommended by manufacturer.
- D. Install wood flooring conforming to the layout indicated on the Drawings.
- E. Where required or where indicated, cut and patch existing flooring and match existing pattern, layout and finish per NOFMA recommendations.

3.03 FINISHING

- A. Sand and finish new flooring as recommended by finish system manufacturer and in conformance with NOFMA recommendations.
 - 1. Machine sand installed unfinished flooring to remove offsets and non-level conditions, ridges, cups, and sanding machine marks which would be visually noticeable after finishing. Use three grades of sandpaper, ending with 00 grade.
 - 2. Vacuum clean and immediately apply finish.
 - 3. Do not permit traffic on floor after sanding and until finish is completed.

4. Cover sanded floor with kraft paper to provide access for application of first finish coats.
- B. Apply wood fillers, stains, and sealers as necessary to ensure uniform appearance of new and refinished flooring. Apply stain with soft, lint-free cloth, in direction of grain, immediately upon finishing sanding operations.
 - C. Machine sand flooring between each coat and vacuum clean between each coat.
 - D. Sealer and Finish Coat Requirements: (Match Existing).
 1. Natural Unstained Hardwood Floors: Minimum three (3) coats polyurethane finish (BonaTech Traffic).
 2. Stained Hardwood Floors: One coat of Stain (Bona Woodline DS-Stains) followed by minimum of three (3) coats polyurethane finish (BonaTech Traffic).
- 3.04 PROTECTION
- A. Installer shall advise the Contractor of procedures required for protection of hardwood flooring during remainder of construction period, so that flooring and finish will be without damage or deterioration at time of acceptance.

END OF SECTION

SECTION 09 61 10

VAPOR MITIGATION AT SLABS

(Part of Work of Section 09 00 05 – RESILIENT FLOORS, Filed Sub-bid Required)

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 DESCRIPTION OF WORK

- A. Work Included: This Section includes the furnishing, testing, and application of systems for the reduction of moisture vapor transmission and alkalinity control for interior concrete slabs to receive floor covering (sheet rubber flooring, resilient flooring).
- B. Alternates: Refer to Section 01 23 00, ALTERNATES.
- C. Items To Be Installed Only: Not Applicable.
- D. Items To Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 2. Section 07 92 00, JOINT SEALANTS.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 09 65 00, RESILIENT FLOORING; Resilient flooring.

1.3 SUBMITTALS

- A. Submit product data for each type of product and process specified including:
 - 1. Manufacturer's specification.
 - 2. Installation instructions.
 - 3. Independent test data.
 - 4. Certification requirements.
 - 5. Warranty information.
- B. Submit anhydrous calcium chloride testing (according to ASTM F 1869) performed by the Owner's Testing Laboratory.

1.4 QUALITY ASSURANCE

A. Qualifications of Applicator:

1. Employ an Applicator currently approved by the manufacturer, experienced in surface preparation and application of the material and subject to inspection and control of the manufacturer.
2. Installer shall have no less than five (5) years' experience installing the specified water vapor reduction coating system.

B. Manufacturer's Qualifications:

1. Manufacturer shall have no less than five (5) years' experience in manufacturing the same water vapor reduction system. The water vapor reduction system must be specifically formulated and marketed for water vapor reduction and alkalinity control without change of formulation or system design for a minimum period of five (5) years.
2. Manufacturer shall provide Owner with their standard ten (10) year warranty at no additional cost. Applicator of water vapor reduction system shall provide standard installation warranty for workmanship.
3. Manufacturer must provide Independent lab test reports documenting performance per the following:
 - a. ASTM E 96, Water Vapor Transmission (dry and wet methods) Performance shall be documented by an independent testing laboratory at a minimum of 90% for specified system, water vapor transmission reduction compared to untreated ACI Committee 201 durable concrete.
 - b. ASTM D 1308; insensitivity to alkaline environment up to pH 14.
 - c. Certify acceptance to continuous topical water exposure after final cure.
4. Submit list of product use and performance history, for the same formulation and system design, listing reference sources. Similar projects shall have documented minimum initial water vapor transmission rates of 15 lbs. per 1,000 square feet per 24 hours, and have resulted in maintained water vapor reduction rate of less than 3 lbs. per 1,000 square feet per 24 hours when tested to ASTM F 1869.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the job site in their original unopened containers, clearly labeled with the manufacturer's name and brand designation.
- B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sun light. Product should not be stored in areas with temperatures in excess of 90 °F., or below 50 °F.
- C. Handle product in a manner that will prevent breakage of containers and damage products.

1.6 PROJECT/SITE CONDITIONS

A. Environmental Conditions:

1. Do not apply moisture vapor reduction system to unprotected surfaces or when water is accumulated on the surface of the concrete.
2. Do not apply water vapor reduction system when temperature is lower than 50° F or expected to fall below this temperature within 24 hours from time of application.

3. Allow continuous ventilation and indirect air movement at all times during application and curing process of the water vapor reduction system.

B. Protection: Protect water vapor reduction system to prevent damage from active rain or topical water for a minimum period of 24 hours from time of application.

1.7 SCHEDULING

A. Before installation of the receiving wood flooring, resilient flooring, or carpet flooring systems over the interior concrete slabs, anhydrous calcium chloride testing shall be performed per ASTM F 1869 by Owner's testing laboratory as outlined in Paragraph 3.1 below to determine the level of water vapor transmission in the slab and the type of moisture vapor reduction system required.

B. The Owner's testing agency will coordinate with the Architect and Contractor scheduling water vapor reduction system testing and allowing enough time to test, submit and install the water vapor reduction system before installation of floor finish.

C. The Owner's testing agency will allow for as much time as is reasonable for the concrete slab to dry before installing anhydrous calcium chloride tests. All mastics, glues, and/or contaminants shall be removed to provide a clean, sound, concrete substrate prior to installing anhydrous calcium chloride tests as per ASTM F 1869.

PART 2 - PRODUCTS

2.1 MANUFACTURER / SYSTEM(S)

A. Acceptable Manufacturer: Provide water vapor reduction system(s) manufactured by the following, or approved equal:

1. Vexcon Chemicals, Inc.
7240 State Road
Philadelphia, PA 19135
Telephone 1-888-839-2661.

B. Water vapor reduction system(s), which may be incorporated in the work, shall be the product of a single manufacturer. Systems may include any of the following dependent of existing moisture conditions based on recommendations of manufacturer and applicator based on test results:

1. Vexcon MoistureBloc Emulsion One Step.
2. Vexcon MoistureBloc Emulsion Vapor Reduction System consisting of Two Step System (Vapor Reduction Primer Step 1 and Vapor Reduction Topcoat Step 2).
3. Vexcon MoistureBloc Emulsion Vapor Reduction System consisting of Two Step System (Vapor Reduction Fast Track Primer FT Step 1 and Vapor Reduction Fast Track Topcoat FT Step 3).
4. Vexcon MoistureBloc Universal.
5. Vexcon MoistureBloc MX.

2.2 MATERIALS

A. General: Use materials of one manufacturer throughout the project as hereinafter specified.

B. Vexcon MoistureBloc Emulsion One Step Vapor Reduction:

1. System Performance: Able to reduce moisture vapor emission rates from a range of 8 to 9 lb. per 1,000 sq. ft. per 24 hours to an acceptable level below 3 lb. per 1,000 sq. ft. per 24 hours.
 2. Apply system at a rate of 140 to 160 sq. ft. per gallon in accordance with manufacturer's recommendations as indicated by Product Data Sheet CP114.
 3. Warranty: Manufacturer's Standard Warranty.
- C. Vexcon MoistureBloc Emulsion Vapor Reduction System consisting of Two Step System (Vapor Reduction Primer Step 1 and Vapor Reduction MoistureBloc Emulsion Topcoat Step 2).
1. System Performance: Able to reduce moisture vapor emission rates from a range of 8 to 9 lb. per 1,000 sq. ft. per 24 hours to an acceptable level below 3 lb. per 1,000 sq. ft. per 24 hours.
 2. Apply Step 1 Primer at a rate of 160 – 180 sq. ft. per gallon in accordance with manufacturer's recommendations as indicated by Product Data Sheet CP115A.
 3. Apply a second application of Step 1 Primer at a rate of 160 – 180 sq. ft. per gallon in accordance with manufacturer's recommendations as indicated by Product Data Sheet CP115A applied at a 90 degree angle to the first coat.
 4. Apply Step 2 Topcoat at a rate of 300 sq. ft. per gallon in accordance with manufacturer's recommendations as indicated by Product Data Sheet CP115A.
 5. Warranty: Manufacturer's Standard Five (5) Year Warranty.
- D. Vexcon MoistureBloc Emulsion Vapor Reduction System consisting of Two Step System (Vapor Reduction Fast Track Primer FT Step 1 and Vapor Reduction Fast Track Topcoat FT Step 3).
1. System Performance: Able to reduce moisture vapor emission rates from a range of 12 to 15 lb. per 1,000 sq. ft. per 24 hours to an acceptable level below 3 lb. per 1,000 sq. ft. per 24 hours.
 2. Apply FT Step 1 Primer at a rate of 150 – 160 sq. ft. per gallon in accordance with manufacturer's recommendations as indicated by Product Data Sheet CP116C.
 3. Apply Step 3 Reactive Topcoat Primer at a rate of 240 – 250 sq. ft. per gallon in accordance with manufacturer's recommendations as indicated by Product Data Sheet CP116C.
 4. Warranty: Manufacturer's Standard Five (5) Year Warranty.
- E. Vexcon MoistureBloc Universal.
1. System Performance: Able to reduce moisture vapor emission rates from 8 lb. per 1,000 sq. ft. per 24 hours to an acceptable level below 3 lb. per 1,000 sq. ft. per 24 hours.
 2. Apply Step 1 Primer at a rate of 140 – 160 sq. ft. per gallon in accordance with manufacturer's recommendations as indicated by Product Data Sheet CP118.
 3. Warranty: Manufacturer's Standard Warranty.
- F. Vexcon MoistureBloc MX.
1. System Performance: Able to reduce moisture vapor emission rates from 27 lb. per 1,000 sq. ft. per 24 hours to an acceptable level below 3 lb. per 1,000 sq. ft. per 24 hours.
 2. Apply MoistureBloc MX Primer at a rate of 200 – 300 sq. ft. per gallon in accordance with manufacturer's recommendations as indicated by Product Data Sheet CP125.
 3. Warranty: Manufacturer's Standard Warranty.

2.3 AREAS NOT REQUIRING VAPOR REDUCTION SYSTEM

- A. Anhydrous calcium chloride testing performed by Owner's testing agency for interior concrete slab areas receiving wood flooring, resilient flooring, and carpet flooring systems will determine where these systems might be required. Water vapor reduction system might be required on concrete floors with water vapor transmission level less than 3 lbs./24 hours per 1,000 square feet or 5 lbs. for some specific flooring systems, verify with flooring system manufacturer.
- B. Water vapor reduction system is not required on interior concrete slabs without floor finishes or for any suspended concrete slabs (i.e. not slab-on-grade).

2.4 MIX DESIGNS

- A. Use clean containers and mix thoroughly as per manufacturer's requirements to obtain a homogeneous mixture.
- B. Use a low speed motor less than 400 rpm and a two bladed Jiffy mixing blade only. DO NOT AERATE. Mix ratios are measured by volume.
- C. Mix Ratio: Per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Calcium chloride test requirements:
 - 1. Anhydrous calcium chloride testing shall be performed by Owner's Special Inspector as outlined in Section 01 40 00, QUALITY REQUIREMENTS.
 - 2. Provide anhydrous calcium chloride tests according ASTM F 1869 in accordance to all surface preparation methods outlined. Tests shall be installed onto freshly abraded contaminant free concrete.
 - 3. Only conduct calcium chloride tests at the same temperature and humidity expected during normal use. If this is not possible, then the test conditions should be 75°F +- 10°F and 50+-10% relative humidity. Maintain these conditions 48 hours prior to and during tests. Water vapor transmission levels are directly affected by ambient room temperature and readings conducted without a sustained ambient temperature are not acceptable.
 - 4. The Owner's testing agency shall provide test results with a marked-up floor finish plan showing test results. The Owner's testing agency shall provide a written clarification on status of the ambient air temperature and humidity before and during the testing procedures.
 - 5. The Owner's testing agency shall provide a marked up floor plan showing areas with vapor reduction system recommendations.
- B. Initial calcium chloride tests:
 - 1. Before installation of wood or carpet flooring system over interior concrete slabs, the Owner's testing agency shall make known the level of water vapor transmission in the slab in accordance to ASTM F 1869 to all parties involved. The Owner's testing agency will document the test results and provide recommendations on the type of moisture vapor reduction system to be utilized.
- C. Floor treatment calcium chloride tests:

1. After proper cure of the final coat of the water vapor reduction system Owner's testing agency shall provide calcium chloride tests to determine if the level of water vapor transmission and alkalinity are reduced to Owner's specified levels in conjunction with the flooring manufacturer's installation requirements. Contact The Owner and water vapor reduction system Manufacturer's Representative concerning areas with a water vapor transmission level greater than the Owner's specified levels.

D. Adhesion tests:

1. The Owner's testing agency shall verify proper adhesion of flooring adhesives, coatings, and leveling compounds to the final vapor reduction coating system for acceptability. Contact Manufacturer's Representatives of flooring for recommendations.

3.2 PREPARATION

- A. Inspect all surfaces with regard to their suitability to receive moisture vapor reduction system with vapor reduction coating system by Manufacturer's Representative.
- B. Clean all surfaces to receive moisture vapor reduction system. Shotblast all floors and clean surfaces with Shop Vac to remove all residue off the substrate. Remove all defective materials, and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laltance, shotblast beads, etc. Repair all cracks, expansion joint, control joints, and open surface honeycombs and fill in accordance with manufacturer's recommendations. Inform vapor reduction system manufacturer if concrete additives like chlorides or any other soluble compounds that can contaminate surfaces have been used in the concrete mix. Reinforcing fibers must be burned off, scraped and vacuumed. Remove, after shotblasting, leaving no fibers left on the concrete surfaces. Provide uncontaminated, absorbtive, sound surface. Do not acid etch.
- C. Repair concrete prior to moisture vapor reduction system installation by utilizing approved concrete repair materials. Comply with all requirements as listed in manufacturer's technical data information. Consult with vapor reduction manufacturer.
- D. Make sure that surfaces to be treated with moisture vapor reduction system have not previously been treated with other materials like underlayments, screeds, penetrating sealants, etc. If this is the case, consult with the manufacturer's representative prior to any application of moisture vapor reduction system.
- E. Only a surface substrate that remains uncontaminated, absorbtive, and sound is fit to receive a water vapor reduction system. Comply with all requirements as listed in Manufacturer's technical data information.
- F. Proper removal of contaminants can render surfaces too rough for certain flooring systems. Shotblast a small test area and verify with the flooring applicator that the surfaces are fit to receive the specified flooring system without the application of an underlayment on top of the specified system.

3.3 APPLICATION

- A. System Application: Apply water vapor reduction system per referenced Product Data Sheet(s).

- B. A cementitious underlayment system with an approved epoxy primer if required by the installer or floor manufacturer may be used to level and smooth surfaces after shotblasting the floor on top of the water vapor reduction system. The underlayment system utilized must be tested and approved (no exceptions) by the manufacturer of the underlayment system prior to installation. No underlayment system containing gypsum will be allowed. When water based adhesives are utilized in the floor covering installation, use an approved underlayment system with primer prior to the Installation of the flooring system. Please consult the adhesive manufacturer for their minimum recommended thickness of cementitious underlayment to absorb excess moisture in the adhesive. Leveling of the substrate shall not be considered part of the water vapor reduction system.
- C. For installation of resilient flooring directly over the water vapor reduction system, the contractor responsible for installing the floor covering system shall use 100% solids adhesives and or contact type adhesives with long working times that can be applied to substrates with a pH up to 10. The method of use is to apply the contact type adhesives to the substrate and allow the materials water to flash off prior to the flooring installation. Always test proper adhesion of adhesive to water vapor reduction system prior to Installation of entire flooring systems.

3.4 CLEANING

- A. Clean all tools and equipment immediately after use for water vapor reduction.
- B. Remove all debris resulting from water vapor reduction system Installation from project site.

3.5 PROTECTION

- A. Protect each coat during specified cure period from any kind of traffic, topical water, and contaminants.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

(Part of Work of Section 09 00 05 – RESILIENT FLOORS Filed Sub-bid Required)

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.1 DESCRIPTION OF WORK

- A. Provide resilient flooring and related items, as indicated on the Drawings and as specified herein. Work of this Section includes, but is not limited to:
 - 1. Slip resistant safety flooring for Kitchen and Pantry.
 - 2. Solid luxury vinyl tile (LVT-1) for offices, meeting rooms, multi-purpose room.
 - 3. Resilient wall base (WB-1).
- B. Alternates: Refer to Section 01 23 00, ALTERNATES.
- C. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
- D. Items To Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE; Concrete slab.
 - 2. Section 09 61 10, VAPOR MITIGATION AT SLABS.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
 - 1. Certification by resilient flooring manufacturer that products supplied for resilient flooring installation comply with local regulations controlling use of volatile organic compounds (VOC's).
- B. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- C. Verification Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.

- D. Product certificates, in lieu of laboratory test reports when permitted by Architect, signed by manufacturer certifying that each product complies with requirements.
- E. Maintenance data for resilient flooring and base, to include in Operating and Maintenance Manual specified in Section 01 77 00, CLOSEOUT PROCEDURES.
- F. Submit results of moisture and bond tests of concrete slab substrates.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Resilient Flooring: Obtain each type, color, and pattern of resilient flooring from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Fire Performance Characteristics: Provide resilient flooring with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E 648.
 - 2. Smoke Density: Less than 450 per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver resilient flooring, and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F (10 deg C) and 90 deg F (32 deg C).
- C. Store resilient flooring on flat surfaces. Move floor materials and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.
- D. Move resilient floor coverings and related products into spaces where they will be installed at least 72 hours in advance of installation.

1.6 PROJECT CONDITIONS

- A. Maintain a minimum temperature of 70 deg F (21 deg C) in spaces to receive resilient flooring for at least 48 hours prior to installation, during resilient flooring installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F (13 deg C).
- B. Do not install resilient flooring materials until they are at the same temperature as the space where they are to be installed.
- C. Maintain relative humidity in spaces to receive resilient flooring before, during, and after installation within the range recommended by manufacturer.
- D. Close spaces to traffic during resilient flooring installation.

1.7 COORDINATION, SEQUENCING, AND SCHEDULING

- A. Coordinate work of this Section with work of other Sections affecting, or affected by, this work, as necessary to ensure completion of work of the Contract on schedule.

- B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed.
- C. Do not install flooring over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

1.8 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
 - 1. Furnish not less than one box for each 50 boxes or fraction thereof, of each class, wearing surface, color, pattern and size of resilient tile installed.
 - 2. Furnish not less than 3% (three percent) of each color and size of rubber sheet flooring installed.
 - 3. Furnish not less than 3% (three percent) of each color and size of luxury vinyl tile installed.

1.9 WARRANTY

- A. Provide manufacturer's warranty against excessive wear in accordance with the following:
 - 1. Solid Luxury Vinyl Tile: Ten (10) year limited warranty.
 - 2. Slip Resistant Safety Flooring: Ten (10) year limited warranty.
 - 3. Resilient Wall Base: Five (5) year limited warranty.

PART 2 - PRODUCTS

2.1 GENERAL MATERIAL REQUIREMENTS

- A. Resilient materials shall be uniform in thickness and size.
- B. Resilient material shall be cut accurately with square, true edges.
- C. Plain colors shall be uniform throughout.
- D. Variegated colors and patterns shall be reasonably uniform so as not to mar appearance of floor.
- E. Except as otherwise indicated or specified, all colors shall be as selected by the Architect from the full range of manufacturer's standard colors.
- F. Resilient materials shall be free of objectionable odors, blisters, cracks, objectionable foreign material, or other physical defects affecting appearance or serviceability.

2.2 SLIP RESISTANT HOMOGENOUS SHEET VINYL SAFETY FLOORING

- A. Acceptable Manufacturer:
 - 1. Manufacturer: Altro Flooring (Altro).
- B. Slip Resistant Homogenous Sheet Vinyl Flooring equal to conforming to ASTM F 1303, Type 2, Grade 1, sheet vinyl flooring with moisture resistant Class A backing.

1. Manufacturer: Altro.
2. Product: Altro Safety Flooring.
3. Style: TBD.
4. Color No. / Color: TBD.
5. Thickness: 0 2 mm.
6. Roll Length: 66 linear feet.
7. Roll Width: 6 ft. – 7 in.
8. Slip Factor: 1.03 Wet and 0.88 Dry.
9. Adhesive: Altro Eco Fix.
10. Note: Provide 4 inch and 6 inch high integral base where scheduled.
11. Install Method: TBD – If weld rod use WR289; if mastic use AM265.

2.3 SOLID LUXURY VINYL TILE (LVT)

- A. Acceptable Manufacturer: Provide products of the following manufacturers that meet or exceed specified requirements:

1. COREtec Flooring; COREtec.

- B. Solid Luxury Vinyl Tile (LVT-1): Provide solid luxury vinyl tile equal to COREtec Flooring Luxury Vinyl Tile conforming to ASTM F 1700, and as follows:

1. Product: (TBD).
2. Color: (TBD).
3. Product Number: (TBD).
4. Product Construction: High Performance Luxury Vinyl Tile.
5. Class / ASTM F 1700: Class III Printed Vinyl Plank.
6. Wear Layer Thickness: Manufacturer's Standard.
7. Total Thickness: Manufacturer's Standard.
8. Backing Class: Commercial Grade.
9. Finish: Manufacturer's Standard.
10. Nominal Dimension: (TBD).
11. Performance Specifications:
 - a. IIC Sound Rating (ASTM E492-09): 57 IIC.
 - b. Slip Resistance (ASTM D2047): >0.55 wet/dry, ADA Compliant.
 - c. Static Load Limit (ASTM F970): 1500 psi.
 - d. Flexibility (ASTM F137): Passes.
 - e. Resistance to Heat (ASTM F1514): Passes.
 - f. Resistance to Light (ASTM F1515): Passes.
 - g. Radiant Flux (ASTM E648): Class I.
 - h. Smoke Density (ASTM E 662): ≤ 450.
 - i. Size & Squareness (ASTM F2055): Passes, +/- 0.016 in. per linear foot
 - j. Thickness (ASTM F386): Passes.
 - k. Dimensional Stability (ASTM F2199): Passes.
 - l. Residual Indentation (ASTM F1914): Passes.
 - m. Resistance to Chemicals (ASTM F925): Passes.
12. Health + Environmental Specifications:
 - a. Embodied Carbon (Cradle to Gate): 12.4 Kg CO /M.
 - b. Full Life Cycle Carbon Emissions: Carbon Neutral Floors™
 - c. Total Recycled Content (Pre-Consumer): 39%.
 - d. Indoor Air Quality: GREENGUARD Gold.
 - e. FloorScore: CDPH 01350 compliant.

- f. Material Composition: Free of Ortho Phthalates, Added Formaldehyde and Heavy Metal Stabilizers.
- g. Disclosure of Environmental Impacts Environmental Product Declaration.
- h. Disclosure of Product Ingredients Health Product Declaration.
- i. Environmental Certifications NSF/ANSI 332 Silver.
- j. LEED v4 Contributes to IEQ: Low Emitting Materials; M&R: EPD and EPR.
- k. End of Life Fully Recyclable into Carpet Tile Backing through ReEntry®.

13. Technical Information:

- a. Installation: COREtec LVT Installation Guidelines.
- b. Maintenance Recommended: COREtec LVT Maintenance Guidelines.
- c. Reclamation Recyclable through ReEntry - Call 1.888.733.6873.
- d. Warranty: 15 Year Standard LVT Warranty.

2.4 RESILIENT WALL BASE (WB-1)

A. Acceptable Manufacturers: Provide products of one of the following manufacturers that meet or exceed specified requirements:

- 1. Johnsonite, Inc., A Tarkett Company (Johnsonite).
- 2. Nora Flooring (Nora), flooring by nora systems, Inc.
- 3. Roppe.

B. Wall Base (WB-1):

- 1. Manufacturer: Johnsonite
- 2. Type: Traditional Wall Base.
- 3. Height: 4 in.
- 4. Specifications:
 - a. Manufactured from a proprietary thermoplastic rubber formulation.
 - b. Meets performance requirements for ASTM F 1861 Standard Specification for Resilient Wall Base, Type TP, Group 1.
 - c. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I.
 - d. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, Class A, Smoke <450.
 - e. Flexibility: Does not crack, break, or show any signs of fatigue when bent around a 1-1/4 in. diameter cylinder when tested according to ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials protocols.
 - f. Color Stability: Meets or exceeds ASTM F 1861 requirements for color stability when tested to ASTM F 1515 Standard Test Method for Measuring Light Stability of Resilient Flooring protocols.
 - g. Phthalate-free.
 - h. Possible LEED contributions include MR:2, MR:4, MR:5, and EQ: 4.3.
 - i. Contains at least 14% pre consumer recycled content.
 - j. 100% Recyclable.
 - k. SCS FloorScore® Certified.

5. Color: (TBD).

B. Adhesive: As recommended by the rubber stair tread manufacturer.

2.5 ADHESIVES, MASTIC UNDERLAYMENTS, CRACK FILLERS, AND PRIMERS

- A. Adhesives shall be water resistant type and brand recommended by manufacturer for each of the various conditions and flooring materials. Where manufacturer lists more than one recommended adhesive, manufacturer's "preferred choice" shall be used.
 - 1. Adhesives shall meet or exceed the VOC limits (50 grams / liter) of SCAQMD Rule #1168 – Adhesive and Sealant Applications’.
- B. Crack filler shall be as recommended by flooring manufacturer, and equal to Armstrong "S-190", or Amtico "Crack Filler", as approved by the Architect.
- C. Primers for use for all the various conditions and materials shall be non-staining type as recommended by manufacturer of each specific material for each specific application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General: Examine areas where installation of resilient flooring will occur, with Installer present, to verify that substrates and conditions are satisfactory for resilient flooring installation and comply with flooring manufacturer's requirements and those specified in this Section.

3.2 PREPARATION OF SURFACES

- A. Initial Preparation Under Other Sections:
 - 1. Surfaces to receive resilient materials shall be level, plumb, true and clean, free of projections, ridges, and waves, and free of loose dirt and dust, grease, oil, and other deleterious materials such as resin type curing compounds, paint, glue, and similar materials, ready to receive work of this Section. Filling of cracks with crack filler, as required, however, will be included as part of work of this Section.
 - 2. Surfaces of concrete floor slabs to which resilient flooring is to be applied shall be finished to tolerance recommended by resilient flooring manufacturer.
 - 3. When variation in finished surface exceeds allowable amount specified therein, it shall be brought within the allowable tolerance with latex type underlayment applied in strict accordance with manufacturer's instructions.
- B. Inspection of Surfaces and Final Preparation under this Section:
 - 1. Thoroughly examine all surfaces to receive work of this Section and notify the Architect in writing of all conditions which would adversely affect this work. Do not commence work in any area where such notice of adverse conditions has been sent until corrective work has been completed or waived. Start of work in any area without issuances of such notice shall constitute acceptance of conditions in the area as suitable to properly receive the work of this Section.
 - 2. Fill all cracks, control joints, etc., in sub-surfaces, using approved Crack Filler in accordance with manufacturer's published instructions. Do final cleaning of surfaces just prior to installation, removing all dust, dirt, and other loose particles which may have accumulated since initial cleaning.
 - 3. Allow concrete slabs to dry adequately before commencing application of flooring materials, checking the moisture content, if necessary, by means of primer tests, relative humidity tests, or mat moisture and bonding tests, all such tests being at the option of the Contractor, although the Architect may require any such tests to be done by the Contractor at the Contractor's expense, if he wishes to verify or record the moisture conditions.

- C. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive resilient flooring.
- D. Use trowelable leveling and patching compounds per resilient materials manufacturer's directions to fill cracks, holes, and depressions in substrates.
- E. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.
- F. Broom or vacuum clean substrates to be covered by resilient materials immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
- G. Apply concrete slab primer, if recommended by resilient flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.3 INSTALLATION, GENERAL

- A. Do not begin installation until work of other sections including painting, is substantially complete. Use only experienced workmen. Strictly adhere to printed instructions of manufacturers of various materials; if found to be in conflict refer to Architect for decision.
- B. Maintain room temperatures in installation areas at not less than 65°F. for a period of at least 48 hours prior to commencement of resilient flooring work, and to at least 48 hours after completion, and not less than 60°F. from that time on.
- C. Lay resilient flooring materials in manner to insure good, uniform contact with subsurface materials, and to produce finished surfaces which are smooth, even, and in true planes, free of buckles, waves, and other imperfections. Store and use adhesive in accordance with manufacturer's published instructions.
- D. Where different colors of resilient flooring occur in adjoining rooms or areas, and no threshold is called for, install feature strip under door or across center of doorless opening, of color selected by the Architect.
- E. Fit flooring neatly into breaks and recesses, against bases and thresholds, and around pipes, columns, and other projections. Cut, fit, and scribe borders after application of field tile.
- F. Install edge strips where resilient flooring materials terminate at points higher than contiguous finished flooring.
- G. Clean off surplus adhesive from resilient materials and adjacent surfaces.

3.4 SOLID LUXURY VINYL TILE INSTALLATION

- A. Lay tile square with room axis, with joints aligned in both directions and with borders not less than 1/2 the width of the field tile, as directed or approved by the Architect. Direction of tile grain, when laid, shall lie in single direction. Use only full tile in the field.
- B. Adjust tiles that have not been seated level with surrounding tiles in manner recommended by manufacturer.

- C. Replace tile showing broken corners or fracture lines by warming tile, carefully removing, and replacing with new tile of same type, color, pattern, and thickness.

3.5 SAFETY FLOORING INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Provide all labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Provide painting and finishing work throughout exterior and interior of Project as indicated and scheduled on the Drawings and as specified.
 - 2. Examine Contract Documents to determine full extent of painting and finishing work required. Materials provided under other Sections that need painting or finishing and are left unfinished under requirements of other Specification Sections, shall be painted and finished to completion under work of this Section, unless specifically scheduled herein to be left unfinished.
 - 3. Preparatory work of materials and surfaces to receive paint beyond that specified to be done as work of other Sections, shall be included as work of this Section.
- B. Painting Contractor shall be responsible for insuring that all coatings and the application of all coatings conform to all federal, state, and local regulations, including VOC/VOS rules at the time of application.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
 - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE; Concrete.
 - 2. Section 05 50 00, METAL FABRICATIONS; Prime coat on miscellaneous iron.
 - 3. Section 06 10 00, ROUGH CARPENTRY; Wood framing and wood preservative treatments.
 - 4. Section 06 20 00, FINISH CARPENTRY.
 - 5. Section 07 46 00, EXTERIOR SIDING AND TRIM.
 - 6. Section 07 92 00, JOINT SEALANTS.
 - 7. Section 08 11 00, STEEL DOORS AND FRAMES.
 - 8. Section 08 14 00, WOOD DOORS.
 - 9. Section 09 21 16, GYPSUM BOARD ASSEMBLIES; Gypsum wallboard to be painted.
 - 10. Division 23 – HVAC and Division 26 - ELECTRICAL; Factory finish and prime coats on mechanical and electrical fixtures and equipment.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.

- B. Initial Color Selection Samples: Submit manufacturer's standard color charts or chips showing complete range of colors, textures, and finishes available for each paint system used.

- 1. Provide brush-off for color match meeting Owner and Architect's approval.

- C. Verification Samples: After initial selection of colors, submit representative samples of each paint system color that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide texture to simulate actual conditions. Define each separate coat, including block fillers and primers. Resubmit samples until required sheen, color, and texture have been approved. Provide samples as follows:

- 1. Paint Samples for Smooth Surfaces: Provide samples of painted finishes on gypsum drywall or Masonite board having minimum size of 144 sq. in.

1.05 QUALITY ASSURANCE

- A. Source: Provide primers and undercoat paint produced by same manufacturer of finish coats for each substrate.
- B. Coordination: Review other Specification Sections where primers are provided to ensure compatibility with finish coatings provided under this Section.
- C. Mock-Ups: Prior to commencing work of this Section, provide 100 sq. ft. mock-ups of each color, paint system, and substrate at locations acceptable to the Architect. Obtain Architect's acceptance of visual qualities. Refinish mock-ups until Architect's acceptance is obtained. Maintain acceptable mock-ups throughout the remainder of the work to serve as criteria for acceptance of the work. Acceptable mock-ups may be incorporated into the finish work.
- D. The painting subcontractor shall submit qualifications indicating his experience as a painting contractor. These qualifications shall include a list of projects successfully completed, similar in size and scope to this Project.

106 TESTS

- A. The Owner may employ an independent testing agency to perform tests, evaluations, and certifications of products used. Cooperate and permit samples of materials to be taken as they are used.

1.07 PROJECT CONDITIONS

- A. Weather, Temperature, and Humidity: Perform work only when existing and forecasted weather conditions fall within limits established by manufacturers of materials used.
 - 1. Indoor Temperature: Maintain indoor temperature at 65°F. during application and drying of paints.
 - 2. Outdoor Temperature and Conditions: Air and surface temperature shall be between 50°F. and 90°F. Surfaces shall be dry within limits of finish system manufacturer.
 - 3. Do not paint exterior surfaces while surfaces are exposed to the hot sun.
- B. Substrates: Proceed with work only when substrate construction and penetration work is complete.
- C. Lighting: Since lighting conditions can alter appearances of finish painting work, perform work of this Section under lighting conditions simulating permanent lighting system to the greatest extent possible.

- D. Where painting operations require the use of interior paints and coatings which are not latex or acrylic based materials (i.e. solvent-based materials) or paint or coating materials which when applied will produce fumes or vapors which may adversely affect the occupants of the building, the Contractor shall schedule this painting work (applying solvent-based or oil-based paints and coatings) during premium time (overtime), at no additional cost to the Owner, so as not to affect other contractors working on-site.
- E. A room shall be assigned for the storage of painting tools and materials. The floor shall be properly protected with drop cloths or building paper. Paint shall be mixed in suitable containers, and necessary precautions shall be taken to prevent fire. This room shall be locked at the completion of each day's work. The Contractor shall have duplicate keys.
- F. Protect all adjacent surfaces from damage by paint and provide all drop cloths and masking to accomplish the same.
- G. Do not use any plumbing fixture or pipe for the disposal of waste materials. Carry all water required to the mixing room and dump all waste materials in containers outside the building. Remove oily rags and other combustible waste materials from the building daily.
- H. Removal of Accessories:
 - 1. The General Contractor will remove and replace all finished hardware applied to doors, except butts, and shall be responsible for the removal and replacement of all accessories, plates and fixtures of other trades, as necessary for the satisfactory completion of work under this Section.
 - 2. Doors already in place shall be removed and the top and bottom edges finished with two coats of specified finish applied prior to finishing face of doors. Doors shall be replaced after edges are dry.
 - 3. In no case shall there be any attempt to paint around finish hardware or other new or existing removable items which are already in place.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products in accordance with Section 01 60 00, PRODUCT REQUIREMENTS.
- B. Deliver materials in unopened original containers bearing manufacturer's labels.
- C. Store materials in fully sealed containers, outside the building, preferably in exterior storage shed, well ventilated, and with a minimum ambient temperature of 45°F. Oily rags and waste must be removed from the building every night, and under no circumstances will be allowed to accumulate. Each space containing stored paint materials shall be provided with UL labeled fire extinguisher of suitable type, class, and capacity.

1.09 COORDINATION

- A. Work under this section shall be properly coordinated with the work of other sections to assure the steady progress of all the work of the Contract.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Paints and Coatings: Provide first quality products as manufactured by one of the following manufacturers that meet or exceed specified requirements:
 - 1. Benjamin Moore and Co. (Moore).
 - 2. The Sherwin-Williams Company (S-W).
 - 3. Devoe and Reynolds (Devoe).
 - 4. Tnemec Company, Inc. (Tnemec).
- B. Clear Penetrating Sealer for Concrete (Except for Concrete Floors to receive Finish Floor System): Provide products of the following manufacturer that meet or exceed specified requirements; equal products of other manufacturers will be acceptable substitutes provided that material meets the performance characteristics of the specified product:
 - 1. Ashford Formula, manufactured by Curecrete Chemical Company, Inc.; or approved equal by Sika Corporation, Chem-Trete; or approved equal.
- C. Materials used shall be best grade products of their respective kinds. The Painting Schedule is based on products the above-named manufacturers. These are specified to establish a standard of quality and kind of material desired. Provide these products or equals as approved by Architect.
- D. Note: If substitutes are proposed, submit complete schedule showing materials specified and equivalent materials proposed as substitutes. Provide complete manufacturer's product data on proposed materials. Substitutes must be approved by Architect before commitment for materials is made.
- E. Assume full responsibility for proper performance of materials, for method of application, and for compatibility of materials applied over shop coats or other coats previously applied, including but limited to primers, sealers, preservative treatments, etc. Notwithstanding specific schedules in this Section, select primers which have been verified to be appropriate for each of the substrates and finishes encountered.
- F. Provide miscellaneous painting materials such as linseed oil, shellac, turpentine, and thinner of the highest quality.

2.02 COLORS

- A. Provide colors in accordance with approved Color Schedule. Colors designations indicated in the Color Schedule are associated with a particular paint or coating manufacturer's custom and/or standard line of available colors.
- B. Paint or coatings of other manufacturers as listed herein will be acceptable provided that the paint or coating meets or exceeds the quality of paint or coating specified and that the paint or coating may be tinted as required to provide an acceptable color match and appropriate degree of gloss, acceptable to the Architect.
- C. Tint and match colors to the satisfaction of Architect. Provide facilities for comparison and adjustment of colors.
- D. No limit is placed on number of colors that may be required; however the following maximum number of colors may be used in any one room, area, or surface:

1. Four colors.

E. Colors: To be determined or as selected by the Architect or Owner.

PART 3 - EXECUTION

3.01 INSPECTION AND GENERAL PREPARATION

- A. Inspect surfaces to receive finishes to ensure they are in proper condition to receive work under this Section.
- B. If surfaces are not thoroughly dry, or if surfaces cannot be put in proper condition to receive paint or other finish by customary cleaning methods, sanding, or spackling, notify Architect in writing.
- C. Commencing work on any surface will be construed as acceptance of the surface as being satisfactory to properly receive the work of this Section.
- D. Furnish and lay drop cloths in all rooms and areas where painting and finishing is being done, to adequately protect flooring and other work from all damage during the painting work.
- E. Remove hardware, accessories, device plates, lighting fixtures, factory finished work, and similar items; or provide ample in-place protection. Use skilled mechanics for removal, resetting, and protection.
- F. Cleaning: Do not paint over dirt, dust, rust, grease, moisture, or other contaminants detrimental to the formation of a durable paint finish. Clean surfaces thoroughly prior to painting in any given area.
- G. Touch up bare or abraded spots on surfaces with shop or existing finishes scheduled to be painted under this Section. Use same material used for shop coat. Substrate shall be smooth, free from raised grain, putty sags, cracks, rust, grease, dirt, or other foreign matter or defect.
- H. Incompatible Shop Primers: Remove incompatible shop primers and reprime surfaces or provide barrier coats in compliance with finish paint manufacturer's instructions.

3.02 SURFACE PREPARATION

- A. Prepare surfaces to receive work of this Section in strict accordance with manufacturer's instructions applicable to each material, condition, and finish.
- B. Gypsum Wallboard: Fill holes, dents, and similar flaws in gypsum wallboard with joint compound. Cut out and fill cracks. Sand surface of patch smooth and flush with adjacent surfaces. Do not abrade adjacent surfaces. Patched areas shall not be detectable in finished work.
- C. Wood to be Painted: Sand surfaces smooth and free of marks prior to applying first coat. Wash sap spots and knots with mineral spirits. When dry, touch-up spots and knots with an approved sealer for exterior work, and with two coats of shellac for interior work.
 - 1. Fill nail holes, cracks, open joints, and other defects, with putty or plastic wood filler. Sand smooth when dry.
 - 2. Prime tops, edges, and bottoms, of unprimed wood doors immediately upon delivery. Prime hardware cut-outs in similar manner prior to installation of butts, locks, and closers.

3. Prime wood edges, ends, faces, undersides, backsides, including cabinets, casework, paneling, and moldings and trim.
 4. Prime wood glazing rabbets and sealant slots before glazing or sealant work is begun.
- D. Field-Welded Metal: After installation, field-welding, and grinding, and immediately before painting, remove rust, loose mill scale, dirt, weld flux, weld spatter, weld smoke stains, burnt primer, and other foreign material with wire brushes and/or steel scrapers. Power tool clean in accordance with SSPC SP 3. Remove grease and oil by use of solvent recommended by paint manufacturer. Sand exposed surfaces, and between coats, as required to produce smooth, even finishes.
1. Sand smooth and spot prime welded areas, and areas where prime coat has been damaged or abraded, using rust inhibitive primer scheduled in this Section.
- E. Other Ferrous Metal: Remove rust, mill scale, and foreign materials. Wire brush or sand damaged or rusted area to bright metal. Remove grease or dirt with solvents recommended by paint manufacturer just prior to applying paint.
1. Spot prime all areas where shop coat has been damaged or abraded, using same type paint as used for shop coat.
- F. Field-Welded Galvanized Metal: After installation, field-welding, and grinding, and immediately before painting, remove rust, loose mill scale, dirt, weld flux, weld spatter, weld smoke stains, and other foreign material with wire brushes and/or steel scrapers. Power tool clean in accordance with SSPC SP 3. Remove grease and oil with solvents recommended by paint manufacturer. Sand exposed surfaces, and between coats, as required to produce smooth, even finishes.
1. Sand smooth welded areas and areas where galvanized coating has been damaged or abraded. Spot prime using zinc primer scheduled in this Section.
- G. Other Galvanized Metal: Prior to installation, remove corrosion and foreign materials by sanding or other appropriate method. Remove grease or dirt with solvent recommended by paint manufacturer just prior to applying primer.
- H. Other Non-Ferrous Metal: Prepare shop primed non-ferrous metals similarly to ferrous metals, specified above.
1. Prepare unprimed non-ferrous metals by thoroughly cleaning of oil, grease, and temporary protective coatings using solvent recommended by primer manufacturer. Provide additional pretreatment recommended by primer manufacturer to assure permanent adhesion of paint coats.
- I. Concrete to Receive Clear Penetrating Sealer:
1. Concrete to be Sealed: Allow a minimum of 30 days curing time prior to sealing new concrete.
 2. Sweep all areas to be sealed with a fine bristle broom or scrub, hose off with water and let dry, to remove surface dust, dirt, and contamination.
- J. Other Materials: Prepare other materials in strict accordance with recommendations of manufacturers of materials to be finished, and primers and finishes to be applied.
- K. Materials Preparation: Mix and prepare paint materials in accordance with manufacturer's printed instructions. Use only thinners approved by paint manufacturer, and only within recommended limits.

3.03 APPLICATION

- A. Painting Schedule in this Section lists minimum number of coats required. If specified minimum number of coats does not completely cover or hide base materials, provide additional coats required for coverage and uniform finish appearance, without additional cost to Owner.
- B. Apply paint in strict accordance with manufacturer's instructions. Use applicators and techniques best suited for substrates and types of materials being applied. No material shall be thinned in any way except as directed by manufacturer.
 - 1. Workmanship shall be of the highest quality. Only skilled workmen shall be employed. All materials shall be applied under adequate illumination, evenly spread and smoothly flowed on without runs or sags. All work not conforming to the specifications shall be cleaned off and repainted at the expense of the Painting Contractor.
 - 2. Do not apply initial coating until moisture content of surface is within limitations recommended by manufacturer and surface is prepared in conformance with specifications and manufacturers recommendations.
 - 3. All materials shall be applied in accordance with the manufacturer's directions as printed on container and any thinning required shall be done in the manner and exclusively with the type of reducer recommended.
 - 4. No painter's finish shall be applied until the preceding coat is thoroughly dry and in no case less than six (6) days for exterior work and two (2) days for interior work, unless manufacturer of the paint material in question specifically directs otherwise. Exterior painting shall not be undertaken at temperatures below 50 degrees F. or immediately following rain, frost, or if dew is on the surface, sand and dust between each coat to remove defects.
 - 5. Finishing materials shall be free from skins, lumps or any foreign matter when used and shall be kept well stirred while being applied. Each coat shall be evenly brushed out.
- C. Apply paints and coatings at coverage rates and dry film thicknesses scheduled at the end of this Section. Each coat applied must be inspected and approved by Architect prior to application of succeeding coat, otherwise no credit for the coat applied will be given and work in question shall be recoated without additional expense to Owner. Notify Architect when each coat is ready for inspection.
- D. Additional Coats: Provide additional coats necessary to eliminate show through and bleed through conditions.
- E. Drying Time: Allow manufacturer's recommended drying time between successive coats. However, allow each coat to thoroughly dry prior to application of subsequent coat.
- F. Sanding: Lightly sand finishes between coats using #00 sandpaper.
- G. Tinting: Tint prime coat on gypsum wallboard and plaster to approximate color of final shade.
- H. Closets: Finish closets inside the same as adjoining rooms, unless otherwise specified or scheduled.
- I. Doors and Panels: Paint all doors, panels, access panels, etc., in the "open" position. Paint all edges, tops, bottoms, and both faces. Paint back face of access panels and removable or hinged covers to match adjacent exposed surfaces.
- J. Movable Equipment and Furnishings: Paint surfaces behind movable equipment and furnishings same as adjacent exposed surfaces.

- K. Permanently Fixed Equipment: Paint surfaces behind permanently fixed equipment with prime coat only.
- L. Duct Interiors: Paint interior surfaces of ducts where visible through registers, grilles, or louvers with flat black, non-specular paint.
- M. Concrete to Receive Clear Penetrating Sealer: Apply sealer in accordance with manufacturer's recommendations at a rate not to exceed 150 sq. ft. / gallon.
- N. Finished work shall be free from runs, sags, hairs, defective brushing, and clogging of lines and angles. Flaws visible in the completed work shall be removed and the area satisfactorily repaired.
- O. Mechanical and Electrical Work: Painting of mechanical and electrical items is limited to items exposed to view in occupied areas; mechanical and electrical items within mechanical rooms, and other similar spaces are to be left unpainted or shop finished without a field-applied finish):
 - 1. Mechanical items to be painted include, but are not limited to:
 - Ductwork.
 - Heat exchangers.
 - Insulation
 - Motors and mechanical equipment.
 - Piping, hangers, and supports.
 - Tanks and equipment.
 - 2. Electrical items to be painted include but are not limited to:
 - Conduit and fittings.
 - Switchgear.
- P. Completed Work: Provide finishes that match approved samples and mock-ups for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.04 COMPLETION

- A. Cleaning: At completion of work of this Section, remove paint and varnish spots, and oil, grease, and other stains caused by this work from exposed surfaces. Leave finishes in a satisfactory condition.
- B. At completion of work of this Section, remove masking materials and other debris. Reinstall or replace fixtures, plates, etc., removed to facilitate application of paint.
- C. Retouching: Touch-up and repair applied finishes which, for any reason have been damaged during construction work. All finished work applied under this Section shall have finished surfaces as approved by finish material manufacturer.
- D. Final Inspection: Protect painted surfaces against damage until date of Substantial Completion. Architect will conduct final inspection of painting work. Areas that do not comply with requirements of these Specifications shall be repainted or retouched to satisfaction of Architect at no additional cost to Owner.

- E. Paint Schedule: Prepare Schedule which includes a schedule identifying paint manufacturer, paint type, paint color, and gloss for each painted surface in each room. Said Schedule shall be sufficiently detailed to permit the Owner to use this Schedule for future maintenance, repainting, and reordering of paints and coatings.

3.05 SURFACES NOT TO BE FINISHED

- A. Finishes for the following items are either included under other appropriate Sections or require no painting, except as otherwise specifically scheduled with subsequent Exterior and Interior Schedules.
1. Chrome or nickel plating, stainless steel, bronze, brass, and aluminum other than mill finished, unless otherwise specified.
 2. Factory finished mechanical and electrical equipment, pumps, and machinery, which occur in mechanical or equipment rooms or areas.
 3. Galvanized ducts, pipes, conduits, etc., occurring within mechanical areas or spaces. Also all such items fully concealed from view in the finished work (except items located above open cell ceilings in corridors).
 4. Factory finished materials, specialties, and accessories unless otherwise specified.
 5. Ceramic and clay products, glass, plastic, and other surfaces with "integral" finishes, except as otherwise scheduled hereinbelow.
 6. Exterior concrete.
 7. Cabinetry specified as shop finished.

3.06 PAINT SCHEDULE

- A. Number of coats scheduled is minimum. Refer to Paragraph 3.2 for surface preparation and Paragraph 3.3A., hereinbefore.
- B. Painting of Exterior Surfaces:
1. Preprimed Exterior Galvanized Steel Door and Frame (Alkyd Primer, Alkyd Finish):
 - a. Field-Applied Undercoat: One Coat, Benjamin Moore IronClad Alkyd Low Lustre Enamel #163, 1.3 mil DFT.
 - b. Field-Applied Finish: Two Coats, Benjamin Moore Impervo Semi-Gloss Enamel, 1.7 mil DFT per coat.
 2. Exterior Galvanized Steel for Acrylic Polyurethane Finish (handrail and railing assemblies, exterior steel doors and frames):
 - a. One Coat - Epoxy Primer in shop, under other Section.
 - b. After Installation:
 - 1). Galvanizing Repair at Field Welds - Tnemec No. 90-97 Tneme-Zinc Primer (DFT 3.0 mils)
 - 2). Intermediate Coat - Tnemec Series 27 Typoxy (DFT 3.0 to 4.0 mils).
 - 3). One Coat - Tnemec No. 73 Endura-Shield III (DFT 2.0 to 3.0 mils).
 3. Exterior Wood Siding for Stain Finish:
 - a. Two Coats - Equal mixture of Cabot's Bleaching Oil and Cabot's Weathering Stain (Driftwood Gray) to provide a uniform weathering gray finish.

4. Exterior PVC Trim for Paint Finish:
 - a. Primer Coat: Insl-X 'STIX' waterborne bonding primer (urethane acrylic) primer.
 - b. Two Coats - 100% Acrylic Latex House Paint manufactured by Benjamin Moore, Sherwin Williams, or approved equal. Provide Satin Finish.

- C. Painting of Interior Surfaces: Important Note: Notwithstanding anything in the following schedule to the contrary, interior painting and finishing shall conform to the applicable laws and building code regarding fire hazard classifications of finish materials.
 1. Interior Gypsum Wallboard Ceilings and Soffits for Acrylic Latex Finish, Flat Finish: Satin:
 - a. One Coat: Sherwin-Williams (S-W) Harmony Interior Latex Primer B11W900 or Benjamin Moore (BM) Eco Spec WB Interior Latex Primer 372.
 - b. Two Coats: Sherwin-Williams (S-W) Harmony Interior Latex Flat B5 Series or Benjamin Moore (BM) Eco Spec WB Interior Latex Flat Finish 373.

 2. Interior Gypsum Wallboard for Acrylic Latex Finish, Eggshell or Satin:
 - a. One Coat: Sherwin-Williams (S-W) Harmony Interior Latex Primer B11W900 or Benjamin Moore (BM) Eco Spec WB Interior Latex Primer 372.
 - b. Two Coats: Sherwin-Williams (S-W) Harmony Interior Latex Eg-Shel B9 Series or Benjamin Moore (BM) Eco Spec WB Interior Latex Eggshell Finish 374.

 3. Interior Gypsum Wallboard for Acrylic Latex Finish, Semi-Gloss:
 - a. One Coat: Sherwin-Williams (S-W) Harmony Interior Latex Primer B11W900 or Benjamin Moore (BM) Eco Spec WB Interior Latex Primer 372.
 - b. Two Coats: Sherwin-Williams (S-W) Harmony Interior Latex Semi-Gloss, B10 Series or Benjamin Moore (BM) Eco Spec WB Interior Latex Semi-Gloss Finish 376.

 4. Interior Gypsum Wallboard for Epoxy Finish:
 - a. One Coat - Benjamin Moore Super Spec HP Polyamide Epoxy High Gloss Enamel P42 (DFT 2.0 to 3.0 mils).
 - b. Two Coats - Benjamin Moore Super Spec HP Acrylic Epoxy Coating P43 (DFT 1.5 mils).

 5. Interior Finish Carpentry for Semi-Gloss Paint Finish (softwoods, paint grade hardwood, plywood, MDF, MDO, and hardwood veneers):
 - a. One Coat: Sherwin-Williams (S-W) Harmony Interior Latex Primer B11W900 or Benjamin Moore (BM) Eco Spec WB Interior Latex Primer 372.
 - b. Two Coats: Sherwin-Williams (S-W) Harmony Interior Latex Semi-Gloss, B10 Series or Benjamin Moore (BM) Eco Spec WB Interior Latex Primer 372.

 6. Interior Finish for Transparent Finished Woodwork:
 - a. Sand - 220 grit sandpaper.
 - b. Stain - Moore Interior Wood Finishes Penetrating Stain 241
 - c. Two Coats - Moore Benwood Polyurethane Finish 435
 - d. Sand Between Urethane Coats - 220 grit sandpaper.

7. Exposed Structural Steel:
 - a. Shop Primer: Tnemec Series 10-1009 Grey Non-Lead Based Primer (dry-film 2.5 mils).
 - b. One Coat: Tnemec Series 15 Unibond Rust Inhibitive Coating (dry-film 3.0 mils)
8. Interior Metal Handrail and Railing Assemblies:
 - a. One Coat - Epoxy Primer in shop, under other Section.
 - b. After Installation:
 - 1). Touch-Up Coat - Tnemec "No. 161 Hi-Build Epoxoline" Epoxy
 - 2). Two Coats - Tnemec "No. 73 Endura-Shield III" Acrylic Polyurethane (DFT 1.5 to 2.0 mils)
9. Interior Metals not Specified to Receive other Coating Systems:
 - a. One Coat - Approved primer, in shop under other Sections where specified), or Benjamin Moore #M04 Acrylic Metal Primer

Note: One prime coat only is required at interior metal work, except touch-up of areas which have become rusted or damaged prior to finish painting.
 - b. Two Coats - Benjamin Moore Pristine Eco Spec Interior Latex Semi-Gloss 224.
10. Penetrating Sealer for Exposed Concrete Floor not scheduled to receive another finish:
 - a. One Coat - Curecrete Chemical Co. "Ashford Formula" (150 sq. ft. per gallon).
11. Mechanical and Electrical Work (Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork visible through grilles and registers):
 - a. Same as specified for other interior metals, hereinabove.

END OF SECTION 09 91 00

SECTION 10 14 20

INTERIOR SIGNAGE (CODE REQUIRED)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Code-required interior panel signage, including but not limited to, accessibility signage, toilet room signage, mechanical and electrical room signage, time delay door hardware signage.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 26 00 00 - ELECTRICAL for illuminated exit signs.

1.04 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
 - 1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.
- C. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
 - 1. Panel Signs: Full-size Samples of each type of sign required.
 - 2. Approved samples will not be returned for installation into Project.
- D. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain each sign type through one source from a single manufacturer.

- B. Regulatory Requirements: Comply with the Massachusetts Architectural Access Board, Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.07 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.01 PANEL SIGNS

- A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
 - 1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.
- B. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
 - 1. Panel Material: Opaque acrylic sheet.
 - 2. Raised-Copy Thickness: Not less than 1/32 inch.
- C. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for interior applications.

2.02 MATERIALS

- A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- B. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:
 - 1. Impact Resistance: 16 ft-lbf/in. per ASTM D 256, Method A.
 - 2. Tensile Strength: 9000 lbf/sq. in. per ASTM D 638.
 - 3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D 790.
 - 4. Heat Deflection: 265 deg F at 264 lbf/sq. in. per ASTM D 648.
 - 5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.
- C. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing.
- D. Vinyl Film lettering and graphics at interior locations: Provide sizes and colors indicated.

E. Tactile Panel Signs

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

ACE Sign Systems, Inc.
Advance Corporation; Braille-Tac Division.
ASI-Modulex, Inc.
Seton Identification Products.
ASE Manufacturing.
Supersine Company (The).
Southwood Corp.

2. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
3. Laminated, Etched Photopolymer: Raised graphics with Braille 1/32 inch above surface with contrasting colors in finishes and color combinations as selected by Architect from manufacturer's full range and laminated to acrylic back.
 - a. Typeface: Century Gothic.
 - b. Edge: Square cut.
 - c. Corner: Square.
 - d. Custom Paint Colors: Match sample provided by the Architect.
 - e. Braille: Dome-shaped to comply with ADA. Braille with flat tops is not acceptable.
 - f. Pictograms: as indicated on Signage Schedule.
 - g. Room Number Text: as indicated on Signage Schedule.
 - h. Room Name Text: as indicated on Signage Schedule.
 - i. Insert Height: 1 inch or as indicated on Signage Schedule.
4. Mounting: Unframed, wall mounted with two-face tape.
 - a. Mounting Methods: Use double-sided vinyl tape and silicone fabricated from materials that are not corrosive to sign material and mounting surface. Provide at:
 - 1) Tactile sign with slot for paper insert.
 - 2) Tactile sign without slot for paper insert.
 - 3) Pictogram signage installed as part of signage mounted to glass.

2.03 ACCESSORIES

- A. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.
- B. Anchors and Inserts: Provide recommended anchors and inserts for installation. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Verify that items provided under other sections of Work are sized and located to accommodate signs.
2. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
- B. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
- C. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- D. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
- E. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.03 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by the Owner.

END OF SECTION

SECTION 10 21 13

METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. Furnish and install ceiling hung metal toilet compartments, vision screens, accessories, hardware, and related items to complete the work as indicated on the Drawings and/or specified herein and includes, but is not necessarily limited to, the following:
 - 1. Metal toilet compartments and vision screens, completely erected.
 - 2. All related mounting brackets, fastening devices, and anchors.
 - 3. All related finish hardware and accessories, as specified.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 01 11 00, SUMMARY for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 01 33 00, SUBMITTAL PROCEDURES.
 - 3. Section 05 50 00, METAL FABRICATIONS; Steel channel supports above suspended ceilings to receive ceiling-mounted pilasters.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Show interfaces and relationships to work of other trades.
- C. Field Measurements: Take necessary field measurements before preparation of shop drawings and fabrication. Do not delay progress of the job. If field measurements are not possible prior to fabrication, allow for field cutting and fitting.
- D. Initial Selection Samples for Partitions: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- E. Verification Samples for Partitions: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.

- F. Other Samples: Submit the following samples in duplicate to the Architect for approval.
1. Each item of hardware, accessories, mounting brackets, and fastening device.
 2. Metal color sample with stepped back coating and finishes to show base metal, protective treatments, primer, and finish coat of enamel.
- G. Certificates: Submit duplicate certificate from the toilet compartment manufacturer, properly attested, stating that the materials and construction will comply with the requirements of the Drawings and Specifications. The certificates shall be submitted after final approval of shop drawings and before delivery or installation of the enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURER AND TYPE

- A. Acceptable Manufacturers:
1. All American Metal Corporation, Freeport, NY 11520.
 2. Sanymetal Products, Somerset, KY 42501.
 3. Global Steel Products Corp., Deer Park, NY 11729.
 4. Knickerbocker Partition Corporation, Freeport, NY 11520-3035.
- B. Provide Type C/H by All American Metal Corp. or approved equal product manufactured by Sanymetal Products or Global Steel Products Corp.

2.02 MATERIALS AND PRODUCTS

- A. Sheet Steel: ASTM A 591, Class C, galvanized-bonderized, stretcher leveled and smooth; provide the following metal thicknesses:
1. 16 gage at pilasters
 2. 20 gage at panels
 3. 22 gage at doors
 4. 12 gage at anchorage reinforcement
 5. 14 gage at tapping reinforcement
- B. Core: Water resistant kraft paper honeycomb of thickness to provide the following minimum finished dimensions:
1. Doors and Panels: 1 in.
 2. Pilasters: 1-1/4 in.
- C. Pilaster Trim (Shoes): ASTM A 167, type 302/304 minimum 20 gage stainless steel; not less than 3 in. high.
- D. Fasteners: Where exposed, provide non-removable stainless steel, chrome plated steel, or chrome plated brass. Where concealed, provide hot-dip galvanized steel.

2.03 HARDWARE, BRACKETS, AND FITTINGS

- A. Provide manufacturer's standard items including, but not limited to, cut-out type hinges which hold door slightly open when door is not latched shut, recessed latches, latch strikes and keeper with silenced door stops, combination coat hooks and rubber tipped bumpers, and door pulls.

- B. Brackets, Hardware, and Accessories: Manufacturer's standard design fabricated from chrome plated cast nonferrous alloy (Zamac). All items shall be fully finished on all exposed surfaces. Sawn pieces of aluminum extrusions are not acceptable.

2.04 FABRICATION

- A. Fabricate all parts of the work to be truly flush, straight, plumb, level and square with no noticeable dents, bulges, warps and twists.
- B. Provide panels, pilasters, and doors with sizes, shapes, and profiles as indicated on approved shop drawings.
- C. Field measure and fabricate panels, pilasters, and doors so that joints between adjacent members and between members and adjacent construction are not more than 1/2 in. wide.
- D. Provide minimum 24 in. wide in-swinging doors for toilet stalls, except where indicated otherwise and except at handicapped accessible stalls which shall swing out with door width and other requirements complying with requirements of authorities having jurisdiction.
- E. Laminate face sheets to honeycomb core and form edges in manufacturer's standard manner. Weld edges and corners and grind flush and smooth.

2.05 FINISH

- A. Baked Acrylic Enamel: Clean galvanized steel surface after fabrication to remove processing compounds, oils, and other contaminations. Apply finish as follows:
 - 1. Primer: Provide one coat of manufacturer's standard rust-inhibiting primer, sprayed on and baked.
 - 2. Finish Coats: Provide two coats of manufacturer's standard synthetic resin baking enamel, baked-on at 285^oF.
 - 3. Colors: As selected by Architect from manufacturer's standard and standard-special colors. More than one color is required.

PART 3 EXECUTION

3.01 ERECTION

- A. Erect ceiling mounted compartments, hardware and accessories in a rigid, substantial manner, straight and plumb and with all horizontal lines level, in strict accordance with approved shop drawings and manufacturer's published instructions.
- B. Clearance at wall shall be approximately 1 in. for panels and 1/2 in. for pilasters.
- C. All evidence of drilling, cutting, and fitting to room finish shall be concealed in the finished work.
- D. Clearance at vertical edges of doors shall be uniform from top to bottom and shall not exceed 3/16 in. Doors shall be free of warp or wind.
- E. Adjust hardware so that doors operate smoothly. Allow no metal not shop enameled to be exposed in the finished work, except chromium plated items.
- F. Attach vision screens to walls with round headed chrome-plated steel vandal-proof screws through holes provided in flanges, securely anchored to back-up construction.

- G. Clean finished surfaces free of imperfections. Replace in conformance with this Specification all items that become damaged and cannot be brought to satisfactory finished condition, as determined by the Architect.

END OF SECTION

SECTION 10 22 39

OPERABLE PANEL PARTITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. Provide operable panel partition as indicated on the Drawings and as specified herein. Operable partitions shall be of the following type:
 - 1. Manually operated, continuously hinged panels configuration, STC rating of 51, with vinyl covered panels, white board surfaces (partial), and track system for top supported panels.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 05 50 00, METAL FABRICATIONS; Miscellaneous steel framing and supports for operable partitions.
 - 2. Section 09 21 16, GYPSUM BOARD ASSEMBLIES; Gypsum wallboard partitions and soffits.
 - 3. Section 09 51 00, ACOUSTICAL CEILINGS; Acoustical ceilings.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each product or material used. Provide certifications that materials and systems comply with specified requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorage, connections and accessory items. Provide installation templates for work installed by others. Show interfaces and relationships to work of other trades.
- C. Field Measurements: Take necessary field measurements before preparation of shop drawings and fabrication. Do not delay progress of the job. If field measurements are not possible prior to fabrication, allow for field cutting and fitting.
- D. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- E. Verification Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.

1. Include actual samples of material for panel edges and accessories involving color selection.
- F. Test Reports: Provide certified reports for specified tests.
1. Provide acoustical test reports from and based on tests performed by a qualified independent testing agency certifying that the product and materials furnished comply with specified requirements.
- G. Certificates: Provide product certificates signed by manufacturers of operable panel partitions certifying that their products comply with specified requirements.
- H. Operating and Maintenance Data: Provide operating and maintenance data for the following:
1. Panel Finish: Precautions for cleaning materials and methods that could be detrimental to finishes and performance. Instructions for restretching sagging or distorted finish face.
 2. Partition Track: Provide maintenance data for tracks and operable parts of partitions.
- 1.05 QUALITY ASSURANCE
- A. Reference Standards: Conform to governing laws, building code and manufacturer's printed standards.
- B. Source: For each material type required for work of this Section, provide primary materials that are products of one manufacturer. Provide secondary or accessory materials that are acceptable to manufacturers of primary materials.
- C. Installer Qualifications: Engage an experienced Installer who is certified in writing by the operable panel partition manufacturer as qualified to install the manufacturer's partition systems.
- 1.06 TESTS
- A. Surface-Burning Characteristics: Provide units with vinyl facing materials that have the following surface burning characteristics when tested according to ASTM E 84 by UL or other testing and inspecting agencies acceptable to authorities having jurisdiction:
1. Flame Spread: Flame spread rating of 5 or less.
 2. Smoke Developed: 20 or less.
- B. Fire Performance Characteristics: Provide units that are identical to those tested for the following fire performance characteristics, per ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify units with appropriate markings of applicable testing and inspecting organization.
1. Surface Burning Characteristics: As follows, tested per ASTM E 84: Flame Spread: 25 or less; Smoke Developed: 25 or less.
- C. Sound Transmission Classification (STC):
1. Provide units which have STC rating of 51 as specified when tested according to ASTM E 90, determined by ASTM E 413.

1.07 EXTRA MATERIALS

- A. Extra Materials: Furnished from same production run as materials installed. Package materials with protective covering and identify with labels describing contents. Deliver extra materials to Owner.
 - 1. Finish Face Material: Furnish quantity of full-width, equal to 5 percent of lineal yards installed.

1.08 PROJECT CONDITIONS

- A. Substrates: Proceed with work only when substrate construction and penetration work is complete.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Store under cover and protect from weather damage.
- B. Sequence deliveries to avoid delays but minimize on-site storage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER / PRODUCT

- A. Acceptable Manufacturer: Operable partitions shall be manufactured by the following or approved equal:
 - 1. Hufcor Inc.
 - 2. Modernfold, Inc., a DORMA Group Company.
- B. Acceptable Product (Basis of Design): Hufcor Series 633 Manually Operated, Continuously Hinged, Center Stacking.

2.02 OPERABLE PANEL PARTITION WALL CHARACTERISTICS

- A. Provide top supported, continuously hinged panel configuration (as indicated) with operable (drop) floor seals which move in overhead track, and meeting the following:
 - 1. Configuration: Continuously hinged panels, with stacking, as indicated on the Drawings.
 - 2. Operation: Manually operated.
 - 3. Panel Size: Full height as indicated; panel widths shall be equal with maximum width of 48 inches.
 - 4. Panel Thickness: Nominal 4 inches.
 - 5. Panel Core: Steel.
 - 6. Panel Weight: Not more than 8 lb. per sq. ft.
- B. Panel Construction and Finish
 - 1. Panel Construction: Panel of thickness indicated below and panel width in manufacturer's standard (48 in. maximum), 21 gauge steel face sheets welded to 16 gauge steel channel frames, reinforced as required for suspension of panels. Frame shall be fully unitized with overlapped and welded corners to create a rigid structure independent of panel skin and facing materials. Do not piece steel face sheets. Provide internal acoustical insulation and back face sheets with gypsum board as required to obtain STC rating.

2. Typical Panel Finish: Reinforced vinyl fabric with woven backing weighing not less than 15 oz. per lineal sq. yd. Color shall be as selected by the Architect and Owner.
3. Trim: Manufacturer's standard metal trim and seal cover; color as selected by the Architect and Owner.
4. Markerboard Finish: Provide magnetic steel markerboard surfaces as indicated. Refer to Drawings for elevations and scope.

C. Sound Seals:

1. Vertical interlocking sound seal between panels (astragal) shall be required in each panel edge and be of a reversible tongue and groove configuration permitting universal panel operation. Astragals shall be steel for maximum durability and fire resistance. Rigid plastic astragals are not permitted.
2. Horizontal top seals shall be low-friction continuous contact multi-finger extruded vinyl sweeps with no mechanically operated parts.
3. Horizontal bottom floor seals shall be manually activated operable bottom seals providing nominal 2 in. operating clearance with an operating range of plus 0.50 in. and minus 1.50 in.
4. First and last panels shall have expandable nose section with jamb (expandable panel with bulb seal).

D. Suspension System:

1. Track shall be extruded aluminum alloy 6063-T5. Track shall be capable of either direct mounting to a wood header or shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 3/8 inch minimum diameter threaded rods. Brackets must support the load-bearing surface of the track.
2. Exposed track soffit shall be aluminum, integral to the track and prime painted.
3. Track Configuration: Refer to layout of partition as indicated on the Drawings.

PART 3 - EXECUTION

3.01 INSPECTION

- A. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work.
1. Examine flooring, structural support, and opening for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
 2. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of the work means Installer accepts both substrates and conditions.

3.02 INSTALLATION/ERECTION

- A. Install operable partitions and tracks in strict accordance with approved shop drawings and manufacturer's printed instructions and recommendations. Install level and true and securely anchor track to supporting construction above. Comply with applicable requirements of ASTM E 557.
- B. Field Measurements: Take accurate field measurements before preparation of shop drawings and fabrication. Do not delay job progress.
- C. Install track in as long a length as possible and with flush, hairline joints.

- D. Install panels so that vertical joints are plumb, flush and light tight.

3.03 FIELD TESTING

- A. Owner may engage an independent testing service to provide in-place tests of each operable partition for acoustical performance.
 - 1. Testing will be in accordance with ASTM E 336.
 - 2. If partition does not meet specified STC rating, modify and adjust assembly until compliance is achieved.
 - 3. Contractor shall pay for retesting.

3.04 ADJUSTING

- A. Adjust operable panel partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.05 CLEANING AND PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, which ensures that operable panel partitions are without damage or deterioration at time of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.
- B. Test and adjust seals, hardware, carriers, tracks, and other operable components. Replace damaged or malfunctioning operable components.
- C. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
- D. Review data in maintenance manuals. Refer to Division 01 Section "Contract Closeout".
- E. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION

SECTION 10 26 00

WALL AND CORNER GUARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Furnish and install wall and corner guards, as indicated on the Drawings and as specified.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Wood blocking.
 - 2. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.
 - 3. Section 09 65 00, RESILIENT FLOORING; Resilient base.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorage, connections and accessory items. Provide installation templates for work installed by others. Show all interfaces and relationships to work of other trades.
- C. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- D. Verification Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of six in. long.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Stainless Steel Corner Guards: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Institutional Products Corporation (IPC).
 - 2. Pawling Corporation (Pawling).

3. Wilkinson Company, Inc. (Wilkinson).

2.02 CORNER GUARDS - STAINLESS STEEL

- A. Provide surface mounted stainless steel corner guard fabricated of 16 gage, Type 304 or Type 430 satin finished stainless steel, with factory-applied peel-off protective covering.
 1. Provide mechanical fastening as recommended by manufacturer for specific substrate.
 2. Where permitted by the Architect, guards may be installed using countersunk exposed stainless steel screws, located 8 in. o.c.
- B. Angle Corner Guards:
 1. Pawling Pro-Tek Corner Guard CG-51, 2 in. x 2 in., with 1/8 in. radius, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install corner guards in strict accordance with approved shop drawings and manufacturer's published instructions and recommendations.
- B. Install at the elevations and mounting heights indicated on the Drawings.
- C. Install plumb and true, securely anchored or adhered to supporting construction, with fasteners, anchors, and mastics recommended by manufacturers for specific substrates.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

A. Toilet Accessories:

- 1. Contractor-Furnished, Contractor-Installed (C-F, C-I) Accessories: Furnish and install toilet and bath accessories as required to complete the work of the Contract, as indicated on the Drawings and as specified herein. C-F, C-I toilet accessories shall include the following:
 - a. Toilet accessories at Toilet Rooms and other areas indicated.
 - b. Accessories at Janitor's Closet.
 - d. All other toilet and bath accessories indicated.
- 2. Owner-Furnished, Owner-Installed (O-F, O-I) Accessories: The following accessories will be furnished by Owner (or Owner's Vendor) for installation by the Owner or Owner's Vendor (O-F, O-I):
 - a. Wall mounted soap dispenser.
 - b. Wall mounted paper towel dispenser.

B. Alternates: Refer to Section 01 23 00, ALTERNATES.

C. Items To Be Installed Only: Not Applicable.

D. Items To Be Furnished Only: Not Applicable.

E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

- 1. Section 06 10 00, ROUGH CARPENTRY; Wood blocking.
- 2. Section 08 80 00, GLASS AND GLAZING; Full width mirrors at toilet areas.
- 3. Section 09 21 16, GYPSUM BOARD ASSEMBLIES; Wood blocking for fixture supports at gypsum drywall partitions.
- 4. Section 09 65 00, RESILIENT FLOORING; Resilient flooring.
- 5. Division 26 – ELECTRICAL.

1.02 SUBMITTALS

- A. Shop Drawings: Submit complete shop drawings of all work of this Section to Architect for approval, showing all pertinent details of construction and installation, including details of methods of attachment to supporting materials.

- B. Product Data: Submit complete manufacturer's product data of all work of this Section to Architect for approval, consisting of complete product description and specifications, catalog cuts, and other descriptive data required for complete product and product use information.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Accessories shall be manufactured by one of the following, or approved equal:
 - 1. Bobrick Washroom Equipment Company (Bobrick).
 - 2. American Specialties, Inc. (ASI).
 - 3. Bradley Corporation Washroom Specialties Division (Bradley).
 - 4. General Accessories Manufacturing Company (GAMCO).
- B. Bobrick catalog designations are specified to establish standards of quality for performance and materials and not to limit competition.

2.02 TOILET AND BATH ACCESSORIES - GENERAL

- A. Furnish and install all toilet and bath accessories indicated on the Drawings or as scheduled below, except toilet accessories specified to be provided under other Sections.
- B. Manufacturers' names shall not be visible on exposed surfaces when installed.
- C. Materials and Finishes:
 - 1. Stainless Steel: AISI Type 302, AISI Type 304, or AISI Type 430.
 - 2. Finish: Unless otherwise indicated, provide No. 4 satin finish.
- D. Toilet and Bath Accessories Schedule: The following schedule of items is to establish type and quality and is not necessarily complete.
 - 1. Carefully review the Drawings for other types of toilet accessories and to establish quantities, locations, and mounting heights of the various accessories required.
 - 2. In the event that locations or mounting heights are not indicated, they shall be as directed by the Architect.
 - 3. Abbreviations included herein for each toilet accessory designation shall be as referenced on the Contract Documents.

2.03 CONTRACTOR-FURNISHED, CONTRACTOR INSTALLED (C-F, C-I) TOILET ACCESSORIES

- A. Toilet Tissue Holder, Single-Roll Type with Hood, Surface Mounted: Bobrick Model B-6699, or approved equal.
- B. Combination Paper Towel Dispenser/Waste Receptacle, Recessed Mounted: Bobrick Model B-38034, or approved equal.
- C. Sanitary Napkin Disposal, Surface Mounted: Bobrick Model B-254, or approved equal.
- D. Robe Hook: Bobrick Model B-672.
- E. Grab Bars: Grab bars shall be fabricated of stainless steel tubing, 1-1/2 in. diameter by minimum 0.050 in. thick Type 304L, satin finish, with complete anchor and fastener kit, with concealed mounting, equal to Bobrick Model B-6806 Series, or approved equal.

1. Grab bars as installed shall be of sufficient strength and design to sustain a concentrated load of 250 lb., minimum.
 2. Each flange shall have three attachment devices.
 3. Wall clearance shall be 1-1/2 in. unless otherwise indicated.
 4. Grab Bar Lengths and Configuration:
 - a. Grab Bar at Back Wall of Toilet, 36 inch long: Bobrick Model B-6806 x 36 in.
 - b. Grab Bar at Sidewall of Toilet, 42 inch long: Bobrick Model B-6806 x 42 inch.
- F. Baby Changing Station: Bobrick Model KB100-100 Horizontal Deck Mount Changing Station.
- G. Custodian's Mop and Broom Holder: Bobrick Model B-224 x 30.
- 2.04 OWNER-FURNISHED, OWNER-INSTALLED (O-F, O-I) TOILET ACCESSORIES
- A. Wall Mounted Soap Dispensers.
- B. Wall Mounted Paper Towel Dispenser.
- 2.05 LOCKS AND KEYS
- A. Provide tumbler locks for all lockable access doors and panels. Locks shall be keyed alike for each room or for entire Project, in accordance with Owner's instructions.
- 2.06 FASTENINGS, PACKING, AND MARKING
- A. Fastening devices shall be theft-proof, of appropriate type and of adequate capacity for each purpose intended. Exposed heads of fasteners shall be stainless steel with finish to match surrounding surfaces. All metal accessories shall have the required screws, bolts, and other fastenings necessary for proper installation, all of which shall be wrapped in the same package as the accessory item for which it is intended.
- B. Each package shall be clearly labeled indicating the portion of the work for which it is intended.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Before installation of toilet and bath accessories, check openings and recesses to receive recessed units to assure they are of proper size and location, and are plumb and square. Check substrate materials, blockings, and built-in anchor plates for structural adequacy to support the accessories.
- B. Installation:
1. Mount recessed accessories securely into wall openings and recesses, tightly anchored into place, and with trim fitted tightly and neatly against the wall surface.
 2. Mount surface mounted accessories plumb, level, and true, and securely anchored into place.
 3. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446.

- C. After installation, adjust all accessories for proper operation, and clean and polish all exposed surfaces. Protect accessories from damage from all sources whatever.
- D. Deliver to Owner duplicate keys for each lockable accessory door or panel, properly tagged as to location.

END OF SECTION

SECTION 10 44 00

FIRE EXTINGUISHERS AND FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. Provide fire extinguishers and fire extinguisher cabinets as required to complete the work of the Contract, as indicated on the Drawings and as specified herein. Include, but do not limit to:
 - 1. Fire extinguishers.
 - 2. Fire extinguisher cabinets.
 - 3. Mounting brackets.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY; Wood blocking.
 - 2. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.
 - 3. Division 21 - FIRE PROTECTION; Fire hose cabinets and valve cabinets.
 - 4. Division 21 - FIRE PROTECTION; Fixed fire protection systems.

1.04 QUALITY ASSURANCE

- A. Provide portable fire extinguishers, cabinets and accessories by one manufacturer, unless otherwise acceptable to Architect.
- B. UL-Listed Products: Provide new portable fire extinguishers which are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.
- C. FM Listed Products: Provide new portable fire extinguishers which are approved by Factory Mutual Research Corporation for type, rating, and classification of extinguisher indicated and carry appropriate FM marking.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for all portable fire extinguishers required. For fire extinguisher cabinets include roughing-in dimensions, and details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, style and materials. Where color selection by Architect is required include color charts showing full range of manufacturer's standard colors and designs available.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following:
1. Larsen's Mfg. Co.
 2. J. L. Industries.
 3. J. W. Moon, Inc.
 4. Potter Roemer.

2.02 FIRE EXTINGUISHERS

- A. Provide fire extinguishers that comply with requirements of governing authorities. Extinguishers shall conform to NFPA 10.
- B. Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard which comply with requirements of governing authorities.
- C. Abbreviations indicated below to identify extinguisher types related to UL classification and rating system and not, necessarily, to type and amount of extinguishing material contained in extinguisher.
- D. Fire Extinguisher:
1. Fire Extinguisher: Multi-Purpose Dry Chemical Type: UL-rated 4A:60:B:C, 10 lb. nominal capacity, in enameled steel container, for Class A, Class B, and Class C fires.

2.03 MOUNTING BRACKETS

- A. Provide manufacturer's standard bracket designed to prevent accidental dislodgement of extinguisher, of proper size for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.
1. Provide brackets for extinguishers not located in cabinets and for those located in cabinets, where indicated or required.
 2. Mounting bracket shall be a heavy gage steel bracket with baked enamel finish equal to Larsen's Model Number 862 Fire Extinguisher Bracket.

2.04 FIRE EXTINGUISHER CABINETS

- A. General: Provide fire extinguisher cabinets (FECB) where indicated, of suitable size for housing fire extinguishers of types and capacities indicated.
1. For Use in Non-Rated Walls: Unless otherwise indicated, provide fully-recessed type fire rated fire extinguisher cabinet equal to Larsen's Architectural Series Model No. SS-2409-R2; or approved equal.
 2. For Use in Fire Rated Walls: Unless otherwise indicated, provide fully-recessed type fire rated fire extinguisher cabinet equal to Larsen's Architectural Series Model No. FS SS-2409-R2; or approved equal.
- B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.

- C. Cabinet Type: Suitable for mounting conditions indicated, of the following types:
 - 1. Fully-recessed Cabinet: Cabinet box (tub) fully-recessed in walls of sufficient depth to suit style of trim indicated.
 - 2. Fire Rated: Provide fire rated cabinet box (tub) for installation in fire rated partitions. Fire rating is indicated by FS in the model number.
 - D. Trim-Style: Fabricate trim in one piece with corners mitered, welded and ground smooth.
 - E. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Flat Trim: Square edges with backbend of 5/16 in.
 - 2. Trim Metal: To match door material.
 - F. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
 - 1. Stainless Steel: Manufacturer's stainless steel (Type 302) construction with tubular stiles and rails.
 - G. Door Style: Manufacturer's standard design as indicated below and on Drawing.
 - 1. Vertical Duo Glass Door: Float glass, 1/8 in. thick, unless otherwise indicated.
 - H. Door Hardware: Provide manufacturer's standard door operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam action latch, or door pull, exposed or concealed, and friction latch. Provide concealed or continuous type hinge permitting door to open 180°.
- 2.05 FACTORY FINISHING OF FIRE EXTINGUISHER CABINETS
- A. General: Comply with National Association of Architectural Metal Manufacturers (NAAMM) 'Metal Finishing Manual' for finish designations and application, unless indicated otherwise.
 - B. Apply baked-on acrylic finishes in factory after products are assembled. Protect cabinets with plastic or paper covering, prior to shipment.
 - C. Stainless Steel Finish: All exposed to view stainless steel for trim and for doors shall be AISI No. 4 Finish.
 - D. Painted Finishes:
 - 1. Preparation: Clean surfaces of dirt, grease and loose rust or mill scale. Apply finish to all surfaces of fabricated and assembled units, whether exposed or concealed when installed, except those surfaces specified to receive another finish.
 - 2. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard baked enamel coating.
 - a. Provide manufacturer's standard white color.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 1. Prepare recesses in walls for fully-recessed fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 - 2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
 - 3. Where exact location of surface-mounted cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by Architect.
 - 4. Install only fire rated cabinets in fire rated partitions.

3.02 IDENTIFICATION

- A. Identify fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" painted on door by silk-screen process. Provide lettering on door as indicated, or if not indicated, as selected by Architect from manufacturer's standard letter sizes, styles, colors and layouts.
- B. Identify bracket-mounted extinguishers with red letter decals spelling "FIRE EXTINGUISHER" applied to wall surface. Letter size, style and location as selected by Architect.

END OF SECTION

SECTION 11 40 00
FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 SUMMARY

- A. Work Included: Foodservice Equipment, including but not limited to, the following:
 1. Furnishing and installation of Foodservice (Kitchen) Equipment as scheduled.
 2. Uncrating, assembling, rigging setting, leveling, and properly and securely fastening to wall or floor as required with all necessary items such as braces, filler pieces and related items.
 3. Furnishing, erecting and maintaining staging and scaffolding, including mechanical hoisting equipment, required for the performance of Food Service Subcontractor's work.
 4. Plumbing, electrical, steam, and general accessories for items specified in this section, including, but not limited to faucets, strainers, lever-wastes, tail pieces, control valves, cords and plugs, and disconnects provided as standard with the equipment. Furnish to the proper mechanical or electrical trades for the final connection of utility services. Tag each item with the equipment number for easy reference.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 1. Plumbing Work (Division 22 - PLUMBING):
 - a. Hose bibs.
 - b. Final gas and plumbing connections.
 - c. Water pressure regulators.
 - d. Final connection of traps, tail pieces, valves, stops and shutoff valves required for, but not specified as part of equipment specified in Section 11 40 00.
 - e. Grease traps.
 2. Heating, Ventilating and Air Conditioning (Division 23 – HVAC)
 - a. Final duct connections.
 - b. Exhaust and supply fans.
 - c. Ductwork.
 - d. Fan switches.
 3. Electrical Work (Division 26 - ELECTRICAL):
 - a. Final electrical connections.
 - b. Disconnect switches.
 - c. Receptacles.

1.04 SUBMITTALS

- A. Product Data: Submit brochures containing illustrations, specifications, accessories, line drawings and rough-in information on brand name items (items not of custom manufacture).
- B. Shop Drawings: Prepare plans at a scale of 1/2 inch to the foot showing dimension location, size, height above finished floor and, where necessary, capacity of mechanical services required for each item of equipment.
- C. Equipment: Prepare detailed drawings at a minimum scale of 3/4 inch to the foot, plus necessary cross sections at a scale of 1-1/2 inch to the foot, showing complete details of each item of specially fabricated equipment. Include accurately dimensioned layouts and locations for floor depressions if required or called for in these specifications. Include accurately dimensioned details and locations of special wall openings where items of equipment extend through walls.

1.05 QUALITY ASSURANCE

- A. Qualification of Foodservice Subcontractors:
 - 1. Fabricate all equipment specified as custom using an equipment fabricator who has the plant, personnel and engineering facilities to properly design and manufacture high quality equipment. The selected fabricator is subject to approval by Architect and Owner.
 - 2. Furnish evidence that the Foodservice Subcontractor is a recognized distributor for the items of equipment specified in this section which are of other manufacture than their own.
 - 3. Furnish evidence that equipment of approximately the same type and design has been installed elsewhere and has been operating successfully for at least 5 years. Equipment installed for test or prototype is not considered acceptable.
- B. Fabricate and install equipment to meet Local, State and National Board of Health regulations. Perform work and provide materials in full accordance with latest rules of U.S. Public Health Services, National Board of Fire Underwriters, and local or State Ordinances, regulations of State Fire Marshall and Underwriters Laboratory.
- C. Reference Standards:
 - 1. NSF Standards: Comply with applicable National Sanitation Foundation standards and recommended criteria. Provide each principal item of food service equipment with a "Seal of Approval" by NSF.
 - 2. UL Labels: Where available, provide UL Labels on items of food service equipment with prime electrical components. Provide UL "recognized marking" on other items with electrical components, signifying listing by UL, where available.
 - 3. ANSI Standards: Comply with applicable ANSI standards for gas-burning appliances, for piping to compressed gas cylinders, and for vacuum breakers and air gaps to prevent siphoning in water piping (ANSI 221 series, B57.1, A40.6 and A40.4).
 - 4. NFPA Codes: Comply with NFPA No. 96 for exhaust system equipment; and with NFPA No. 54.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Properly package and protect equipment during shipment, handling, and storage to prevent damage.

- B. Store indoors or under cover, on raised platforms, fully protected from dirt and moisture.

1.07 EXISTING CONDITIONS

- A. Field Measurements: Check measurements at building and be responsible for making the food service equipment fit.
 - 1. Examine drawings and identify critical areas which might affect the fitting of equipment, aisles, installation, or other functional aspects of the equipment. Submit drawings which show structural measurements and dimensions which are critical to the proper execution and fitting of work.

1.08 WARRANTIES

- A. Provide manufacturers' standard guarantees and warranties for work under this section. Such guarantees and warranties shall be in addition to and not in lieu of other rights and remedies which owner may have by law or by other provisions of the Contract Documents.

1.09 GUARANTEES AND WARRANTIES

- A. Provide new equipment furnished for this foodservice facility with a guaranty for a period of one calendar year, beginning on the date of final acceptance of the work of this Section, except in the case of a manufacturer whose standard warranty exceeds this period. Provide self-contained refrigeration units for reach-in refrigerators, freezers, and ice cream chests with a five-year replacement warranty for the sealed unit. The guarantee shall protect against defective material, design and workmanship.
- B. In addition to the guarantee called for under the General Conditions, this Contractor shall further agree that in the event of failure of any system or item of equipment or improper functioning of specified work during the guarantee period, the Contractor shall have "on call" competent service personnel available to make the necessary repairs or replacements of specified work promptly at no cost to the Owner. In the event that replacements of an entire item is required, the Owner shall have the option of full use of the defective equipment until a replacement has been delivered and completely installed.
- C. Furnish manufacturer's warranties for each item of standard equipment and a warranty on fabricated equipment. Submit guarantees and warranties to the Architect in accordance with the conditions found in "Testing, Start-up and Instructions of Owner's Personnel" paragraphs, contained in Part 3, this section.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Foodservice Equipment:
 - 1. All kitchen equipment to be commercial grade electric appliances and generally consist of the following as manufactured by Wolf, KitchenAid, Hobart, Moffat, Garland, Everest, Bosch, Viking, GE or approved equal – final selections and model numbers to be determined.
 - 2. General List and approximate characteristics of equipment include:
 - a. 48 in. wide upright refrigerator.
 - b. 48 in. wide upright freezer.
 - c. 36 in. wide – Six burner range with oven.

- d. 24 in. griddle.
- e. Ansul fire protection system in hood above cooking equipment.
- f. 30 in. wide double wall oven.
- g. Two (2) – 24 in. wide undercounter dishwashers.
- h. Two (2) – 2.2 cubic foot built in microwaves.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Rough-in-work: Foodservice Subcontractor shall examine roughed-in mechanical and electrical services and installation of floors, walls, columns and ceilings, and conditions under which the work is to be installed. They shall verify dimensions of services and substrates before fabricating and installing the work and shall notify Contractor in writing of unsatisfactory conditions for proper installation of food service equipment. Do not proceed with fabrication and installation until unsatisfactory dimensions and conditions are corrected in a manner acceptable for proper installation of equipment.

3.02 INSTALLATION

- A. Service Lines and Equipment Connections: Comply with applicable requirements of Division 22 – PLUMBING and Division 23 – HVAC for piping connections and piping systems. Comply with applicable requirements of Division 26 – ELECTRICAL Sections for electrical work, including equipment connections.
- B. Set in place, level and adjust to correct height each item of non-mobile and non-portable equipment. Anchor to supporting substrate where indicated and where required for sustained operation and use without shifting or dislocation.
- C. Conceal anchorages where possible. Adjust counter tops and other work surfaces to a level tolerance of 0.0625 inch maximum offset, and maximum variation from level or indicated slope of 0.0625 inch per foot.
- D. Complete field assembly joints in the work (joints which cannot be complete in shop) by welding, bolting and gasketing, or similar methods as indicated. Grind welds, smooth and restore finish. Set or trim gaskets flush, except for "T" gaskets as indicated.
- E. Treat enclosed spaces inaccessible after equipment installation by covering horizontal surfaces with powdered borax at a rate of four ounces per square foot.
- F. Install closure plates and strips where required, with joints coordinated with units of equipment. Make joints airtight, waterproof, vermin-proof and sanitary for cleaning purposes. In general, make sealed joints not less than 0.125 inch at 0.25 inch depth. Shape exposed surfaces of sealant slightly concave, with edges flush with faces of materials at joint. At internal corner joints, apply sealant or gaskets to form a sealant-filled or gasket joints up to 0.75 inch joint width; metal closure strips for wider joints, with sealant application each side of strips. Anchor gaskets mechanically or with adhesives to prevent displacement.

3.03 CLEANING AND RESTORING FINISHES

- A. After completion of installation, and completion of other major work in food service areas, remove protective coverings, and clean food service equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed metal surfaces and touch-up painted surfaces. Replace work which cannot be successfully restored.

3.04 TESTING, START-UP AND INSTRUCTIONS OF OWNER'S PERSONNEL

- A. General: Start-up food service equipment after service lines have been tested, balanced and adjusted for pressure, voltage and similar considerations, and after water and steam lines have been cleaned and treated for sanitation.
- B. Test each item of operational equipment to demonstrate that it is operating properly and that controls and safety devices are functioning. Repair or replace equipment found to be defective in its operation, including units which are below capacity or operating with excessive noise or vibration.
- C. Instruct Owner's operating personnel on the proper operation and maintenance procedures for each item of operational food service equipment.
- D. Final Cleaning: After testing and start-up, and before the time of Substantial Completion, clean and sanitize food service equipment, and leave in condition ready for use in food service.

3.05 FOODSERVICE EQUIPMENT SCHEDULE

- A. Refer to Foodservice Equipment scheduled on the Drawings.
 - 1. 48 in. wide upright refrigerator.
 - 2. 48 in. wide upright freezer.
 - 3. 36 in. wide – Six burner range with oven.
 - 4. 24 in. griddle.
 - 5. Ansul fire protection system in hood above cooking equipment.
 - 6. 30 in. wide double wall oven.
 - 7. Two (2) – 24 in. wide undercounter dishwashers.
 - 8. Two (2) – 2.2 cubic foot built in microwaves.

END OF SECTION

SECTION 12 21 00

HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Miniblinds with aluminum louver slats.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 06 10 00, ROUGH CARPENTRY for wood blocking and grounds for mounting horizontal louver blinds and accessories.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
- B. Shop Drawings: Show location and extent of horizontal louver blinds. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.
- C. Samples for Verification: Louver slat in specified color, minimum 12 inches long.
- D. Window Treatment Schedule: Include horizontal louver blinds in schedule using same room designations indicated on Drawings.
- E. Maintenance Data: For horizontal louver blinds to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining horizontal louver blinds and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.
 - 3. Operating hardware.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver blinds in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Designer of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hunter Douglas Contract, Window Coverings.
 - 2. Levolor Contract; a Newell Company; Levolor.
 - 3. OEM Shades Inc.
 - 4. Springs Window Fashions Division, Inc.; Graber.

2.02 HORIZONTAL LOUVER BLINDS, ALUMINUM LOUVER SLATS

- A. Louver Slats: Aluminum, alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radiused corners.
- B. Nominal Slat Width: 1 inch for miniblinds.
- C. Nominal Slat Thickness: Not less than 0.008 inch.
- D. Slat Finish: Two colors as indicated, one per side of slat.
- E. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends
- F. Tilt Control: Consisting of enclosed worm gear mechanism, slip clutch or detachable wand preventing overrotation, and linkage rod, for the following operation:
- G. Tilt Operation: Manual with clear plastic wand
- H. Length of Tilt Control: Length required to make operation convenient from floor level.

- I. Tilt: Full.
- J. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.
- K. Ladders: Evenly spaced to prevent long-term louver sag; braided string.
- L. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
- M. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.
- N. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard, as indicated.
- O. Colors, Textures, Patterns, and Gloss: To be selected by Architect from manufacturer's full range.

2.03 HORIZONTAL LOUVER BLINDS FABRICATION

- A. Product Standard and Description: Comply with AWCMA Document 1029, unless otherwise indicated, for each horizontal louver blind designed to be self-leveling and consisting of louver slats, rails, ladders, tapes, lifting and tilting mechanisms, cord, cord lock, tilt control, and installation hardware.
- B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
- C. Lifting and Tilting Mechanisms: With permanently lubricated moving parts.
- D. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 degrees F:
- E. Blind Units Installed between (Inside) Jambs: Width equal to 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed.
- F. Length equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.
- G. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail and operating hardware, and for hardware position and blind mounting method indicated.
- H. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- I. Color-Coated Finish: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- J. Component Color: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 HORIZONTAL LOUVER BLIND INSTALLATION

- A. Install blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior louver edges in any position are not closer than 1 inch to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

3.03 ADJUSTING

- A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

- A. Clean blind surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and
- C. Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- D. Replace damaged blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 12 48 15

ENTRANCE MAT (WALK-OFF MAT)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 WORK INCLUDED

- A. The work of this Section consists of furnishing and installation of entrance mat (walk-off mat), as indicated on the Drawings and as specified herein. The work of this Section includes, but is not limited to:

- 1. Walk-off mat at locations scheduled.

1.03 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

- 1. Section 09 30 00, TILING.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, and maintenance recommendations for each material used. Provide certifications stating that materials comply with requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication and installation of all parts of the work.
- C. Field Measurements: Where possible, take accurate field measurements before preparation of shop drawings and fabrication. Do not delay job progress; allow for field cutting and fitting where taking field measurements before fabrication is not possible.
- D. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- E. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches.
- F. Quality Assurance Submittals: Submit (1) Certified test reports showing compliance with specified performance characteristics and physical properties, and (2) Manufacturer's Installation Instructions.

- G. Closeout Submittals: Submit (1) Cleaning & Maintenance Data (include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance), and (2) Warranty.

1.05 QUALITY ASSURANCE

- A. Provide surface-mounted fibered entranceway system, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.
- B. Installer: Installer should be highly experienced in performing work of this section, having previously done work similar to that required for this project.
- C. Flammability in accordance with ASTM E 648, Class I, Critical Radiant Flux, minimum 0.45 watts/m².
- D. Slip resistance in accordance with ASTM D 2047, Coefficient of Friction, minimum 0.60 for accessible routes.
- E. Standard rolling load performance is 300 lb./wheel with larger loading requirements as specified (load applied to a solid 5 in. x 2 in. wide polyurethane wheel, 1000 passes without deformation).
- F. Single Source Responsibility: Obtain floor mats from one source of a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage.
- B. Storage: Store materials at temperature and in humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.
- C. Installation: Except as otherwise indicated herein, sequencing or scheduling for performance of work of this section in relation with other work is Contractor's option. Delay installation of mats until near time of substantial completion for the project.

1.07 SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to coordinate this work with related and adjacent work.
- B. Do not install mats until immediately before Owner's Final Acceptance of the Project.

1.08 PROJECT CONDITIONS

- A. Temperature: Maintain temperature where products will be installed before, during and after installation as recommended by Manufacturer.
- B. Field Measurements: Where possible, verify actual measurements by field measuring before fabrication and include measurements in shop drawings. To avoid construction delays, coordinate field measurements and fabrication schedule based upon construction progress.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PRODUCTS/MANUFACTURERS

- A. Recessed Entrance Walk-Off Mats and Frames: Provide the following product that meets or exceeds specified requirements:
1. Mats, Inc.; P O Box 839, 37 Shuman Avenue, Stoughton, MA, 02072; telephone 800-MATS-INC (800-628-7462) or 781-344-1536; fax 781-344-1537; www.matsinc.com ; Supreme Nop Polypropylene Walk-Off Mat.

2.02 RECESSED ENTRANCE MATS - MATERIALS AND PRODUCTS

- A. Polypropylene Roll Goods: 100% heavy denier, solution dyed, UV-stabilized needle punched ribbed polypropylene with high density rubber backing:
1. Color shall be selected by Owner or Architect from manufacturer's standard colors. More than one color may be selected.
 2. Adhesive for Mounting: Multi-Bond Adhesive as recommended by manufacturer.
- B. Product Testing
1. ASTM C 1028 Static Coefficient of Friction for 0.60 wet, 0.61 dry.
 2. ASTM D 2829 Pill Test: Pass.
 3. ASTM E 648 Radiant Panel Test: Passes Federal Flammability Standard.
- C. Frame: Stainless steel in manufacturer's standard profile.

PART 3 - EXECUTION

3.01 INSPECTION

- A. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

3.02 INSTALLATION

- A. Walk off mat shall be installed in strict accordance with the approved shop drawings and the manufacturer's printed instructions and recommendations.

3.03 CLEANING

- A. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work that cannot be successfully cleaned.

END OF SECTION

SECTION 21 0000

FIRE PROTECTION
 (Filed Sub-Bid Required)

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SECTION 210000

FIRE PROTECTION
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 FILING SUB-BIDS

- A. Time, Manner and Requirements for Submitting Sub-Bids:
1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Public Agency at a time and place as stipulated in the "Instructions to Bidders."
 2. Each sub-bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 44F of Chapter 149 of the General Laws, as amended.
 3. Sub-bids filed with the Awarding Authority shall be accompanied by Bid Bond, Cash, Certified Check, Treasurer's Check, or Cashier's Check issued by a responsible bank or trust company payable to the Town of Boxford in the amount of 5 percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- B. No Sub Sub-Bid Requirements for this Section

The Work of this Section is shown on the following Drawings: TBD

1.03 DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment, services and accessories necessary to Design, Furnish and Install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein. The Design shall conform to the documents and shall be subject to approval by the Architect.
- B. Without limiting the generality thereof, the work to be performed under this Section includes:
1. A hydraulically designed automatic sprinkler system to provide 100% protection for the building as noted on the Drawings. Refer to Fire Protection Criteria on the Drawings. Prepare Working Drawings for approval of the Architect, the local authority having jurisdiction, and the owner's insurance company under stamp of an independent Massachusetts Registered Professional Fire Protection Engineer.
 2. Furnish and Install underground fire storage tank including setting of tank, piping to the building, and piping within building, all as drawn. The work also includes access manholes, automatic fill system, controllers, and sensors.
 3. Fire Pump including Controller and Transfer Switch.
 4. Jockey Pump including Controller.
 5. Fire Department Connections.
 6. Test Header
 7. Pipe and Fittings
 8. Valves

9. Hangers
10. Sprinkler Heads
11. Furnishing and installation of Supervisory Switches and Controls
12. Systems Identification
13. Flushing and Testing of the interior system and all exterior piping as provided herein.
14. Drilling, Coring, Cutting & Patching of holes and openings (where the largest dimension thereof does not exceed 12 inches), for Fire Protection Piping and Equipment. All such holes require sleeves.
15. Scaffolding, Rigging, and Staging required for all Fire Protection Work. Comply with Division 1 requirements.
16. Provide Seismic Restraints for all Fire Protection Systems conforming to the requirements of Section 230548 which Section is herein incorporated by reference as work of the Fire Protection Sub Contractor. Seismic Restraints are required in both new and existing building.
17. Furnishing of Access Panels
18. Smoke and Firestopping Seals and sealing of all wall penetrations as detailed on the drawings. Refer to Division 07 which defines the firestopping materials and methods.
19. When open-flame or spark producing tools such as blower torches, welding equipment, and the like are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant non-working fire watch through the Local Fire Department where work is being performed and until it is completed.
20. Provide all water necessary for initial fill of the entire system and all water required for testing from an outside source. Upon completion of all testing and final acceptance of the system completely refill system including water storage tank and all water used for testing including wet well and piping system for a complete and operational system. All water for filling, testing and completion of work is to be clean (swimming pool quality). Do not use the well water system to replace any water used for testing or filling.

1.04 RELATED WORK

- A. The following items of work related to the Fire Protection Work are included under other Sections of the Specifications:
 1. Cutting & Patching beyond 1.04B.14 above: SECTION 017329 – CUTTING AND PATCHING.
 2. Installation of Access Panels: Respective finish section.
 3. Excavation and Backfill: DIVISION 31
 4. Finish Painting: SECTION 099100: PAINTING
 5. Wiring for Supervisory Switches, Electrical Alarm, and Flow Switches, and Power Wiring: SECTION 260000 - ELECTRICAL
 6. Temporary Facilities: SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

1.05 CODES, ORDINANCES, AND PERMITS

- A. Perform all work in accordance with the following Codes:
 1. 780 CMR: The State Building Code.
 2. 527 CMR: The Fire Prevention Regulations.

3. NFPA-13-2013, NFPA-20-2013, NFPA 22-2013, NFPA-24-2010, NFPA-241-2009, and Owner's insurance company requirements.
4. All applicable Local, State, and Federal Codes, Statutes, or Regulations.
5. Town of Boxford Fire Department.
6. Town of Boxford Building Department.

- B. Obtain all permits, inspections, and approvals, from the governing authorities and pay all fees and include cost in the bid.

1.06 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications conflict or are unclear, advise Designer in writing before Award of Contract. Otherwise, Designer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or unclarities thus resolved.
- B. Where Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert Designer in writing before installation. Otherwise, make changes in installed work as Designer requires within Contract Price.
- C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specs, this contractor shall provide that material, installation, or work which is of the higher standard.
- D. It is the intent of these contract documents to have the contractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the contractor has failed to notify the Designer of the situation in accordance with the paragraph above, the contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
- E. In cases covered by the paragraph above, where the contractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution and the Designer shall review, note if necessary, and approve the sketch.

1.07 MODIFICATIONS IN LAYOUT

- A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet architectural requirements.
- B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Designer.
- C. Check Contract Drawings as well as Shop Drawings of all subcontractors to verify and coordinate spaces in which work of this Section will be installed.
- D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.
- E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C, D above. Systems shall be run in a rectilinear fashion.

- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Designer for review and approval.

1.08 RECORD DRAWINGS

- A. General: Refer to DIVISION 01 - GENERAL REQUIREMENTS for general requirements for maintaining as-built drawings and submitting final reproducible record documents.
- B. The General Contractor will provide two sets of black or blue line on white Drawings to the Fire Protection Subcontractor, one set of which shall be maintained at the site and which shall, at all times, be accurate, clear, and complete, showing the actual locations of all equipment and piping as it is being installed. The Record Drawings shall be available to the Architect/Engineer's field representative at all times.
- C. Provide electronic AutoCAD drawings to indicate revisions to piping size and location both exterior and interior; including locations of valves and other equipment requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.
- D. Include in the Record Drawings any addenda, sketches, and supplementary Drawings issued during the course of construction.
- E. Non-availability of Record Drawings or inaccuracies therein will postpone the final inspection until they are available.
- F. All valves shown on these Drawings shall be numbered with numbers corresponding to those on the valve charts.
- G. All costs related to the foregoing requirements shall be paid by the Fire Protection Subcontractor.

1.09 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Provide operating instructions to the owner's designated representative with respect to operation functions and maintenance procedures for all equipment and systems installed. At the completion of the project, turn over to the Architect four (4) complete manuals in three-ring, loose-leaf binders, containing the following:
 - 1. Complete Shop Drawings of all equipment.
 - 2. Operation description of all systems.
 - 3. Names, addresses, and telephone numbers of all suppliers of the system.
 - 4. Preventive maintenance instructions for all systems.
 - 5. Spare parts list of all system components.
 - 6. Valve tag chart noting location of any and all valves controlling the fire protection systems including main control, main drain, auxiliary drain, drum drip, inspectors test connections and any low point drains connected to these systems.
- B. Provide DVD recording of operation and maintenance training sessions and include as part of O & M Manual submittal. Training session video recording and DVDs shall be performed by a professional videographer. Provide indexed table of contents for DVD recording.

1.10 SHOP DRAWINGS AND MATERIAL SCHEDULES

- A. Refer to SECTION 013300 - SUBMITTALS for substitution of equipment and submittal of Shop Drawings. If apparatus or materials are substituted for those specified, and such substitution necessitates changes in or additional connections, piping, supports or construction, same shall be provided as the responsibility, and at the expense, of the Fire Protection Subcontractor.
- B. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Subcontractor. The Subcontractor is responsible for furnishing and installing materials called for in the Contract Documents, even though these materials may have been omitted from approved Submittals.
- C. Submit Shop Drawings for the following materials and equipment.
 - 1. Coordinated Working Drawings and hydraulic calculations including size, type, length, temperature rating of sprinkler heads, piping and the like. Indicate flow test results, design criteria, hydraulic reference points, diffuser and light locations.
 - 2. Access Panels and Covers
 - 3. Sprinkler Heads
 - 4. Hangers and Seismic Restraints
 - 5. Pipe, Fittings, and Appurtenances
 - 6. Systems Identification
 - 7. Valves
 - 8. Fire Department Connection
 - 9. Cross Connection Devices
 - 10. Test Header
 - 11. Fire Pump
 - 12. Fire Pump Controller and Transfer Switch
 - 13. Jockey Pumps
 - 14. Jockey Pump Controller
 - 15. Fire Pump Enclosure
 - 16. Fire Storage Tanks
 - 17. Flexible Joint on Piping from Tank to Wet Well

1.11 COORDINATION DRAWINGS

- A. Before materials are purchased or Work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly annotated and cross-referenced at their interfaces.
- B. Coordination Drawings are for the Contractor's and the Architect's use during Construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.
- C. Detailed procedures for Coordination Drawings are contained in DIVISION 01 of these Contract Documents.

1.12 GUARANTEE

- A. Guarantee all work under this Section free from defects in workmanship or materials for a period of one (1) year from the date of final acceptance of the building, as set forth in the Contract.

- B. Replace any such defective work developing during this period, unless such defects are clearly the result of bad usage of equipment by others. Where such defective work results in damage to work of other Sections of the Specifications, restore such work to its original condition by mechanics skilled in the affected trade.

1.13 DRAWINGS

- A. All work shown on the Drawings is intended to be approximately correct to scale but shall be taken in a sense as diagrammatic. Sizes of pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make a complete working system ready for use.
- B. The Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.
- C. Refer to the Architectural, Structural, and Other Mechanical and Electrical Drawings which indicate the construction in which this work shall be installed. Locations shown on the plans shall be checked against the general and detailed drawings of the construction proper. All measurements must be taken at the building.

1.14 SYSTEM DESCRIPTION

- A. The building shall be 100% sprinklered with an automatic sprinkler system. The system shall be designed in accordance with NFPA-13-2013 and NFPA 20-2013.
- B. Building is to be 100% sprinklered including all closets, Electric rooms, and Emergency Electrical rooms.
- C. Refer to Fire Protection Criteria on the Drawings. Conform to the zoning shown on the plans.
- D. Locations of sprinkler heads are shown in some of the areas to be sprinklered only to establish the patterns and design intent. Major equipment and runs of piping may also be shown. Refer to reflected ceiling plan for location of all sprinkler heads. All sprinkler heads are to be installed dead center of tile.
- E. The documents require that the building be covered 100%. This includes all closets, combustible concealed spaces, and other areas as required under NFPA-13-2013. These areas are to be included in the Sub-contractor's bid whether or not the heads are shown on the sprinkler plans.
- F. The documents include the installation of a Fire Pump. The Fire Pump will be located on the site as indicated and shall be provided with a weatherproof enclosure. The Fire Pump will provide elevated pressure to the building and shall meet the requirements of NFPA-20-2013.
- G. The Fire Protection work specified in this section includes the new fire Storage Tank including all access manholes, fittings and tank bedding material. Excavation, backfill, and finish grading is specified in Division 31. All supervisory work shall be performed by licensed sprinkler installer. Immediately notify General Contractor in event any phase of the work under Division 31 is non-compliant with code or specifications. Installation shall meet the requirements of NFPA-22-2013 and the local Fire Department.

1.15 ALARM FACILITIES

- A. Furnish and install all Supervisory Switches, Flow Switches, Pressure Switches, and other Alarm Devices. Install all such devices on the piping and coordinate with the Electrical Subcontractor who shall wire all such devices to the Fire Alarm System. Every shutoff valve installed on this project shall have a supervisory trouble switch wired to the Fire Alarm Panel.

1.16 PIPE MARKER IDENTIFICATION SYSTEM

- A. Mark all piping installed under this Section with a marking system in basic colors conforming to those specified in ANSI/ASME A-13.1. Markings shall indicate pipe content and direction of flow. Apply markers every 20 feet on center on piping which is exposed in mechanical or storage areas and above suspended accessible ceilings. Also, apply at all access panels, valves, tee joints, alarms, and/or controls.
- B. Adhesive system may be used throughout except at the mechanical rooms in which case markings shall be painted on.

1.17 VALVE TAGS

- A. All valves installed in the Fire Protection Contract shall be tagged. Tags shall be secured to valves with chain link and shall be marked with 3/4 inch high letters as to function. All valve tags shall indicate the Fire Zone.
- B. A corresponding framed Valve Tag Chart shall be installed within each Sprinkler Riser or Control Valve Room indicating location of each valve and the section it serves. This chart shall also be included within the Owner's O&M Manual with valve tag locations noted on the As-Built Sprinkler drawings.

1.18 IDENTIFICATION SIGNS

- A. All equipment and systems shall be identified with signs furnished and attached in accordance with NFPA 13.

1.19 PAINTING

- A. All interior exposed piping is to be painted and all painting, except as noted, will be done by the Painting Subcontractor. All uncovered piping and hangers shall be thoroughly cleaned of rust, oil, and other containments by the Fire Protection Subcontractor and left ready to receive primer coat.
- B. Painting for pipe markings shall be done under this Section.

1.20 HOISTING EQUIPMENT AND MACHINERY

- A. Unless otherwise specified, all hoisting and rigging equipment and machinery required for the proper and expeditious prosecution and progress of the Work of this Section shall be furnished, installed, operated and maintained in safe condition by each sub-contractor, as specified under Section 015000, TEMPORARY FACILITIES AND CONTROLS.

1.21 STAGING AND SCAFFOLDING

- A. Unless otherwise specified, each sub-contractor shall provide all lifts and man-lifts, and furnish, erect and maintain in safe condition, all staging and scaffolding as specified under Section 015000 Temporary Facilities and Controls, as needed for proper execution of the work of this Section. Staging and scaffolding shall be of adequate design, erected and removed by experienced stage builders having all accident prevention devices required by Federal, state and local laws.

1.22 COMMISSIONING

- A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 019113 – General Commissioning Requirements.
- B. Complete installation and startup checks and functional tests according to Section 019113 – General Commissioning Requirements and manufacturers written instructions.
- C. Operational Test: After plumbing systems have been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the startup procedure.
- D. Verify that equipment is installed and commissioned as per requirements of Section 019113 and manufacturers written instructions/requirements.

1.23 ALTERNATES

- A. Refer to Section 01 23 00 for Alternates affecting this section.
- B. Include in your bid a separate price for amounts to be added or deducted from base bid amount.

1.24 BREAKDOWN

- A. Submit a breakdown of the contract price to aid the Architect in determining the value of the work installed as the job progresses.
- B. No requisition will be approved until the breakdown is delivered to the Architect.

1.25 VISIT TO SITE

- A. Prior to submitting a bid, visit the site of work and become familiar with existing conditions at the site of the work. Any assumptions made are at this Subcontractor's expense.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials and equipment furnished under this Section shall be new, unused, first quality of a manufacturer of established reputation and shall be U.L./F.M. approved. Each valve, fitting, section of pipe, and piece of equipment shall have cast or indelibly stamped thereon the manufacturer's name and pressure rating where applicable. All threads for fire department connection shall conform to the standards of the Local Fire Department.

2.02 PIPE AND FITTINGS

- A. Pipe and fittings shall conform to the latest A.S.A., A.S.T.M., C.A., and F.S. Standards. All grooved products shall be of one manufacturer to conform to NFPA Standards.
- B. All piping installed under this Section shall be in accordance with the following:

<u>Service</u>	<u>Materials</u>
Trim piping around alarm valves, sprinkler piping 1-1/2 inch and smaller	ASTM A-53, Schedule 40 black steel pipe
Sprinkler and standpipe piping 2 inch and larger	Schedule 10, ASTM A-135 U.L./F.M. black steel pipe
Dry sprinkler system, regardless of size	ASTM A-53, Schedule 40 galvanized steel pipe
Underground service	CL 52 ductile iron pipe

- C. Fittings on fire line piping, 2 inch and larger, shall be Victaulic Fire Lock Ductile Iron Fittings conforming to ASTM A-536 with integral grooved shoulder and back stop lugs and grooved ends for use with Style 009-EZ or Style 005 couplings.
- D. Fittings for standpipes and risers, 2-1/2 inch and larger, and where ever required to conform to Seismic Requirements shall be Victaulic Vic-Flex Style 75 or 77 with Fire Lock Gasket.
- E. Branch line fittings shall be welded or shall be Victaulic 920/920N Mechanical Tees.
- F. Schedule 10 pipe shall be roll grooved. Schedule 40 pipe where used with mechanical couplings shall be rolled groove and shall be threaded where used with screwed fittings.
- G. Fittings for threaded piping shall be malleable iron screwed sprinkler fittings.
- H. All pipe and fittings shall be U.L./F.M. approved for sprinkler and standpipe service. All pipe and fittings shall be galvanized for dry system and black for wet system.
- I. Fittings on underground fire service piping shall be 250 psi gray iron fittings with mechanical joint ends. Coordinate with site contractor to assure all joints are properly thrust blocked.
- J. Grooved fittings shall be manufactured by Victaulic, Grinnell, Anvil, or equal.

2.03 JOINTS

- A. Threaded pipe joints shall have an approved thread compound applied on male threads only. Teflon tape shall be used for threads on sprinkler heads.
- B. Joints on piping, 2 inch and larger, shall be made up with Victaulic, or equal, Fire Lock Style 005, rigid coupling of ductile iron and pressure responsive gasket system for wet or dry sprinkler system as recommended by manufacturer. Couplings on dry systems shall be galvanized. Cutting, roll grooving, lubrication, and assembly of all joints shall be made strictly in accordance with manufacturer's recommendations. Exercise particular caution in the use of lubricant to avoid "squeeze out" of lubricant when system is in service.
- C. Grooved joints and fittings shall be manufactured by Victaulic, Grinnell, Anvil, or equal.

- D. Furnish and install where piping crosses building expansion joints a listed expansion joint. Expansion joints shall be Metraflex "Fireloop", or manufactured by Flexonic Company or Hyspan, or equal. Expansion joints shall be UL approved for use for fire sprinkler systems.
- E. All joints on Fire Service under slab shall be restrained up to the service stub flange connection above slab.

2.04 VALVES

- A. All shutoff and control valves shall be U.L./F.M. approved, indicating type valves equipped with a supervised trouble switch wired to the fire alarm system. Shutoffs and zone valves may be either OS&Y indicating gates or butterfly valves.
- B. Gate valves shall be outside screw and yoke indicating type, 175 psi W.P. and U.L./F.M. listed, Jenkins or equal. All such valves shall have supervised trouble switch.
- C. Butterfly valves shall be Victaulic Series 705-W for 2-1/2 inch and larger, and Milwaukee indicating type U.L./F.M. butterfly for threaded service. Coordinate with Electrical Sub-contractor to have factory installed monitor switches compatible with the remainder of the Fire Alarm System.
- D. Check valves shall be iron body bronze mounted U.L./F.M., 175# W.P. or U.L./F.M. wafer checks. Grooved end valves shall be Victaulic Style 717 Fire Lock Check Valve.
- E. Pressure relief valves shall be located on wet systems pressure regulating valves and downstream of check valves per NFPA-13-2013. Pressure relief valves shall be listed and not less than 1/2 in. in size and shall be by AGF, Watts, Cla-Val or equal.
- F. Ball drips shall be Potter Roemer #5682, 3/4 inch straight design ball drip valve, or by Victaulic, Viking, or equal.
- G. Drains shall be provided in the systems as may be required by field conditions. Provide drains at all low points and wherever necessary to insure that all portions of the sprinkler piping may be completely drained. Test connections shall be provided as required to test all portions of the system. Pipe low point drains and test connections to suitable receptor as determined in field or shown on Drawings.
- H. Install an inspector's test connection at the furthest point of each sprinkler zone. Run discharge back to a suitable receptor. Exterior wall penetration is permitted with test drain but only as approved by the Architect.
- I. Valves shall be manufactured by Victaulic, Nibco, Viking, or equal. Inspector's test stations shall be manufactured by AFG, Tyco, Victaulic, or equal.

2.05 SPRINKLERS

- A. All sprinklers to be used on this project shall be Quick Response type and shall be stamped with date of manufacture and temperature rating. Temperature ratings shall be determined by the location of the heads per NFPA 13-2013, section 8.3.2.5, and shall be minimum 155 degrees F. throughout except in special areas around heat producing equipment, skylights, and attics in which case use temperature rating to conform with hazard as specified in NFPA 13-2013. Orifice diameter and K factor shall be appropriate to meet the hydraulic design criteria, the available water supply, and NFPA Standards.
- B. Furnish spare heads of each type installed located in a cabinet along with special sprinkler wrenches. The number of spares and location of cabinet shall be in complete accord with NFPA 13-2013.

- C. Sprinklers shall be manufactured by Tyco, Victaulic, Viking, or equal.
- D. Upright sprinkler heads in areas with no ceilings shall be Tyco Model "TY-FRB" Quick Response, upright natural brass finish heads. Include heavy duty sprinkler guards in all mechanical rooms, storage rooms, garage, auto shops, and general shops.
- E. Sidewall heads shall be Tyco Model "TY-FRB" Quick Response with white polyester head and escutcheon.
- F. Pendent wet sprinkler heads shall be Tyco Model "TY-FRB" Quick Response recessed adjustable escutcheon, white polyester finish.
- G. Concealed heads shall be Tyco Model "RFII" Quick Response concealed type, 1-1/2 inch adjustment white cover plate. In special areas, as may be noted on the Drawings, provide alternate cover plate finishes.
- H. Pendent dry sprinkler heads shall be Tyco Model "DS-1" Quick Response dry type, white polyester finish and escutcheon.
- I. Dry sidewall heads shall be Tyco Model "DS-1" dry horizontal sidewall heads, white polyester finish.
- J. Use of flexible stainless steel hose with fittings for fire protection service that connect sprinklers to branch lines in suspended ceilings is acceptable. Flexible hoses shall be UL/FM approved and shall comply with NFPA 13 standards. Hose assemblies shall be type 304 stainless steel with minimum 1-inch true-bore internal hose diameter. Ceiling bracket shall be galvanized steel and include multi-port style self-securing integrated snap-on clip ends that attach directly to the ceiling with tamper resistant screws.

2.06 FIRE DEPARTMENT CONNECTION

- A. Fire Department Inlet Connection shall be Croker #6363 Series; 6 inch Storz inlet x 4 inch outlet, 30 degree elbow, brass plate, and stamped "Sprinkler-Standpipe". Install 1/2" ball drip valve and chrome plated trim wall fitting on bottom of inlet fitting body. Provide access panel for servicing the ball drip.
- B. Fire Department Connection shall be manufactured by Croker, Potter Roemer, Elkhart, or equal.
- C. Confirm size and thread with Boxford Fire Department prior to installation.

2.07 FIRE STANDPIPE EQUIPMENT

- A. Fire Department Valves shall be Croker Series 5015 Fire Department Valves fitted with 2-1/2 inch x 1-1/2 inch reducer, caps and chains all conforming to Local Fire Department thread standard. Valves shall be polished chrome plated and shall be mounted in a recessed cabinet as indicated on Drawings.
- B. Valves shall be manufactured by Croker, Potter Roemer, Elkhart, or equal.

2.08 SUPPLEMENTARY STEEL, CHANNEL, AND SUPPORTS

- A. Furnish and install All Supplementary Steel, Channels, and Supports required for the proper installation, mounting, and support of all equipment.
- B. Supplementary Steel and Channels shall be firmly connected to building construction in a manner approved by the Architect.

- C. The type and size of the Supporting Channels and Supplementary Steel shall be determined by the Fire Protection Subcontractor and shall be sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.
- D. All Supplementary Steel and Channel shall be installed in a neat and workmanlike manner parallel to the walls, floor, and ceiling construction. All turns shall be made with 90 degree fittings, as required to suit the construction and installation conditions.

2.09 HANGERS AND SEISMIC RESTRAINTS

- A. Hangers shall be furnished, installed, and supported from the building structure in accordance with NFPA - 13, Section 230548 and Drawing VS-1.
- B. All piping whether in new or existing building shall be seismic restrained.

2.10 ALARM DEVICES

- A. Flow switches shall be vane type water flow detectors with 0-70 Sec. Adjustable non-accumulative retard device and (2) single pole double throw contacts, Notifier Series WFD Potter, VSR.F or equal.
- B. Pressure switches shall be adjustable Potter Model PS10A or equal.
- C. High/Low pressure switches shall be adjustable Potter Model PS40A or equal.
- D. Supervisory switches on all O.S. & Y. gate valves shall be Notifier NGV complete with mounting bracket.
- E. The wet system alarm device shall be Reliable Model 'E' alarm valve with "E1" trimmings. Package to include electric bell.
- F. Dry valve shall be Reliable Model "A" or "B" as dictated by Hydraulic Calculations complete with Electric Trim Package.
- G. Refer to Drawings for additional devices. Co-ordinate, prior to ordering devices, with the Electrical Sub-Contractor to assure device compatibility with the Fire Alarm System.
- H. Alarm valves shall be as manufactured by Reliable, Victaulic, Tyco, or equal. Flow, pressure and supervisory switches shall be manufactured by Potter, Notifier, System Sensor, or equal.

2.11 ACCESS DOORS

- A. Furnish Access Doors for access to all concealed control valves, drains, inspector's tests, supervisory devices, and to all other concealed parts of the system that require accessibility for the proper operation and maintenance of the system. These doors shall be installed under the appropriate Section of the Specifications for the surface upon which the panels are mounted.
- B. All Access Doors shall be located in a workmanlike manner in closets, storage rooms, and/or non-public areas, positioned so that the valve or part can be easily reached, and the size shall be sufficient for this purpose (minimum size 12 inch x 16 inch). When access doors are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.

- C. Access Doors shall be prime painted and be complete with cylinder lock and two keys as manufactured by Acudor, Inland Steel Products Company "Milcor", or Walsh-Hannon-Gladwin, Inc., "Way Lector". Type shall be as follows:

Acoustical Tile Ceiling	Acudor AT-5020
W.B. Surfaces	Acudor DW-5040
Masonry Construction	Acudor UF-5000
Fire Rated Construction	Acudor FB-5060

- D. Access Doors Shop Drawings shall be submitted to the Architect for approval.

2.12 AIR COMPRESSOR

- A. Furnish and install a C-Aire, Jenny, General Air Products, OL Plus Series, or equal, UL listed air compressor complete with a air maintenance controller to supply and control air to the dry sprinkler system. Compressor shall be 1-1/2 HP and shall be wired for 120V, single phase power.

2.13 FIRE PUMP

- A. Furnish and install, where shown on plans, including a 8' diameter precast concrete wet well, one (1) Peerless Pump Company, Fire Pump System, U.L./F.M. approved, including fire pump, jockey pump, controllers and integral transfer switch. The pumping unit shall meet all requirements of N.F.P.A. Pamphlet No. 20. The fire pump shall be designed to deliver a capacity of 750 USGPM for a pressure boost of 85 PSIG. The pump shall be a vertical turbine, four (4) stage, furnished complete with a 1/2" thick steel plate which is hot dipped galvanized after fabrication. The pump shall furnish not less that 150% of rated capacity at a pressure not less than 65% of rated head. The shut-off total head of the pump shall not exceed 140% of total rated head. Pump to be hydrostatically tested to twice the maximum pressure developed at shut-off but not less than 250 PSIG.
- B. The fire pump shall be Peerless Pump Model UL/FM 12 MB, four stage turbine Fire Pump driven by 50 HP, 1770 RPM, 208 volt, 3 phase, 60 cycle hollow shaft.
- C. Fire Pump Controller and Automatic Transfer Switch Combination shall be listed and labeled by U.L. and F.M. and completely assembled, wired and tested by the manufacturer. Each shall be mounted in separate enclosure; mechanically attached to form one unit and provide for protected interlock wiring. Enclosures shall be drip proof and completely front accessible.
- D. The automatic electric motor controller shall be a Firetrol model FTA1930 UL listed/FM approved specifically for fire pump service. The controller shall be designed for solid state soft starting, with 50% tap for 150% current and 25% torque. The controller shall be rated for the horsepower specified in with a Firetrol Model FTA 950 Automatic Transfer Switch to generator set. The controller shall be capable of interrupting a short circuit current at least equal to the available short circuit current in the controller supply circuit. This fire pump controller installation requires an interrupting capacity of not less than 100,000 amps RMS symmetrical at an operating voltage of 480 volts.
- E. The Automatic Transfer Switch shall incorporate an externally operated main isolating switch, a manual operating handle, indicators, contacts or remote alarms, voltage frequency and phase reversal sensing, time delays and memory circuits.
- F. The fire pump shall be complete with 3-1/2" dial suction and discharge gauges, casing relief valves, air release valve and discharge spool.
- G. The fire pump and the controller shall be thoroughly shop tested and labeled prior to shipment.

- H. Furnish and install duplex jockey pump system. The jockey pumps shall be Grundfos, Myers, Goulds, or approved equal submersible pump with a capacity of 15 USGPM for a pressure boost of 130 PSIG. The jockey pump shall be driven by a 1.5 HP, 3,500 RPM, 480 volt, 3 phase, 60 cycle submersible multi-stage centrifugal pump. Provide conduit box and wiring from pump motor to conduit box.
- I. The jockey pump controller shall be a Firetrol Model FTA500 complete with fusible disconnect, Hand-Off-Automatic selector switch and a pressure switch in a wall mounted NEMA 2 enclosure.
- J. The jockey pump shall start on a pressure drop in the system. The fire pump shall start automatically on a further pressure drop or on a jockey pump failure.
- K. The mounting plate shall be fabricated to include the necessary openings indicated or required. Mount on top of a 6" high concrete housekeeping pad. Fire pump shall be installed in a Rotondo Precast Corp., 6 foot diameter pre-cast concrete wet well by the height required on the drawings.
- L. The manufacturer shall provide the services of a factory-trained representative to be available to assist in final acceptance test. The installing Contractor shall make coordination of final acceptance test with underwriting authorities.
- M. System calibration and start-up shall be included in the package provided by the manufacturer. The manufacturer shall also be responsible for conducting a training seminar for the site facilities people prior to the system being turned over to the Owner (minimum 8 hours).

2.14 FIRE PUMP ENCLOSURE

- A. Building is to be supplied complete with all necessary component parts, to form a complete building system and all parts shall be new and free from all defects or imperfections. The building width and length shall be measured from the outside of the building wall panels and the height of the building shall be the distance measured from the bottom surface of the base channel to the exterior juncture of the roof and sidewall panels and will require a building state certification.
- B. Factory exteriors color of building and roof to be Tan or White only as selected by architect.
- C. Enclosures shall be constructed with prefabricated wall and ceiling panels formed to exact size as described below and manufactured by Kysor Panel Systems, Fort Worth, TX.
- D. BUILDING INSULATION:
 - 1. Insulation shall be 100% rigid urethane with an at temperature conductivity factor (K factor) not to exceed 0.128 Btu/hr. Urethane is to be poured in place with a density of 2.2 pounds per cubic foot. Overall coefficient of heat transfer (U factor) and R value to be as follows:
"R" VALUE
24 (walls) and 34
(ceiling)
 - 2. This insulation shall be a listed urethane with a rating of no more than 25 for flame spread and 450 for smoke developed per ASTM E84. This urethane shall also meet the ignition properties requirements of ASTM D-1929.

- E. All panels to be constructed with die-formed interior and exterior metal pans securely fastened to a perimeter frame of kiln dried spruce-pine-fir (SPF) specie, #2 grade lumber. Perimeter frame to feature tongue and groove profile for positive alignment and sealing. Panel shall be filled with poured-in-place urethane, securely bonded to metal pans and perimeter frame to create a rigid structural panel with a tough, resilient, shock-resisting surface. Provide standard panels, interchangeable, for ease of assembly. Provide special panels, if required, manufactured to the size required to obtain a specified building size. Provide pressure treated (Chemicals) perimeter bracing.
- F. Provide cam-lock fasteners to ensure a tight and positive seal, and reduce on-the-job installation time. Fastener material shall be steel housing, hook and pin with high-pressure die-cast zinc cam. Hardened steel hexagonal wrench is provided to tighten panel fasteners. The hook of the fastener shall engage over the pin when rotating the wrench and with cam-action, draw the panels tightly together. Polyethylene snap-in caps cover the wrench holes. Lock spacing shall not exceed 48" on center.
- G. Each joint shall exhibit a polyvinyl chloride (PVC) bulb type; compression gasket to eliminate water vapor permeability. All gaskets are factory installed and require no additional handling. Gaskets shall be resistant to chemical corrosion and ultraviolet radiation. Gasket operating temperature shall be -34 degrees C to +71 degrees C (-30 degrees F to +160 degrees F).
- H. Provide interior and exterior metal pans as follows:
1. Galvanized Steel:
 - a. Tan Embossed 22 gauge

I. DOORS

1. Door shall be seamless, constructed of two face sheets of 18 gauge cold rolled steel, stretcher-leveled quality of flatness. Vertical edges of doors shall have neat hemmed edge seam mechanically interlocked for maximum structural integrity. All hinge reinforcements shall be of 8 gauge steel projection welded to door. Doors for exterior shall be 1-3/4" thick, 4'-0" x 7'-0".

Door Widths	Louver Sizes
6'-0" X 7'-0" Double	To suit exhaust fan

2. The number of doors, their location and direction of swing is shown on the plans. Standard frames shall be double rabbeted 16 gauge cold rolled steel. Frames shall be mitered, face welded and ground smooth. All hinge reinforcements shall be of 8 gauge steel projection welded to frame. Reinforcements for strike and surface mounted hardware shall be a minimum of 14 gauge. Frames shall be furnished with a factory installed rubber mutes, 3 per strike jamb. Doors and frames shall be factory painted with one coat of baked on primer. All doors shall be preassembled in their frames and hardware installed and tested prior to shipment. Field installation of the door unit shall not require any frame assembly, door handling or hardware installation. Provide door hardware, including non-removable pin butt hinges with individual lockset and accessories, for exterior doors as follows:
 - a. Hinges: 1-1/2" pair (per door), 4-1/2" x 4-1/2", stainless steel. (U.S. 32D), non-removable pins
 - b. Keyed lockset with storeroom function (US 32D).
 - c. Hasp & Staple: 7" extra heavy type, cadmium plated.
 - d. Head Bolt: 6" long with 24" chain, cadmium finish.
 - e. Foot Bolt: 6" long, cadmium finish.
 - f. Weatherstripping

- g. Threshold: aluminum
 - h. Door stop and latch
- J. Roof hatch will be designed to have a minimum clearance six inches on all sides of the pump specified.
- K. Provide panel systems that meet the requirements of the following:
- 1. Flame spread and smoke developed per UL-723, ASTM E-84 and Chapter 26 of the International Building Code
 - 2. Ignition properties per ASTM D-1929
 - 3. Factory Mutual Standard 4894
- L. All work and materials shall be in full accordance with local and State Building Code. Provide all items required by the regulations and codes, but not necessarily specified herein or shown on the drawings.
- M. Insulated panels shall be set on galvanized "Z" base trim, secured to concrete slab, with non-drying butyl caulking. All openings and penetrations through insulated panels shall be sealed with silicone sealant. Clean and degrease applicable surfaces.
- N. Install in complete accordance with the manufacturer's printed instructions.
- O. Louvers shall be the "fixed" type with insect screen. Louver frame shall be made from 22 gauge galvanized steel. Louvers shall be horizontally centered and set into 47" insulated panels.
- P. Provide manufacturer standard exhaust fan.
- Q. Provide a prefabricated roof system for the enclosure, complete with roof hatch, to provide a waterproof covering for insulated ceiling panels. Roof system shall be galvanized standing seam, 22 gauge, 16 inches wide, sheet metal over ceiling panels with a slope of 1/4" per foot. Fasteners shall be corrosion resistant rubber washered Tek screws with length and strength required for metal to be fastened.
- R. Provide enclosure complete with gutters and downspouts, standard metal finishes to match the finish on the insulated panels.
- S. Provide all blocking as required to support pump equipment indicated. Coordinate with pump supplier.
- T. Provide steel skid mount, to receive pump system, ready for casting in concrete floor.
- U. Grounding plate with threaded lugs and mechanically fastened continuity trim are available upon request.
- V. The building manufacturing is to supply all necessary framing and connectors to structurally replace the panel removed by any wall or roof openings. The supplier of the unit being installed shall provide all trim and flashing required to make weather-tight the unit placed in any opening.
- W. INSTALLED ACCESSORIES
- 1. (2) 3 1/2 KVA CFM space heaters with wall mounted thermostat (Each sized per local weather requirements for proper CFM) to handle full heating requirements in case of one unit failure.
 - 2. (1) Motorized Damper
 - 3. (1) Duplex battery powered interior emergency lighting

4. (1) Duplex wall mounted GFCI convenience outlet
 5. (1) Overhead automatic sprinkler system with flow sensor per NFPA 13
 6. (1) 60-amp service entrance rated disconnects provided and installed per NEC and NFPA 20.
 7. (1) Exhaust Fan & Thermostat
 8. (2) 100W Fluorescent Vapor Tight Lights
 9. (1) Transformer for building power and lighting
 10. (6) 15 AMP Single Pole Circuit Breakers
 11. Exterior 70 W High Pressure Sodium Wall Pack with Photocell
 12. (1) Low Temperature Alarm wired to remote panel to be located in the office or as directed. Provide connection point in panel for connection to fire alarm system to send an alarm to the fire department central system, to notify fire department no heat. Coordinate all work with electrical contractor.
- X. All of the above equipment is to be mounted on an open I-Beam structural steel skid having recessed inner support members. All piping, pressure-sensing lines, shut off valves, stuffing box, and casing relief drain lines shall be firmly anchored to the steel base by means of structural steel supports. All electrical wiring between drivers and controller is to be ran in rigid conduit, countersunk and ran through the center of the inner support members of the skid. Coordinate with drawings for additional information. All equipment shall be factory tested as a system by the system manufacturer in accordance with NFPA 20, UL and FM prior to shipment. Additionally, the system manufacturer prior to shipment shall hydrostatically test the entire package. The unit shall be built and tested in an enclosed weatherproof shop and the manufacturer shall provide a certified X-Y plot test report prior to shipping of the system for engineering approval.
- Y. All packaged equipment shall be independently Third Party labeled as a system suitable for the intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.399 and NFPA 70, National Electric Code (NEC), Article 90-7.
- 2.15 UNDERGROUND FIRE WATER STORAGE TANK
- A. Furnish and install as shown and as detailed on the Drawings, size dimensions and details, a single wall fiberglass reinforced underground storage tank for non-potable water storage as manufactured by Xerxes Corporation or approved equal. Tank shall be furnished complete with manways and risers to grade, hold down straps, turnbuckles, tappings for inlets, tank vents, and level indicators. Tanks shall be designed for H-20 loading.
 - B. Excavation, Backfill, Hold down pads and cast iron frames and cover are specified under Division 31. Be responsible, however, and furnish factory trained personnel from the tank manufacturer to inspect the conditions and materials to meet their requirements. Report any deficiencies to the Architect.
 - C. Provide buoyancy calculations from manufacturer. Buoyancy calculations shall be calculated with the tank empty, water table at the same elevation as grade, and using factory supplied deadmen. Provide all necessary precast concrete deadman, hold down straps, and turnbuckles to provide a minimum buoyancy safety factor of 1.2:1.
 - D. Tank shall be installed and tested in accordance with the Xerxes Installation Manual and Operating Guidelines for Single-Wall and Double-Wall Fiberglass Underground Storage Tanks.
- 2.16 TANK FILL AND LEVEL CONTROLS
- A. Controls shall be mechanical float switches which are to be mounted on galvanized support pole and furnished with sufficient cable on each float to run wiring back to control panel. Controls shall be Weil Pump Company Series 8234 or equal by Zoeller, Hayes, or equal.

- B. Control panel shall include control circuit disconnect, high water alarm with audio/visual silencer, and dry contacts for remote annunciation. Panel shall be located in the fire pump enclosure building. Wiring is specified in Division 26.
- 2.17 TEST HEADER
- A. Furnish and install a Croker model 6817-PC test header where indicated on the drawings. Connection shall be labeled as "SYSTEM TEST".
 - B. System test header shall be manufactured by Croker, Potter Roemer, Elkhart, or equal.
- 2.18 DRY SUCTION NOZZLE
- A. Dry Suction Nozzle shall be Croker #6983, 6" NST Swivel connection with cap and chain with chain welded to pipe as detailed on the drawings.
- 2.19 GATE VALVES - EXTERIOR
- A. All gate valves shall conform in design and manufacturing to the latest issue of AWWA Standard C500 "Resilient-Seated Gate Valves for Water Supply", rated at 150 psi working pressure with a minimum 300 psi pressure test
 - B. All valves shall have a 2 inch operating nut, mechanical joint hubs (except for wet tapping sleeves).
 - C. All valves shall open in a COUNTER-CLOCKWISE direction.
- 2.20 MISCELLANEOUS WATER VALVES & FITTINGS - EXTERIOR
- A. Corporation stops shall be brass compression type with AWWA Taper (CC or CS) Thread. Corporations shall be supplied with pack-joint. Corporation stops shall be Ford, Cambridge Brass, Mueller or approved equal.
 - B. Curb stops shall be of brass and shall be manufactured by Ford, Cambridge Brass, Mueller, or approved equal. The inlet and outlet shall have compression connections.
 - C. Each curb stop shall be provided with a cast iron box. The box shall be the extension type with arch patter. Inside diameter of the upper section shall be at least 2-1/2 inches. The boxes shall be furnished with a cast iron lid and heavy brass pentagon plug. Boxes shall be completely thoroughly coated with bitumastic paint.
 - D. Tubing for services and sample lines shall be 200 psi, copper tubing size polyethylene and shall comply with AWWA Specifications.
 - E. Adapter couples may be required for fitting new services to existing service lines. Such fitting shall be compression connections and provide electrical continuity.
 - F. Couplings to be used in connecting two plain ends of cast, ductile iron, or PVC pipe shall be of cast or ductile iron with bolts and nuts complying with AWWA C111. Couplings shall be Dresser Style 38, Smith-Blair Style 441, Clow Type F12308, or approved equal.
- 2.21 FIRESTOP SYSTEMS
- A. General: Provide firestopping at all new fire-rated construction where penetrated by the Work of this Section.
 - B. Refer to Section Division 07, for all product requirements for maintaining integrity of fire-rated construction at penetrations.

2.22 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 015213 - Temporary Facilities and herein.
1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of Section 015213 - Temporary Facilities shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 015213 - Temporary Facilities and as additionally required for dust control).
 3. General Contractor is responsible to provide enclosures required for temporary heat; refer to Section 015213 - Temporary Facilities.
 - a. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Trade Contractor.

2.23 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 015213 - Temporary Facilities.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

- A. All work shall be installed in a first-class manner consistent with the best current trade practices. All materials shall be securely installed plumb and/or level, and all flush mounted equipment shall have front edge flush with finished wall surface.
- B. Protect all concealed heads. Coordinate and advise finishing trades so as to prevent painting of sprinkler heads or inadvertent filling with paint or jointing compound of required air spaces in the case of the concealed type sprinkler heads.
- C. Training:
1. Train the Owner's maintenance personnel on troubleshooting procedures, and servicing and preventative maintenance schedules and procedures.
 2. Schedule training with Owner through the Architect with at least 7 days prior notice.

3.02 WORK COORDINATION AND JOB OPERATIONS

- A. The equipment shall not be installed in congested and possible problem areas without first coordinating the installation of same.
- B. Before materials are purchased or work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly annotated and cross-referenced at their interfaces.

- C. Coordination Drawings are for the Contractor's and the Architect's use during construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.
- D. Detailed procedures for Coordination Drawings are contained in DIVISION 01 - GENERAL REQUIREMENTS of these Contract Documents.
- E. Particular attention shall be directed to the coordination of piping and other equipment installed in the ceiling areas. Coordinate the elevations of all piping in hung ceiling areas to insure adequate space for the installation of recessed lighting fixtures before other mechanical equipment is installed.
- F. Furnish to the General Contractor, and all other Subcontractors, all information relative to the portion of the Fire Protection installation that will affect them, sufficiently in advance so that they may plan their work and installation accordingly.
- G. In case of failure to give proper information as indicated above, sufficiently in advance, pay for all back-charges for the modification, renovation, and relocation of any portion of the work already performed.
- H. Obtain from the other trades, all information relative to the Fire Protection Work to be executed in conjunction with the installation of their respective equipment.

3.03 CUTTING AND CORE DRILLING

- A. Perform all cutting and core drilling operations that are outlined in Part 1 of this SECTION. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the walls, floors, overhead structure, and other structural components is maintained until permanent work is installed. Prior to any coring or cutting, verify all locations of same with the General Contractor. All cutting and coring is to be performed in accordance with approved Coordination Drawings.
- B. Cut all masonry and concrete with an approved diamond blade concrete saw in a neat straight direction, perpendicular to the plane of the wall or floor.
- C. Use a core drilling process which produces clean, sharp edges and the minimum hole size which will accommodate the size of pipe sleeve specified.
- D. Patch all holes up to the sizes indicated in this Section with material and methods as are specified in the Section of the Specifications for the finish trade involved. Holes which are improperly done due to poor materials or method, shall be patched to the satisfaction of the Architect by the finish trade and back-charged to this Subcontractor.

3.04 CLEANING AND PROTECTION

- A. Protect all materials and equipment during shipment and installation and properly handle and store at the job site so as to prevent damage. Assume full responsibility for protection of work until its completion and final acceptance.
- B. Keep the premises reasonable clean at all times and remove rubbish caused by the Fire Protection work as directed by the Architect.
- C. Upon completion of this work, clean all sprinklers, and equipment and replace damaged parts. Failure to fulfill this obligation will result in back-charges for correction of the defective work by others.

3.05 SLEEVES, INSERTS, AND ESCUTCHEONS

- A. All piping passing through slabs, floors, walls, and partitions shall be sleeved and all such sleeves shall be furnished and installed by the Fire Protection Subcontractor as detailed on the Drawings and herein specified. Fire Protection Contractor, shall do his core drilling as approved by the Architect and the cored opening shall have a sleeve caulked and leaded in place. Set sleeves in concrete floors and walls as soon as forms set and before concrete is poured.
- B. All pipes passing through floor, whether slab-on grade or above grade levels shall be sleeved with sleeve extending 1 inch above floor. This includes all piping in toilet room pipe space, stairwells, closets, and partitions.
- C. All sleeves shall be Schedule 40 galvanized steel pipe and shall be reamed. There shall be annular space between the sleeve and pipe per NFPA requirements. Sleeves on drywall, masonry, or concrete walls and partitions shall be flush with wall on both sides.
- D. The space between sleeve and pipe, in all cases, shall be filled with U.L./F.M. approved caulking compound. This includes pipes concealed in chases and/or partitions.
- E. Inserts, where required, shall be furnished and set by the Fire Protection Subcontractor and, where necessary, may be drilled or power driven and shall be sized such that the insert will not exceed a depth of penetration of 1 inch into concrete.
- F. Escutcheons: All exposed pipe, uncovered, passing through walls, or floors, or ceilings, shall be fitted with C.P. brass spun or split type escutcheons with approved clamping device for holding in position. Floor escutcheons shall be deep enough to fit over sleeves, fastened to pipe, and extend down to floor.

3.06 INSTALLATION OF EXTERIOR PIPE

- A. Trenches shall be opened only to such extent as approved by the Architect and the total lengths of open trench shall be as short as practical at all times. Immediately upon opening of trench, pipe bedding shall be placed, compacted, and dressed as specified.
- B. Carefully examine each pipe length before laying, and do not lay defective or damaged pipe. Lay pipe lines to grades and alignment indicated. Provide proper facilities for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable.
- C. Pipe laying shall proceed upgrade with spigot ends of bell-and-spigot pipe, and tongue ends of tongue-and-groove pipe pointing in direction of flow.
- D. Execute installation of flexible joints by placing gaskets and jointing materials in accordance with recommendation of particular manufacturer in regard to use of lubricants, cements, adhesives and other special installation requirements. Surfaces to receive lubricants, cements or adhesives shall be clean and dry. Affix gaskets and jointing materials to pipe not more than twenty-four (24) hours prior to installation of pipe and protect from sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials so damaged shall be removed and replaced. Pipe shall be aligned with previously installed pipe and joint pulled together. If, while making joint, gasket or jointing material becomes loose and can be seen through exterior joint recess when joint is pulled up to within 1 inch of closure, pipe shall be removed and joint remade.

3.07 FLANGED JOINTS

- A. Flanged joints shall be made with full faced one-piece gaskets of best quality cloth inserted sheet rubber at least 1/16 inch thick and all flanges shall be made up evenly and perfectly tight. Bolts and nuts shall be of best quality wrought iron or mild steel with hexagonal heads and nuts and of proper size and length.

3.08 EXTERIOR VALVES AND HYDRANTS

- A. Valves and valve boxes shall be set plumb with valve boxes directly over the valves.

3.09 TESTING

- A. Flush the system and test all work in the presence of the Architect and/or Engineer and as required by NFPA and the Insurance Company. The flushing and testing procedures to be followed are specified herein. At the completion of the testing, submit fully executed copies of Contractor's Material and Test Certificate for both above ground and underground piping as contained in NFPA-13.

1. Water Supply:

- a. Flushing: Underground/exterior service entrance shall be flushed at a minimum velocity of 10 fps in accordance with NFPA Standards 13 and 24.
- b. Flow required to Produce Velocity of 10 ft/sec in Pipes:

24-20 Installation of Private Service	
Table 10.10.2.1.3 Flow Required to Produce Velocity of 10 ft/sec in Pipes	
Nominal Pipe Size	Flow Rate
2 in.	100 gpm
2 1/2 in.	150 gpm
3 in.	220 gpm
4 in.	390 gpm
5 in.	610 gpm
6 in.	880 gpm
8 in.	1,560 gpm
10 in.	2,440 gpm
12 in.	3,520 gpm

2. Sprinkler System:

- a. Hydrostatic Testing: The interior system shall be hydrostatically tested at 200 psi for 2 hours in accordance with NFPA 13 paragraph 25.2.1.
- b. Operational Testing: Water flow switches and associated alarm systems shall be tested by water flow through the inspectors test assemblies in accordance with NFPA 13, 25.2.3.
- c. Main Drain Test: A flow test shall be performed on the main drain valve and recorded on the Contractor's test certificate in conformance with NFPA 13, 25.2.3.4.
- d. Backflow Preventor Flow Test: The double check valve assembly shall be flow tested in conformance with NFPA 13, 25.2.5. Provide piping and or valving arrangement to preform full flow testing of backflow device.
- e. Dry system shall be trip tested and acceptance tested with recorded results submitted to the owner for their review and record in accordance with NFPA 13 and 25. All dry systems shall be completely drained with all water removed prior to being placed in permanent service.

- f. Underground Piping: Underground piping and fire sprinkler lead in connections to each building shall be hydrostatically tested, flushed and chlorinated in accordance with NFPA 24, the Local DPW, and any other pertinent laws or governing standards. Flushing, Testing and chlorination reports shall be given to the owner for review and included in the O&M Manuals for the fire protection systems.
3. Fire Pump
 - a. Flushing: Suction piping shall be flushed at a flow rate not less than indicated in Tables 11-1.2(a) in accordance with NFPA 20, 14-1.1.
 - b. Hydrostatic Testing: Suction and discharge piping shall be hydrostatically tested to not less than 200 psi for 2 hours in accordance with NFPA 20, 14.1.2.
 - c. Flow Test: The minimum, rated and peak loads of the fire pump shall be determined by controlling the quantity of water discharged through approved test devices in accordance with NFPA 20, 14.2.7.2.
 - d. Load Start Test: The fire pump unit shall be started and brought up to rated speed without interruption under the conditions of a discharge equal to peak load in accordance with NFPA 20, 14.2.7.5.
 - e. Phase Reversal Test: A test shall be performed to ensure that there is not a phase reversal condition on either the normal power or the alternate power supply in accordance with NFPA 20, 14.2.7.6.
 - f. Controller Acceptance Test: The fire pump controllers shall be tested in accordance with NFPA 20, 14-2.8.
 4. Fire Water Storage Tanks
 - a. Leak: Upon completion of tank and prior to any specified backfill the tank shall be tested in compliance with NFPA 22, 17.7 to ensure water tightness. This section shall provide all water required for testing. Once testing is complete this section shall provide water for full cistern.
- 3.10 FIRESTOP SYSTEMS:
- A. General: Install firestop systems at all new fire-rated construction where penetrated by the Work of this Section.
 - B. Refer to Division 07, for all installation requirements for maintaining integrity of fire-rated construction at penetrations.
- 3.11 SEISMIC RESTRAINTS
- C. The independent engineer responsible for design of seismic restraints shall visit the project upon completion of the work to certify the installation is consistent with the approved shop drawings. The certification shall be submitted to the Architect and must precede the closing in of ceilings.
- 3.12 SYSTEM SHUTDOWNS
- A. Coordinate shutdowns of existing systems with the Owner and submit a written request at least ten working days in advance. Minimize system shut downs as much as possible. Submit a list of all affected areas, the proposed work to be performed, and the expected length of the shut-down including time for retesting.
 - B. Provide temporary services to maintain active system during extended shut-downs as required for demolition and construction phasing.

END OF SECTION

SECTION 22 0000

PLUMBING
 (Filed Sub-Bid Required)

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SECTION 22 0000

PLUMBING
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 FILING SUB-BIDS

- A. Time, Manner and Requirements for Submitting Sub-Bids:
 - 1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Public Agency at a time and place as stipulated in the "Instructions to Bidders."
 - 2. Each sub-bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 44F of Chapter 149 of the General Laws, as amended.
 - 3. Sub-bids filed with the Awarding Authority shall be accompanied by Bid Bond, Cash, Certified Check, Treasurer's Check, or Cashier's Check issued by a responsible bank or trust company payable to the Town of Boxford in the amount of 5 percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- B. No Sub Sub-Bid Requirements for this Section

The Work of this Section is shown on the following Drawings: TBD

1.03 GENERAL PROVISIONS

- A. All the Contract Documents and General Provisions of the Contract including, but not limited to, General and Supplementary Conditions, and Division 1 Specification Sections apply to this Section.
- B. The work of this Section provides and contains general information which is inherently made a part of each Section and applies to all work performed under this Contract.

1.04 DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein.
- B. The work covered by this Section of the Specifications includes the furnishing of all labor and materials and in performing all operations in connection with the installation of the Plumbing Work.

- C. Without limiting the generality thereof, the work to be performed under this Section includes:
1. Complete Sanitary, Waste & Vent System to 10 ft. outside building and/or as shown on the drawings.
 2. Kitchen grease waste and vent system including exterior precast concrete grease trap, manholes, and cast-iron piping within the exterior grease trap.
 3. Potable Cold, Hot, and Hot Water Re-circulation System.
 4. Natural Gas System for emergency generator.
 5. Insulation.
 6. Potable Water Heating Equipment.
 7. Fixtures and Equipment
 8. Connection to Equipment Furnished by Others
 9. Flushing, Sterilization, and Tests
 10. Furnishing of Access Panels
 11. Drilling, Coring and Cutting & Patching of holes and openings where the largest dimension thereof does not exceed 12 inches for Plumbing Piping and Equipment.
 12. Provide and maintain temporary water service as directed by General Contractor. General Contractor to pay for all water use.
 13. Scaffolding, Rigging, and Staging required for all Plumbing Work. Comply with Division 1 requirements.
 14. Provide Seismic Restraints for all Plumbing Systems conforming to the requirements of Section 230548 which Section is herein incorporated by reference. Seismic restraints are required on all new systems whether in new or existing building.
 15. Preparation of Co-ordination Drawings.
 16. Smoke and Firestopping Seals and sealing of all wall and floor penetrations as detailed on the drawings. Refer to Section 078400 which defines the firestopping materials and methods.
 17. At Project close out the Plumbing Sub-Contractor shall provide the services of an outside firm who shall run an underground video camera, locating all drainage system lines including depth, preparing a video and identifying & correcting any problem areas. The Plumbing Sub-Contractor shall rod-out and power wash all underground drainage systems. Turn over 4 copies of the video and written report to the owner. Videos are required for the underground sanitary and kitchen waste systems.
 18. It shall be the responsibility of this division 220000 to provide all personnel as required to fully coordinate with the commissioning agent. The hours of training and instruction outlined in this division 220000 and the Testing requirements shall be in addition to those tests and requirements outlined in section 019113 and required to fulfill section 019113 commissioning obligations.
 19. When open-flame or spark producing tools such as blower torches, welding equipment, and the like are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant non-working fire watch, paying all fees, where work is being performed and until it is completed. Fee for fire watch shall be included in the bid.

1.05 RELATED WORK

- A. The following Related Work will be performed under the designated Sections:
1. Domestic Water Service to 10 ft. outside – DIVISION 33 – UTILITIES
 2. Cutting and Patching beyond 1.3C.22 above: SECTION 010450 - CUTTING AND PATCHING
 3. Flashing for vents through roof: SECTION 075100 - ROOFING & FLASHING
 4. Electric Power Wiring: SECTION 260000 - ELECTRICAL
 5. HVAC Equipment: SECTION 230000 - HVAC

6. Excavation and Backfill: DIVISION 31 - EARTHWORK
7. Sanitary Sewer and storm drains to 10 feet outside the foundation wall: DIVISION 33 - UTILITIES
8. Finish Painting: SECTION 099000 - PAINTING
9. Installation of Access Panels: SECTION describing material in which panel is installed.
10. Toilet Room Accessories: SECTION 108000 - TOILET ACCESSORIES
11. Temporary Facilities: SECTION 015000 - TEMPORARY FACILITIES
12. Food Service Equipment: SECTION 114000 FOOD SERVICE EQUIPMENT

1.06 CODES, ORDINANCES, AND PERMITS

- A. Perform all work in accordance with the requirements of the Town of Boxford Building Department, Massachusetts State Plumbing and Fuel Gas Codes, D.E.P., A.D.A., NFPA, The Architectural Barrier Code, and applicable State and Federal Laws. Give all requisite notices, file all requisite plans, and obtain all permits required to perform all Plumbing Work. Where the Contract Documents indicate more stringent requirements than the above Codes and Ordinances, the Contract Documents shall take precedence.
- B. Obtain all permits, inspections, and approvals, from the governing authorities and pay all fees and include cost in the bid, including approvals for the cross connection control device. Provide the Owner with the cross connection permit for the device in the Owner's name.
- C. Owner will pay all related Gas Utility Company back charges.

1.07 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications conflict or are unclear, advise Designer in writing before Award of Contract. Otherwise, Designer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or unclarities thus resolved.
- B. Where Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert Designer in writing before installation. Otherwise, make changes in installed work as Designer requires within Contract Price.
- C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specs, this contractor shall provide that material, installation, or work which is of the higher standard.
- D. It is the intent of these contract documents to have the contractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the contractor has failed to notify the Designer of the situation in accordance with the paragraph above, the contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
- E. In cases covered by the paragraph above, where the contractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution and the Designer shall review, note if necessary, and approve the sketch.

1.08 MODIFICATIONS IN LAYOUT

- A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet architectural requirements.
- B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Designer.
- C. Check Contract Drawings as well as Shop Drawings of all subcontractors to verify and coordinate spaces in which work of this Section will be installed.
- D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.
- E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C, D above. Systems shall be run in a rectilinear fashion.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Designer for review and approval.

1.09 SHOP DRAWING AND MATERIAL SCHEDULES

- A. Refer to SECTION 013000 - SUBMITTALS for submittal of Shop Drawings. If apparatus or materials are substituted for those specified, and such substitution necessitates changes in or additional connections, piping, supports or construction, same shall be provided as the responsibility, and at the expense, of the Plumbing Subcontractor.
- B. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Subcontractor. The Subcontractor is responsible for furnishing and installing materials called for in the Contract Documents, even though these materials may have been omitted from approved Submittals.
- C. Submit Shop Drawings for the following materials and equipment.
 - 1. Valves, Piping, couplings and Fittings
 - 2. Fixtures, Drains and Equipment including Supports
 - 3. Backflow Preventers
 - 4. Access Panels and Covers
 - 5. Insulation
 - 6. Drains, and Hydro Mechanical Specialties
 - 7. Hose Bibs, Wall Hydrants
 - 8. Hangers, Anchors, Guides, and Supports including Seismic Restraints
 - 9. Cleanouts
 - 10. Piping Identification System
 - 11. Water Heating Equipment

1.10 COORDINATION DRAWINGS

- A. Before materials are purchased or Work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly annotated and cross-referenced at their interfaces (match lines).
- B. Coordination Drawings are for the Contractor's and the Architect's use during Construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.
- C. Detailed procedures for Coordination Drawings are contained in DIVISION 01 - GENERAL REQUIREMENTS of these Contract Documents.

1.11 RECORD DRAWINGS

- A. General: Refer to DIVISION 01 - GENERAL REQUIREMENTS for general requirements for maintaining as-built drawings and submitting final reproducible record documents.
- B. The General Contractor will provide two sets of Drawings to the Plumbing Subcontractor, one set of which shall be maintained at the site and which shall, at all times, be accurate, clear, and complete, showing the actual locations of all equipment and piping as it is being installed. The Record Drawings shall be available to the Architect/Engineer's field representative at all times.
- C. Provide electronic AutoCAD drawings to indicate revisions to piping size and location both exterior and interior; including locations of valves and other equipment requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.
- D. Include in the Record Drawings any addenda, sketches, and supplementary Drawings issued during the course of construction.
- E. Non-availability of Record Drawings or inaccuracies therein will postpone the final inspection until they are available.
- F. All valves shown on these Drawings shall be numbered with numbers corresponding to those on the valve charts.
- G. All costs related to the foregoing requirements shall be paid by the Plumbing Subcontractor.

1.12 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Provide operating instructions to the Owner's designated representative with respect to operation functions and maintenance procedures for all equipment and systems installed. At the completion of the project, turn over to the Architect four (4) complete manuals, in three-ring, loose-leaf binders, containing the following:
 - 1. Complete Shop Drawings of all equipment.
 - 2. Operation description for all systems.
 - 3. Names, addresses, and telephone numbers of all suppliers of the system.
 - 4. Preventative maintenance instructions for all systems.
 - 5. Spare parts lists of all system components.
 - 6. Four copies of video of below slab piping.

7. Valve tag chart.

- B. Provide DVD recording of operation and maintenance training sessions and include as part of O & M Manual submittal. Training session video recording and DVDs shall be performed by a professional videographer. Provide indexed table of contents for DVD recording.

1.13 GUARANTEE

- A. Refer to Division 1 of the Contract. Guarantee all work under this Section free from defects in workmanship and materials for a period of one (1) year from the date of final acceptance of the building, as set forth in the Contract. Replace any such defective work developing during this period, unless such defects are clearly the result of bad usage of equipment by others. Where such defective work results in damage to work of other Sections of the Specifications, restore such work to its original condition by mechanics skilled in the affected trade.

1.14 DRAWINGS

- A. All work shown on the Drawings is intended to be approximately correct to scale, but shall be taken in a sense as diagrammatic. Sizes of pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make complete working systems ready for use. The Plumbing Drawings are intended to show the main stacks and risers and may or may not necessarily show all runout piping particularly in lavatories and gang toilet areas. Contractor shall include all runout piping to all referenced scheduled fixtures and equipment appearing on the Plumbing Drawings.
- B. All floor drains installed on this project, including all kitchen floor drains and trough drains, shall be equipped with trap primers. The trap primer and piping is not shown on the drawings and shall be located in the field by the Contractor as dictated by field piping conditions.
- C. The Plumbing Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.
- D. Refer to the Architectural, Structural, and other Mechanical and Electrical Drawings, which indicate the construction in which this Work shall be installed. Locations shown on the plans shall be checked against the general and detailed Drawings of the construction proper. All measurements shall be taken at the Building.

1.15 VALVE TAGS, NAMEPLATES, AND CHARTS

- A. All valves on pipes of every description shall have neat circular brass valve tags at least 1-1/2 in. in diameter attached with brass hook to each valve stem. Stamp on these valve tags, in letters as large as practical, the number of the valve and the service, such as "H.W., C.W., GAS", for hot water, cold water, and gas respectively. The numbers for each service shall be consecutive. Where valves are located above ACT ceilings, furnish and install valve finder ceiling tack, tack shall be minimum 7/8 in. diameter with 1/2 in. steel point, color as determined by Owner.

- B. All valves on tanks and pumps shall be numbered by 3 in. red metal discs with white numbers 2 in. high, secured to stem of valves by means of small solid link brass chain, to correspond to numbers indicated for valves on the Record Drawings and on two (2) printed detailed lists. These printed lists shall state the numbers and locations of each valve and the fixture or group of fixtures which it controls, and other necessary information such as requiring the opening or closing of another valve or valves when any one valve is to be opened and closed, and shall be prepared in form to meet approval of the Architect, and shall be framed under glass.
- C. Nameplates, catalog numbers, and rating identifications shall be securely attached to Electrical and Mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

1.16 PIPE MARKER IDENTIFICATION SYSTEM

- A. Mark all piping installed under this Section and at all Access Panels with a marking system in basic colors conforming to those specified in ANSI/ASME A-13.1. Markings shall indicate pipe content and direction of flow. Markers shall be applied at all valves and tee joints, and on straight runs of pipe at every 20 ft.-0 in. on center.
- B. Markers shall be vinyl snap-around pipe type system. Adhesive markings are not acceptable.
- C. Clearly mark potable water system with 4 inch wide colored bands, with arrow for direction of flow, every twenty-five (25) feet on center on all piping installed whether it is concealed or exposed and also on both sides of floor and/or wall penetrations. Mark potable water green. Within 6 in. of each band identify with letter "Potable C.W." Color of letter shall match banding.

1.17 SANITARY, WASTE, VENT, AND KITCHEN GREASE WASTE AND VENT SYSTEMS

- A. Furnish and install complete Sanitary, Waste, Vent, and Kitchen Grease Waste and Vent Systems (all hereinafter called Drainage Systems) to convey wastes from all Soil and Waste Stacks, Fixtures, Equipment, Kitchen Fixtures, as indicated and/or described in these Plans and Specifications. Urinal waste shall be 2 in. cast iron or sizes indicated on the drawings. Waste piping smaller than 3 in. shall not be used underground. The use of double "Y's" in the horizontal shall not be permitted. All piping shall be installed straight and true and located concealed within building construction.
- B. All horizontal Drainage Systems Piping within the building, 3 in. and smaller, shall be pitched at least 1/4 in. per ft. in the direction of flow. Drainage Piping 4 in. and larger shall be pitched at least 1/8 in. per ft. Make changes in direction of drainage lines with 45 wyes, long turn wyes, or sweep bends.
- C. Furnish and install all cleanouts indicated on the Drawings and/or where required in Drainage Pipes regardless of size so that the distance between cleanouts does not exceed 45 ft. o.c. Cleanouts shall be installed at the base of all risers and at each change of direction.
- D. Refer to drawings for termination points, which generally are connection to existing piping or to 10 feet outside the building.

- E. The kitchen Grease Waste System shall be a completely separate system beginning at the exterior grease interceptor through the kitchen and vented individually through the roof. Do not connect soil lines to the grease waste nor sanitary vents to the grease vent. Furnish and install the cast iron tees and associated piping within the grease trap including 5-foot length on the outlet. All the piping within the grease trap shall be made up with caulked and leaded joints. Locate inlet and outlet tees below access manholes to allow for inspection and maintenance. Exterior grease trap and access manholes shall be provided by this Section, 220000.

1.18 DOMESTIC WATER SYSTEMS

- A. Furnish, install, sterilize, and test in accordance with the documents and the Plumbing Code, complete potable Domestic Cold, Hot, and Hot Water Recirculating Systems including all piping, valves, low point drains, shock absorbers, hangers, insulation, backflow preventers and water heating equipment. Clearly mark the systems as provided above. This work shall start as indicated on the Drawings.
- B. In general, piping shall pitch upward in the direction of flow with each branch and riser separately valved and with 1/2 in. hose end drain on the outlet side of the valve and at all low points in the system. Install shutoff valves for each battery of fixtures and other valves as necessary to isolate any part of each system.
- C. Install shock absorbers on hot and cold water piping to each fixture. Provide shock absorbers at all quick closing valves and as shown on the Drawings and/or specified.
- D. Install a 1/2 inch hose bibb in each toilet room provided with a floor drain. The hose bibb shall be installed under a lavatory.
- E. Install a 1/2 inch hose bibb in each mechanical room.
- F. Furnish and install a ball valve, balancing valve and check valve at each hot water recirculation line before it connects to another hot water recirculation line.

1.19 FUEL GAS SYSTEM

- A. Furnish and install a complete Natural Gas Supply System including pipe, fittings, valves, connections to all gas fired equipment requiring gas, and all accessories and incidentals as indicated or specified. Installation shall be made in accordance with the State Gas Code requirements. Piping shall be installed with an 8 in. long sediment leg at the base of all risers. All changes in direction shall be made with plugged tees for cleaning piping out.
- B. All horizontal Gas Piping shall be pitched not less than 1/4 in. in 15 ft. to prevent traps. Pitch piping to risers. Install an 8 in. long sediment leg at the base of all risers. All changes in direction shall be made with plugged tees for cleaning piping out. All horizontal branch outlet pipes shall be taken from the top or side of horizontal mains and not from the bottom. Install shutoff valves for each battery of equipment and other valves as necessary to isolate any part of each system.
- C. Arrange with the Local Gas Company for the installation of the gas meters, services, and gas pressure regulators. Refer to DIVISION 01 - GENERAL REQUIREMENTS for information regarding Utility Company Charges.
- D. Provide seismic restraints for all gas piping per requirements of the Mass. Building Code. Refer also to Section 230548.

- E. Plumbing Sub-Contractor shall furnish and install all gas vents for all knockdown regulators whether furnished by this Section, HVAC, or any other Section.
- F. Gas to the Emergency Generator shall be installed according to the following:
 - 1. A dedicated fuel line shall be installed for the Generator immediately downstream of the meter assembly.
 - 2. The fuel line for the Emergency Power Generator and the fuel line for the remaining appliances shall each have a separate shut off valve installed immediately downstream of the meter to enable each line to operate independently.
 - 3. The fuel line for the Emergency Power Generator shall be labeled at the shut off valve on each side of the wall it penetrates, floor, and every 10 ft. along its run with the following:

WARNING: Emergency Power Generator. Do not shut off without the approval of appropriate authorities.

1.20 EQUIPMENT FURNISHED BY OTHERS

- A. Miscellaneous items, including but not necessarily limited to the following, shall be furnished and set by others as specified in other SECTIONS of the Documents.
 - 1. Refrigerators
 - 2. Dishwashers
 - 3. Kitchen Equipment
- B. Verify the extent of the connection requirements from the General, Architectural, and Mechanical Plans and Specifications.
- C. The Plumbing Subcontractor shall be responsible in making final connections to all equipment furnished by others, to ascertain complete cross-connection prevention compliance, and to furnish and install vacuum breaker and backflow preventers which may be required to be Code compliant and are not so furnished with the equipment.

1.21 PAINTING

- A. All interior exposed piping is to be painted and all painting, except as noted, will be done by the Painting Subcontractor. All uncovered piping and hangers shall be thoroughly cleaned of rust, oil, and other containments by the Plumbing Subcontractor and left ready to receive primer coat.
- B. Painting for pipe markings shall be done under this Section.
- C. Painting of exterior gas piping at gas meter and generator, shall be done under this Section.

1.22 HOISTING EQUIPMENT AND MACHINERY

- A. Unless otherwise specified, all hoisting and rigging equipment and machinery required for the proper and expeditious prosecution and progress of the Work of this Section shall be furnished, installed, operated and maintained in safe condition by each sub-contractor, as specified under Section 015000, TEMPORARY FACILITIES AND CONTROLS.

1.23 STAGING AND SCAFFOLDING

- A. Unless otherwise specified, each sub-contractor shall provide all lifts and man-lifts, and furnish, erect and maintain in safe condition, all staging and scaffolding as specified under Section 015000 Temporary Facilities and Controls, as needed for proper execution of the work of this Section. Staging and scaffolding shall be of adequate design, erected and removed by experienced stage builders having all accident prevention devices required by Federal, state and local laws.

1.24 COMMISSIONING

- A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 019113 – General Commissioning Requirements.
- B. Complete installation and startup checks and functional tests according to Section 019113 – General Commissioning Requirements and manufacturers written instructions.
- C. Operational Test: After plumbing systems have been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the startup procedure.
- D. Verify that equipment is installed and commissioned as per requirements of Section 019113 and manufacturers written instructions/requirements.

1.25 BREAKDOWN

- A. Submit a breakdown of the contract price to aid the Architect in determining the value of the work installed as the job progresses.
- B. No requisition will be approved until the breakdown is delivered to the Architect.

1.26 VISIT TO SITE

- A. Prior to submitting a Bid, visit the site of work and become familiar with existing conditions. Any assumptions made are at this Subcontractor's expense.

1.27 ENERGY REBATE PROGRAM

- A. This project has been designed to incorporate equipment approved for energy rebate such as domestic water heaters. Provide actual equipment purchase price to owner to assist filling out forms for utility company rebates.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials and equipment furnished under this SECTION shall be new, unused, first quality of a manufacturer of established reputation. Each valve, fitting, section of pipe, and piece of equipment supplied to project shall have cast or indelibly stamped thereon the manufacturer's name, pressure rating where applicable, type, and any other specific information provided by manufacturer. Materials shall conform to Massachusetts Code as a minimum requirement and shall appear on the Massachusetts Approved Plumbing Products list.

2.02 PIPE AND FITTINGS

- A. Pipe and fittings shall conform to the latest A.S.A., A.S.T.M., C.A., and F.S. standards.
- B. All piping installed under this SECTION shall be in accordance with the following:

<u>Service</u>	<u>Material</u>
Underground Drainage and Vent piping	Service weight cast iron soil pipe-coated bearing collective trademark of the Cast Iron Soil Pipe Institute (CISPI)
Above ground Drainage and Vent, piping 2 in. and larger	No Hub cast iron soil pipe and fittings bearing collective trademark of the CISPI
Above ground drainage, and Vent piping 2 in. and smaller	Type 'L' hard tempered copper tubing
Trap primer piping from Primer to floor drain	Type 'K' soft rolled copper tubing with Swaged ends
Domestic water piping above ground and Pump Force Main Piping	Type 'L' hard tempered copper tubing
Indirect waste piping	Type 'L' hard tempered copper tubing coated with two (2) coats of white epoxy paint
Gas piping above ground	ASTM A-53 Schedule 40 black steel pipe
Gas piping below ground	ASTM A-53 Schedule 40 black steel pipe with fusion bonded epoxy coating Scotchkote 6233 or equal.
C. Fittings for underground Drainage Piping shall be service weight bell and spigot pattern C.I. soil pipe fittings. Above ground shall be no hub C.I. soil pipe fittings, Massachusetts Standard.	
D. Fittings for sweat drainage piping and force main piping shall be cast bronze or wrought copper of recessed drainage pattern.	
E. Fittings for Type 'L' hard tempered copper tubing for domestic water piping shall be copper press fittings.	
1. Acceptable Manufacturers:	
a. Viega North America,	
b. Elkhart Products Corporation	
c. Victaulic	
d. Or equal	
2. Material:	
a. ASTM B88 and ANSI/ASME B16.22. O-rings for copper press fittings shall be EPDM.	

3. Installation of copper press fittings and installation are to be made in strict accordance with the manufacturers installation instructions. All tubing is to be reamed prior to the installation of the fitting. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

F. Fittings for gas piping 2-inch and smaller shall be threaded malleable iron gas pattern fittings for screwed pipe. All gas piping 2 ½ inch in size and larger shall be welded and shall utilize butt welded steel pipe fittings.

2.03 JOINTS

A. Joints for underground cast iron bell and spigot soil pipe shall be made up with resilient gaskets. Above ground shall be made up of heavy duty – 4 band stainless steel clamps, and gaskets. Couplings shall be in compliance with CISPI 310 and shall bear the mark of NSF International. Couplings shall be Husky “SD 4000”, Clamp - All HI-TORQ 125, Mission “HW”, or equal.

B. Copper water tubing and fittings shall be assembled with press or grooved fittings depending on pipe size.

C. Grooved Joint Lubricants: Lubricate gasket in accordance with the manufacturer’s published instructions with lubricant approved for the gasket elastomer and fluid media.

D. Copper waste and vent tubing and force main tubing with sweat fittings shall be assembled with lead free solder, Silverbrite, Oatey, Harris, or equal, and a non-corrosive flux recommended by the manufacturer.

E. Joints between copper waste/vent tubing and cast iron shall be made with cast iron threaded fittings and copper thread by sweat fittings.

F. Joints between copper tubing and ductile iron water pipe or at flanged joints to tanks shall be made with a combination iron and brass flange with composition gasket and iron bolts.

G. Joints at water heaters or other tanks having threaded connections shall be made up with dielectric unions.

H. Joints between floor or wall flanges and fixtures shall be made with one-piece special molded neoprene gaskets which shall be furnished by the fixture manufacturer.

I. Threaded pipe joints including plastics shall be made up with teflon tape.

J. Joints on screwed gas piping shall be made up with thread compound on male threads only. Welded joints shall be made up by certified welders. All joints on piping 2-1/2 in. and larger shall be welded.

2.04 VALVES

A. Furnish and install valves where indicated on the Drawings or where specified and located so that they may be operated, repaired, or replaced with a minimum effort and repacked under pressure.

- B. The following list of valves is intended only as a guide for type and quality. Valves shall be as manufactured by Apollo, Milwaukee, Nibco, Elkhart, Watts, Victaulic, or approved equal.

Shutoff valves	Apollo #94VLF-A lead-free ball valves
Balancing valves	ThermOmegaTech Circuit Solver CS, self-acting thermostatic recirculation balance valve.
Grooved end butterfly valves	Victaulic Series 608N for copper
Gate valves 4 in. and larger	Jenkins 651-A
Stop and waste valves 1 in. and smaller	Apollo #95LF-203 through #95LF-205, lead-free
Check valves	Walworth #406 SJ
Gas service stops, 2 in. and smaller	Apollo #70-102-07 through #70-108-07 with tee handle
Gas service stops, 2-1/2 in. and larger	Rockwell #143 lubricated plug valve
Drain valves	Apollo #77WLF-HC ball valve with cap and chain 1/2 in. x 3/4 in. hose end
Backwater Valve (Drainage Systems)	Zurn #Z1095. At below grade installations provide with extension to grade Zurn model Z1095-FC, height as required.

2.05 INSULATION

- A. Insulation for all water piping whether concealed or exposed shall be 1 in. thick, heavy density, preformed snap-on insulation equal to Johns Manville Micro-Lok HP, 850 degrees snap-on system. Insulation for cold water piping shall have a factory applied vapor barrier with ends and butts sealed with overlapping 4 in. sealing strips.
- B. Valves and fittings shall be insulated with pre-formed fiberglass fitting insulation cut from dense fiberglass blanket and covered with pre-molded P.V.C. fitting covers. P.V.C. covers shall overlap the adjoining insulation and shall be secured with pressure sensitive vinyl tape over a vapor barrier adhesive seal at the joints. (Note: Staples or tacks are not permitted on covers).
- C. All insulation shall have self-sealing type, all service jacket (ASJ-SSL) factory applied. At all exposed piping, cover jacket with continuous P.V.C. jacket.
- D. Sealers, solvents, tapes, and adhesives, and mastics used in conjunction with the installation of insulation under this Section shall possess the maximum possible fire safe qualities available and shall be NFPA approved.
- E. Covering shall be applied over clean and dry surfaces. No covering shall be applied until after the approval of all pressure and leakage tests.

- F. Insulation shall be as manufactured by Johns Manville, Inc., Owens-Corning Fiberglass Corporation SSL II-ASJ, or Knauf Insulation 1000. Insulation shall be applied by skilled insulation mechanics in a first class manner.

2.06 TRAPS

- A. Furnish and install traps with cleanouts on all fixtures and equipment requiring connection to the sanitary system of the same size and material as the pipe on which they occur. Traps installed on threaded pipe shall be recessed drainage pattern.

2.07 DRAIN VALVES

- A. It shall be possible to drain the water from all sections of the Potable Hot and Cold Water Piping. Furnish and install 1/2 in. x 3/4 in. hose end ball valves with cap and chain. (see 2.04 for model no.)

2.08 SHOCK ABSORBERS

- A. Furnish and install, where shown on Drawings and where required to prevent water hammer, Zurn Manufacturing Company model 1260-XL lead free shock absorbers, or equal, as manufactured by J.R. Smith Manufacturing Company, Watts Manufacturing Company, or equal.
- B. Installation of absorbers shall be as per manufacturer's recommendations.

2.09 PIPING ACCESSORIES

- A. Pressure and Temperature Relief Valves shall be A.S.M.E. rated temperature relief 210 deg. F. double BTU rated, self-closing, as manufactured by Watts Regulator Company or equal by Wilkins, McDonnell and Miller, or equal.
- B. Vacuum reliefs shall be lead free Watts Regulator Company #LFN36 or equal by Wilkins or Lawler.
- C. Temperature gauges shall be 4-1/2 in. diameter dial thermometers, any angle, and range of 30 degrees F. to 240 degrees F. as manufactured by Weiss Instruments, U.S. Gauge, Terice or equal.
- D. Domestic Water system pressure gauges shall be 4-1/2 in. diameter with a range of 0 to 160 psi as manufactured by Weiss Instruments, U.S. Gauge, Terice or equal.
- E. Natural gas system pressure gauges shall be 4 inch diameter with a range of 0 to 30 inches of water as manufactured by Weiss Instruments, U.S. Gauge, Terice or equal.
- F. Furnish and install where piping crosses building expansion joints on the domestic water piping and gas piping, expansion joints and anchors sized for 1-1/2 in. expansion per one hundred feet. Expansion joints shall be Metraflex "Metraloop", or manufactured by Flexonic Company or Hyspan, or equal. Piping shall be anchored and guided to force the expansion in the proper direction. Domestic water expansion joints shall be NSF approved. Gas expansion joints shall be AGA approved.

- G. Trap primer connections are required on all floor drains to maintain trap seal. The requirement for trap primer connections shall include all floor drains in the kitchen including trough drains furnished by others. Trap primers shall be Precision Plumbing Products, Inc., Model PRO1-500 flow activated prime-pro trap-primer valve or shall, where appropriate, be Zurn, Watts, Smith or equal in-line connections installed on flush valve supply. Electronic trap primer shall be Precision Plumbing Products, Inc. Model MPB-500 mini-prime electronic trap-primer manifold, 120 volt, single phase. Furnish distribution units as required.

2.10 HYDRANTS AND HOSE BIBB

- A. Wall hydrants shall be Zurn Series Z-1310-PB Ecolotrol cast brass 3/4 in. non-freeze wall hydrant with integral backflow preventer, 3/4 in. hose connections, polished nickel bronze face, loose key handle, brass wall sleeve, and fitted with brass locknut.
- B. Hose bibb shall be T & S Brass or equal model #B-720 modified, chrome plated, 3/4 in. hose end, integral stop, vacuum breaker, modified with lock shield and loose tee handle.
- C. Hydrants shall be manufactured by Zurn, J.R. Smith, Watts, or equal. Hose bibbs shall be manufactured by T&S Brass, Speakman, Chicago, or equal.

2.11 CLEANOUTS

- A. Cleanout plugs on the Sanitary System shall be of heavy cast brass of the screwed type. Plugs shall be full size up to and including 4 inch.
- B. For piping running under floor slab, cleanouts shall be brought up to just under the floor slab level. Furnish and install access cover for all floor-type cleanouts, Zurn ZN-1400 Series with scoriated nickel bronze or by Watts, J.R. Smith, or equal. At exterior locations use Zurn model #Z-1474 cleanout housing set over brass cleanout plug.

2.12 ACCESS DOORS

- A. Furnish Access Doors for access to all concealed control valves, cleanouts, valves, expansion joints, and to all other concealed parts of the Plumbing System that require accessibility for the proper operation and maintenance of the system. These doors shall be installed under the appropriate SECTION of the Specifications as determined by the surface upon which the panels are mounted.
- B. All Access Doors shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that the valve or part can be easily reached, and the size shall be sufficient for this purpose (minimum size 12 in. x 16 in.). Furnish Access Doors for each pipe space to permit thorough inspection of same. When access doors are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.
- C. Refer to Section 083100 - Access Doors and Frames, for all product requirements for furnishing access panels.
- D. Coordinate locations and schedule with the work of trades involved with construction in which access panels will be installed.
- E. Access Door Shop Drawings shall be submitted to the Architect for approval.
- F. All access panels shall be keyed alike. Coordinate keying with other trades.

2.13 SUPPLEMENTARY STEEL, CHANNEL, AND SUPPORTS

- A. Furnish and install all supplementary steel, channels, and supports required for the proper installation, mounting, and support of all equipment.
- B. Supplementary Steel and Channels shall be firmly connected to building construction in a manner approved by the Architect.
- C. The type and size of the Supporting Channels and Supplementary Steel shall be determined by the Plumbing Subcontractor and shall be sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.
- D. All Supplementary Steel and Channel shall be installed in a neat and workmanlike manner parallel to the walls, floor, and ceiling construction. All turns shall be made with 90 deg. fittings, as necessary to suit the construction and installation conditions.

2.14 HANGERS, ANCHORS, GUIDES, AND PIERS

- A. All piping shall be supported from the Building Structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and pitching of lines, to prevent vibration, and to secure piping in place, and shall be so arranged as to provide for expansion and contraction.
- B. The spacing for hangers for horizontal piping shall be in accordance with the following:
 - 1. Cast Iron Soil Pipe: 5 ft.-0 in. at the hubs for 5 ft. lengths. For 10 ft. lengths, use one (1) hanger at the hub and one (1) at midpoint of the length. Install cast iron pipe in accordance with CISPI Handbook - latest edition.
 - 2. Copper Tubing: 6 ft.-0 in. o.c. for 1-1/4 in. and smaller, and 10 ft.-0 in. o.c. for 1-1/2 in. and larger.
 - 3. Steel Pipe: 10 ft.-0 in. o.c. for 1-1/2 in. and over; 8 ft. - 0 in. for 1-1/4 in.; 6 ft. - 0 in. for 1 in. and smaller.
- C. Hanger rod diameter shall be as follows:

Pipe Size	Rod Diameter
1/2 in. thru 2 in.	3/8 in.
2-1/2 in. and 3 in.	1/2 in.
4 in. and 5 in.	5/8 in.
6 in.	3/4 in.
8 in. and over	7/8 in.

- D. Vertical lines shall be adequately supported at their bases by a suitable hanger placed in the horizontal line near the riser and at every 10 ft. interval.
- E. All Hangers shall be adjustable Clevis Hanger. Hanger rods shall have machine threads. Malleable iron brackets of approved type shall be used along the walls. All Hangers for copper tubing shall be copper plated except where pipe is insulated, in which case, Steel Clevis Hanger and pipe shield shall be used.
- F. Piping shall not be hung from the hangers of other trades.

- G. Provide seismic restraints for all piping per requirements of the MA Building Code and Section 230548. All gas piping shall be seismically restrained.
- H. Hangers shall be manufactured by Grinnell, Carpenter and Paterson, Fee and Mason, or equal.
- I. Wire and strap hangers will not be permitted in this installation.
- J. Install a 14 gauge metal pipe shield between pipe insulation and all pipe hangers. Hangers shall be sized so that the pipe insulation passes through the hanger and is supported on the shield.

2.15 DRAINS

- A. Furnish and install all floor drains where shown on the Drawings.
- B. All floor drains in flooring systems without waterproofing membranes shall have galvanized iron clamping rings with 6-pound lead flashing to bond 9 in. in all directions. All drains shall be checked with Architect's Drawings to determine depth of the flashing collar. Brass extension pieces shall be provided if necessary.
- C. All floor drains installed on this project shall be fitted with Automatic Trap Primer Connections. Field determine appropriate location for Trap Primer valve and drain piping.
- D. Drain Schedule:
 - 1. Type "A" – Zurn #ZN-415-5BZ-P dura coated cast iron body with bottom outlet, combination invertible membrane clamp, adjustable collar, seepage slots, type BZ polished nickel bronze, light-duty, leveling strainer, trap primer connection.
 - 2. Type "B" –Zurn #Z-550-Y-P, 9 in. diameter top, dura coated cast iron body bottom outlet, seepage pan, combination membrane flashing clamp, frame for medium-duty, cast iron, heel-proof slotted grate, sediment bucket, cast iron grate, trap primer connection
 - 3. Type "C" - Zurn #ZN-1910-25-P cast iron body sanitary floor drain, white acid resisting interior and A.R.E. sediment bucket, 8 in. x 8 in. nickel-bronze frame and 6 in. Nickaloy Funnel. Trap primer connection.
- E. Drains shall be of one manufacturer, by Zurn, J.R. Smith, Watts, or equal.
- F. In bathrooms, Kitchen, and Mechanical Rooms, coordinate all floor drain locations in field with Architect. Floor drains shall be set at an elevation/grade to allow for floor drainage from all directions. Drain locations shall not conflict with toilet partition walls.

2.16 PLUMBING FIXTURES

- A. Furnish and install all fixtures and equipment, including supports, connections, fittings, and any incidentals, to make a complete installation in accordance with the Drawings and as specified.
- B. The Architect shall be final judge as to whether fixtures and trim fulfill the requirements of the Specifications and as to whether they are of suitable quality.
- C. All fixtures requiring hot and cold water shall have the cold water faucet on the right hand side of the fixture and the hot water faucet on the left hand side of the fixture.

- D. Escutcheons shall be furnished and installed on all supplies and traps. Escutcheons shall be one (1) piece chrome plated brass with set screws.
- E. All fixtures shall have the manufacturer's guaranteed label or trademark indicating first quality. All acid resisting enameled ware shall bear the manufacturer's symbol signifying acid resisting material.
- F. Unless otherwise specified, faucets and all exposed fittings shall be chromium plated.
- G. All supply pipes shall run in a reasonable straight vertical line from the stops to faucets. Traps shall be installed perpendicular to walls.
- H. Vitreous china and acid resisting enameled fixtures shall be of one manufacturer by Sloan, American Standard, Toto, or equal. Trim shall be Symmons, Speakman, Chicago, T & S Brass, or equal. Flush valves shall be Sloan, Toto, Zurn, or equal. Water coolers and drinking fountains shall be manufactured by Elkay, Just, Filtrine, or equal. Stainless steel sinks shall be Elkay, Just, Kindred, or equal.
- I. Note: All fixtures and fittings shall be vandal proof mounted, unless specifically noted otherwise.
- J. Carefully coordinate roughing for flush valves so that the dimension from top of fixture to C-L of flush valve is a minimum of 6 in..
- K. Fixture Schedule:

1. P-1 Water Closet:

Sloan WETS-2452.1101 water closet and flush valve combo, ST-2459 vitreous china, wall hung, elongated, siphon jet bowl, 1-1/2 in. top spud, with ECOS 8111 flush valve.

Olsonite 10CT solid plastic white open front seat with check hinge.

Zurn Z1203/Z1204 300-lb carrier. Carefully coordinate with Architect's plans to fit in wall. Use Z-1209 where required by field conditions.

2. P-1A Water Closet, Accessible:

Same as specified for P-1 except mounting height and location shall meet Accessibility Standards. Locate handle of flush valve to wide side of toilet stall. Refer to Architect's Drawing and request direction in field in writing before installing.

3. P-2 Urinal:

Sloan WEUS-1205.1410 urinal and flush valve combo, SU-1205 washout wall hung urinal, 0.125 gallon per flush, with ECOS 8186 flush valve.

Zurn Z-1222 concealed support.

Urinal installation shall conform to Accessibility Standards.

4. P-3 Lavatory, Undermount:

Undermount sink will be integral with the countertop as specified in Division 12.

Chicago EQ-A12C-23ABCP, 4-inch centers, self-generating with battery backup sensor faucet with 0.35gpm outlet, with integral thermostatic mixing valve.

McGuire Model 155-WC, 1-1/4 in. offset drain with open grid strainer.

McGuire Model H-167 (pair) C.P., 3/8 IPS angle supply with loose key stop.

McGuire Model B-8902 C.P., 1-1/4 in. x 1-1/2 in. cast brass adjustable 'P' trap with cleanout and #17 ga. tubing outlet to wall.

Conceal all exposed roughing and electrical wiring components under lavatory with Truebro Model #2018 rigid PVC enclosure. Provide two enclosures

5. P-3A Lavatory, Wall Hung:

American Standard "Decorum" 9024.004EC, wall mounted 20 in. x 18 in. vitreous china lavatory, 4-inch centers, punched for concealed armchair carrier.

Chicago EQ-A12C-23ABCP, 4-inch centers, self-generating with battery backup sensor faucet with 0.35 GPM outlet, with integral thermostatic mixing valve.

McGuire Model 155-WC, 1-1/4 in. offset drain with open grid strainer.

McGuire Model H-167 (pair) C.P., 3/8 IPS angle supply with loose key stop.

McGuire Model B-8902 C.P., 1-1/4 in. x 1-1/2 in. cast brass adjustable 'P' trap with cleanout and #17 ga. tubing outlet to wall.

Zurn #Z-1231 floor mounted concealed arm chair carrier.

Conceal all exposed roughing and electrical wiring components under lavatory with Truebro Model #2018 rigid PVC enclosure.

6. P-4 Electric Water Cooler w/Bottle Filler:

Elkay Model LZO8WSLK, Barrier Free drinking fountain, sensor actuator, ADA compliant, 8.0 GPH, and sensor bottle fill station.

Elkay MLP100 in wall carrier

1-1/4 in. x 1-1/2 in. rough p-trap with cleanout; 1/2 in. ball valve stop.

7. P-5 Mop Receptor:

Stern Williams, Model SB-902, 24 in. x 24 in. x 12 in. model Terrazzo mop service basin with stainless steel backsplash and caps all sides, 3 in. cast brass drain for inside caulk connection.

Kohler K-8907 service sink fitting, polished chrome, brace to wall, integral screw driver stops, vacuum breaker, 3/4 in. hose end. Install a 1/2 in. check valve on the supplies & provide access panel.

Furnish and install 1/2" hot and cold water Watts LF009 reduced pressure backflow preventer for soap dispenser.

8. P-6 Sink:

Elkay LRAD-2219 single bowl, 22 in. x 19 in. x 6 in. deep self-rimming countertop mounted, 18 GA type 304 stainless steel sink with offset rear outlet; three (3) hole punched faucet ledge, sound deadening underside.

Chicago #201A-GN8A-E2805-5CP-369 concealed deck faucet with 8 in. swing gooseneck spout, 2-3/8 inch wrist blade handles, E-2805 0.5 GPM aerator.

Elkay LKAD-35, crumb cup strainer with offset 1-1/2 in. tailpiece and stainless steel ground seat stopper.

1-1/2 in. x 2 in. chrome plated P-trap with cleanout, waste outlet with escutcheon.

Pair of 1/2 in. x 3/8 in. supplies with stops and escutcheons.

Conceal all exposed roughing under sink with Truebro insulation kit.

2.17 BACKFLOW PREVENTERS

- A. Backflow preventers shall be reduced pressure type furnished complete with shutoff valves, Massachusetts Approved. Backflow preventers 2-1/2 inch and smaller shall be Watts #LF009-QT-S. Backflow preventers 3 inch and larger shall be Watts 957-QT. Backflow preventers shall be lead free, all bronze, complete with strainer and soft seated check valve. Size shall be as indicated on Drawings.
- B. Mount backflow preventer 3 ft.(+/-) above finished floor. Provide indirect waste funnel and run pipe to an air gapped discharge at sink or floor drain. Furnish a spare parts kit and parts list mounted in the vicinity of the device.
- C. Prior to the installation of devices in the name of the Owner file for, pay for, and obtain all required permits and approvals for cross connection control devices from the Authority having Jurisdiction.
- D. Backflow preventers shall be of one manufacturer, by Watts, Wilkins, Beeco, or equal.

2.18 UNION AND NIPPLES

- A. All connections between copper tubing and galvanized piping or between copper tubing and all tanks (such as water heaters, chillers, and similar equipment) shall be made with dielectric unions and nipples.
- B. All connection to Water Heaters, Meters, Pumps, and other equipment requiring maintenance or alteration shall be made up with unions. Unions on brass piping, 2 in. and smaller, shall be brass composition "E" in strict accordance with Federal Specification WW-U-516. On plastic piping, use unions of the same material as the piping.
- C. All close and shoulder nipples shall be corresponding materials as the pipe and shall be extra heavy.

2.19 WATER HEATERS

- A. Provide one packaged type electric water heater Model No. SH-200 as manufactured by HUBBELL Electric Heater Co., Stratford, CT.
- B. The pressure vessel section, including the electrical control panel, shall be mounted on structural supports and be suitably insulated, jacketed, painted, and provided with lifting lugs. The entire unit is to be packaged ready for plumbing and electrical service connections and shall bear the UL listing mark certifying the entire water heater.
- C. The pressure vessel shall be all welded construction and ASME Code Section IV stamped for a working pressure of 125 psi and contain a minimum of 220 gallons of storage. The storage vessel shall be carbon steel and lined with seamless Hydrastone Cement to a minimum thickness of 5/8" on 100% of all interior tank surfaces. The pressure vessel is to be completely covered with 2" thick "E" type energy conservation fiberglass blanket insulation and enclosed in a heavy gauge galvanized steel metal jacket finished in gray hammertone enamel. An ASME approved automatic reseating combination temperature and pressure relief valve set at the tank WP and 210°F shall protect the vessel.
- D. The recovery section shall be rated at 30 kW which will heat 123 GPH of water at 100 deg. F rise.
- E. The heater shall be designed to operate at 480 volts, 3 phase, 60 Hz, with a fused low voltage transformer providing 120 volt to all operating controls. The immersion heating element shall be high quality copper sheathed and sized to obtain the rated recovery. Each element circuit is to be independently operated through a definite purpose magnetic contactor having a resistive load rating equal to or exceeding the ampere rating of that particular circuit and shall be protected by individual power fuses rated at approximately 125% of the ampacity of the circuit. Multiple circuit elements shall be provided with a master terminal block for connecting of the incoming power feeds. A safety door interlock switch shall interrupt power to the control circuit when the control panel door is opened. The control thermostat shall be immersion type and shall be consistent with the recovery rate of the heating element as to the number of steps required. A hi-limit control with a manual reset button shall be factory installed to disconnect all ungrounded conductors to the heating element(s) in the event of an over-temperature condition in the storage section.
- F. In addition, the water heater shall be supplied with a digital display electronic temperature controller and with Building Automation System package for remote operation and alarm conditions (IP).

- G. The water heater manufacturer shall warranty all electrical components against defects in workmanship and material for a period of one (1) year from date of start-up, and the pressure vessel for a full five (10) years Non Pro-Rated from date of start-up, provided that the unit is started within three (3) months of date of shipment and installed and operated within the scope of the tank design and operating capability.
- H. Expansion Tank: Furnish and install as shown on plans a 45 gallon (30 gallon acceptance volume), 20 in. diameter x 39 in. (high) pre-charged steel thermal expansion tank with a fixed FDA approved butyl bladder. The tank shall have a top NPT stainless steel system connection and a .301" - 32 charging valve connection (standard tire valve) to facilitate the on-site charging of the tank to meet system requirements. The tank must be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code and stamped 150 psi working pressure. Tank shall be Wessels model number TTA-100 or by Amtrol, Taco, or approved equal.

2.20 TEMPERING VALVES

- A. Tempering valves shall be as manufactured by Powers, Acorn Controls, Heat Timer Corp, or equal.
- B. Furnish and install where shown for temperature control at all domestic water heating systems, Powers Intellistation Jr., model LFIS075VL, digital mixing valve. In case of power failure valve shall flow full cold for safety. Provide inlet check-stops, outlet volume/shutoff valve, dial thermometer, and test connection. Valves are to be factory assembled and tested.
- C. Furnish and install a 4 in. diameter thermometer on the outlet side of each tempering valve as manufactured by U.S. Gauge Company, Powers Regulator Company, and/or Terrice Company.

2.21 RECIRCULATING HOT WATER PUMPS

- A. Circulators shall be all-bronze booster type, Grundfos Magna3 40-80 or equal by Bell & Gossett, Taco or approved equal.
- B. Circulators shall be connected to the Building Management System by Division 23.

2.22 INSTANTANEOUS ELECTRIC WATER HEATERS

- A. Furnish and install electric instantaneous water heaters at locations shown.
- B. Water heaters shall meet the thermal efficiency and standby heat loss requirements of ASHRAE 90.1 – 2010. Water heater rated for energy star certification for commercial applications.
- C. Heaters to be installed level and plumb in accordance with manufactures written instructions and referenced standards.
- D. Water heaters to be manufactured by EEMAX, Chronomite, Stiebel-Eltron, or approved equal.

2.23 ELECTRIC WATER HEATER

- A. Furnish and install in Janitor's closets as shown on drawings, HTP model #EVR08.0A020C with an 8 gallon storage capacity, an input of 2,000 watts, a recovery rate of 9 GPH at 90 degree F temperature rise. The water heater will be equipped for 120 volts, single phase operation.

- B. The tank shall be constructed of titanium glass-lined carbon steel and have a working pressure of 150 PSI. A large capacity sacrificial magnesium anode rod will provide additional corrosion resistance.
- C. The water heater shall be equipped with an adjustable surface mounted thermostat and an LED indicator of operation with a manual reset high limit safety control, and an electric junction box located on the top of heater. All water heaters will be shipped with an ASME Rated temperature and pressure relief valve. Contractor to run water from relief valve to discharge to mop sink.
- D. Water heaters shall be covered by a six (6) year limited warranty against inner tank leakage from the date of installation and two (2) years coverage on component parts. See product warranty for details.

2.24 WATER METER

- A. Furnish and install water meter with inlet strainer in accordance with the standards of the Local Water Department. Coordinate the installation with the water department and include in the Plumbing Bid the cost of the meter. Refer to Part 1 of this section regarding assessments, and the like.

2.25 FIRESTOP SYSTEMS

- A. General: Provide firestopping at all new fire-rated construction where penetrated by the Work of this Section.
- B. Refer to Section 078400 - Firestopping, for all product requirements for maintaining integrity of fire-rated construction at penetrations.

2.26 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - Temporary Facilities and Controls and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of Section 01 50 00 - Temporary Facilities and Controls shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contract requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - Temporary Facilities and Controls and as additionally required for dust control).
 - 3. General Contractor is responsible to provide enclosures required for temporary heat; refer to Section 01 50 00 - Temporary Facilities and Controls.
 - a. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Trade Contractor.

2.27 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - Temporary Facilities and Controls.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

- A. All work shall be installed in a first-class manner consistent with the best current practices. All materials shall be securely installed plumb and/or level, and all flush mounted equipment shall have front edge flush with finished wall surface.
- B. All piping shall be installed true to line and grade in the case of underground piping. All piping above ceilings or exposed shall be grouped together, be parallel to each other, and be either parallel or perpendicular to the structure. Utilize gang hangers wherever feasible. Group all valves together where feasible.
- C. Training:
 - 1. Train the Owner's maintenance personnel on troubleshooting procedures, and servicing and preventative maintenance schedules and procedures.
 - 2. Schedule training with Owner through the Architect with at least 7 days prior notice.

3.02 WORK COORDINATION AND JOB OPERATIONS

- A. The equipment shall not be installed in congested and possible problem areas without first coordinating the installation of same.
- B. Particular attention shall be directed to the coordination of piping and other equipment installed in the ceiling areas. Coordinate the elevations of all piping in hung ceiling areas to insure adequate space for the installation of recessed lighting fixtures before other mechanical equipment is installed.
- C. Furnish to the General Contractor, and all other Subcontractors, all information relative to the portion of the Plumbing installation that will affect them, sufficiently in advance so that they may plan their work and installation accordingly.
- D. In case of failure to give proper information as indicated above sufficiently in advance, pay for all back-charges for the modification, renovation, and relocation of any portion of the work already performed.
- E. Obtain from the other trades, all information relative to the Plumbing Work to be executed in conjunction with the installation of their respective equipment.

3.03 CUTTING AND CORE DRILLING

- A. Perform all cutting and core drilling operations that are outlined in Part 1 of this SECTION. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the walls, floors, overhead structure, and other structural components, which are to remain, is maintained until permanent work is installed. Prior to any coring or cutting, verify all locations of same with the General Contractor. All cutting and coring is to be performed in accordance with approved Coordination Drawings
- B. Cut all masonry and concrete with an approved diamond blade concrete saw in a neat straight direction, perpendicular to the plane of the wall or floor.

- C. Use a core drilling process which produces clean, sharp edges and the minimum hole size which will accommodate the size of pipe sleeve specified. Submit procedures for cutting thru existing steel beams to Architect for review.
- D. The patching of holes shall be performed by Plumbing Sub-contractor utilizing methods outlined for the finish trade involved. Holes shall be patched to the satisfaction of the Architect.

3.04 CLEANING AND PROTECTION

- A. Protect all materials and equipment during shipment and so as to prevent damage. Water closets, lavatories, and sinks shall be boarded over and all other fixtures shall be protected with pasted on paper. Post notice prohibiting the use of the fixtures prior to completion. Assume full responsibility for protection of work until its completion and final acceptance.
- B. Keep the premises reasonably clean at all times and remove rubbish caused by the Plumbing Work as directed by the Architect.
- C. Upon completion of this work, clean all fixtures and equipment installed herein and replace damaged parts. Failure to fulfill this obligation will result in back-charges for correction of the defective work.

3.05 SLEEVES, INSERTS, AND ESCUTCHEONS

- A. All piping passing through slabs, floors, walls, partitions, foundation walls and grade beams, shall be sleeved and all such sleeves shall be furnished and installed by the Plumbing Subcontractor as detailed on the Drawings and herein specified. Set sleeves in concrete floors and walls as soon as forms are set and before concrete is poured. Core drilling openings shall have a sleeve caulked and grouted in place.
- B. All pipes passing through floor, whether slab-on grade or above grade levels, shall be sleeved with sleeve extending 1 in. above floor. This includes all piping in toilet room pipe space, stairwells, closets, partitions and pre-cast planks.
- C. All sleeves shall be Schedule 40 galvanized steel and shall be reamed. There shall be a minimum of 1 in. annular space between the sleeve and pipe provide greater clearance where seismic requirements dictate. Sleeves on insulated pipe shall be large enough to allow insulation to pass through sleeve. Sleeves on drywall, masonry, or concrete walls and partitions, shall be flush with wall on both sides.
- D. The space between sleeve and pipe in all cases shall be filled with a U.L./F.M. approved caulking compound. This includes pipes concealed in chases and/or partitions.
- E. Inserts where required shall be furnished and set by the Plumbing Subcontractor and where necessary may be drilled or power driven and shall be sized such that the insert will not exceed a depth of penetration of 1 in. into concrete.
- F. Escutcheons: All exposed pipe, uncovered, passing through walls or floors or ceilings shall be fitted with C.P. brass spun or split type escutcheons with approved clamping device for holding in position. Floor escutcheons shall be deep enough to fit over sleeves, fastened to pipe, and extend down to floor.

3.06 TESTING

- A. Test all Work in the presence of the Architect and/or Engineer and as required by Local Codes.
- B. After Soil, Waste, and Vent Piping is in place and before being buried or furred in, plug lower ends and fill the system with water up to the top of stacks. Piping is to be left tight under these conditions and water level shall be maintained intact for the period of at least four (4) hours.
- C. Test all water piping by applying a hydrostatic pressure of 150 PSIG using a pump for this purpose. Make sure that all lines are properly plugged or capped and that air has been vented before applying pressure which shall remain constant without pumping for two (2) hours at least.
- D. Test gas piping per State Gas Code.
- E. Any leaks in joints or evidence of defective pipe on fittings disclosed by test shall be immediately corrected by replacing defective parts with new joints or materials. No makeshift repair effected by caulking threaded pipe with lead wool, application or Wilky or patented compounds will be permitted.
- F. Provide testing report for all systems tested.

3.07 CHLORINATION

- A. Upon completion of the Plumbing Work, thoroughly chlorinate the entire domestic water system before putting same in service. Chlorinate all work in the presence of the Architect and/or Engineer. The chlorinating agent shall be as a solution of sodium hypochlorite. Water shall be fed slowly into the new line with chlorine in the proper amount to produce a dosage of 50 PPM. Open and close all valves while system is being chlorinated.
- B. After the sterilization agent has been applied for 24 hours, pay for an independent testing agency to test for residual chlorine and for presence of bacteria. A residual of not more than 5 PPM shall be required in all parts of the line.
- C. If test show 5 PPM or greater of residual chlorine, flush out system until all traces of the chemical used are removed.
- D. Provide testing report from independent testing agency.

3.08 INSTALLATION OF FIRESTOP SYSTEMS

- A. General: Install firestop systems at all fire-rated construction where penetrated by the Work of this Section.
- B. Refer to Section 078400 - Firestopping, for all installation requirements for maintaining integrity of fire-rated construction at penetrations.

3.09 SEISMIC RESTRAINTS

- A. The independent engineer responsible for design of seismic restraints shall visit the project upon completion of the work to certify the installation is consistent with the approved shop drawings. The certification shall be submitted to the Architect and must precede the closing in of ceilings.

3.10 SYSTEM SHUTDOWNS

- A. Coordinate shutdowns of existing systems with the Owner and submit a written request at least ten working days in advance. Minimize system shut downs as much as possible. Submit a list of all affected areas, the proposed work to be performed, and the expected length of the shut-down including time for retesting.
- B. Provide temporary services to maintain active system during extended shut-downs as required for demolition and construction phasing.

END OF SECTION

SECTION 23 0000

HVAC
 (Trade Bid Required)

PART 1 - GENERAL 1

1.01 RELATED DOCUMENTS 1

1.02 FILING SUB-BIDS 1

1.03 RELATED DOCUMENTS 2

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END OF INDEX

SECTION 23 0000

HVAC
(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 FILING SUB-BIDS

- A. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Public Agency at a time and place as stipulated in the "Instructions to Bidders."
2. Each sub-bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 44F of Chapter 149 of the General Laws, as amended.
3. Sub-bids filed with the Awarding Authority shall be accompanied by Bid Bond, Cash, Certified Check, Treasurer's Check, or Cashier's Check issued by a responsible bank or trust company payable to the Town of Boxford in the amount of 5 percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

- B. No Sub Sub-Bid Requirements for this Section

- C. Trade Sub-Bid Requirements:

CLASS OF WORK	PARAGRAPH NUMBER
Insulation	2.04, 2.05, 3.03, 3.04
Sheetmetal & Accessories	2.12, 2.13, 2.14, 3.11, 3.12, 3.13, 3.14
Automatic Temperature Control	2.17, 3.17
Testing, Adjusting, and Balancing	3.18

The Work of this Trade Bid is shown on the following Contract Drawings:

1. M1.1 – FIRST FLOOR PLAN - HVAC
2. M1.2 – ATTIC FLOOR PLAN – HVAC
3. M1.3 – ROOF PLAN – HVAC
4. M2.1 – EQUIPMENT SCHEDULES - HVAC
5. M2.2 – EQUIPMENT DETAILS I – HVAC
6. M2.3 – EQUIPMENT CONTROLS I – HVAC

7. VS1.1 – VIBRATION & SEISMIC DETAILS I

D. Additional Provisions

1. The work of bid package may involve several comeback operations with associated mobilizations and demobilizations. Trade contractor includes all costs normally associated with this condition. Reference project schedule.
2. The work of each Trade Contractor and Subcontractor includes making provisions to accommodate minor variances in line, plumb, etc. to the extent that they are within the predecessor trade tolerances. Any elements outside of those tolerances must be brought to the attention of the project superintendent prior to the installation of new work.
3. Document, deliver, unload and properly secure all maintenance (attic) stock, if specified within each Trade Contractor's scope of work, to an area designated by the Construction Manager. Documentation of turnover of all maintenance (attic) stock must be processed through Procore.
4. Coordinate all deliveries at least 48 hours prior to delivery with the field superintendent.
5. Each Trade Contract includes daily cleaning to a central location as directed by Construction Manager's Superintendent, including breakdown of shipping containers and packaging.
6. Trade Contractor shall provide all scaffolding, staging, hoisting, rigging, etc. as required to complete scope of work. Safe use and maintenance of staging materials and equipment is the responsibility of this trade contractor.
7. Trade Contractor shall coordinate with other Trade Contractors for the installation, and/or testing, of their work.
8. Trade Contractor is responsible for the protection of all existing construction adjacent to the work of their bid packages.
9. In base bid, this trade contractor shall include all winter condition requirements pertinent to complete this scope of work, including but not limited to, heating and enclosures. See schedule.
10. Includes all mock ups.
11. Confirm all dimensions in the field prior to installation.
12. Include police details for work occurring in the public way
13. Building Permit by Others
14. Utility costs for light and power by Others
15. Hazardous materials, removal or testing by Others.
16. Includes all Insurance and Bonds per contract documents.

1.03 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.04 DEFINITIONS

- A. Most terms used within the documents are industry standard. Certain words or phrases shall be understood to have specific meanings as follows:
 1. Provide: Furnish and install completely connected up and in operable condition.
 2. Furnish: Purchase and deliver to a specific location within the building or site.
 3. Install: With respect to equipment furnished by others, install means to receive, unpack, move into position, mount and connect, including removal of packaging materials.
 4. Conduit: Raceways of the metallic type which are not flexible.
 5. Connect: To duct, pipe or wire up, including all branch ductwork, piping, and/or circuitry, control and disconnection devices so item is complete and ready for operation.

6. Subject to Mechanical Damage: Equipment, ductwork, piping and raceways installed exposed and less than eight feet above finished floor in mechanical rooms or other areas where heavy equipment may be in use or moved.
7. General Contractor and Construction Manager are one in the same.

1.05 DESCRIPTION OF WORK

- A. Work included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. High Efficiency Boiler
2. Energy Recovery Units
3. Exhaust Fans
4. Ductwork with Insulation, Diffusers, Registers and Grilles
5. Ductless Cooling Units and Air Cooled Condensing Units
6. Terminal Heating Units
7. Automatic temperature controls
8. Valves
9. Meters and Gauges
10. Hangers and Attachments
11. Mechanical Identification
12. Mechanical Insulation
13. Hydronic Piping
14. Pumps and Accessories
15. Metal Ductwork
16. Ductwork Accessories
17. Air Outlets & Inlets
18. Vehicle Exhaust Capture Systems
19. Firestopping and Sealants
20. Testing, Adjusting, Balancing, and Commissioning

1.06 RELATED WORK

- A. Cutting beyond the requirements as stated herein, and patching of all openings regardless of size, is specified in the respective Sections of the trade responsible for furnishing and installing similar new materials.
- B. For temporary controls, coordinate with General Contractor and/or Construction Manager.
- C. For flashing of vents through roof and setting of roof curbs and flashing of such, refer to SECTION 076200 - SHEET METAL FLASHING & TRIM.
- D. For power wiring of mechanical equipment refer to SECTION 260001 - ELECTRICAL.
- E. For excavation and backfill of below grade mechanical and related systems refer to Division 31.
- F. For firestopping not called for in this Section refer to Section 078413- Penetration Firestopping and Section 078443 – Joint Firestopping.
- G. For finished painting of mechanical systems not called for in this Section refer to SECTION 099000 – PAINTING AND COATING.
- H. For interior concrete work relating to this Section refer to SECTION 033000 - CAST IN PLACE CONCRETE.
- I. For exterior concrete work relating to this Section refer to SECTION 033000 - CAST IN PLACE CONCRETE.

- J. For Commissioning, requirements refer to SECTION 018100 - COMMISSIONING.
 - K. For Access Panels refer to SECTION 092116 – Gypsum Board Assemblies, SECTION 095113 – Acoustical Panel Ceilings and SECTION 040002 – Unit Masonry.
 - L. For Vibration Control and Seismic Restraints refer to SECTION 230548 – VIBRATION CONTROL & SEISMIC RESTRAINT.
- 1.07 CODES, ORDINANCES, AND PERMITS
- A. Perform all work in accordance with the requirements of the Town of Boxford Building Department, State of Massachusetts Building Code, and applicable State and Federal Laws. Give all requisite notices, file all requisite plans, and obtain all permits required to perform HVAC Work. Pay all fees and include in the Bid.
- 1.08 QUALITY ASSURANCE
- A. Codes and Standards:
 - 1. HI Compliance: Design, manufacture, and install HVAC pumps in accordance with HI Hydraulic Institute Standards".
 - 2. ANSI Standards: Comply with ANSI A13.1 for pipe, valve, and equipment identification.
 - 3. I=B=R Compliance: Provide cast iron boilers that have been tested and rated in accordance with Institute of Boiler and Radiator Manufacturers (I=B=R) "Testing and Rating Standard for Cast Iron and Steel Heating Boiler", and bear I=B=R emblem on nameplate affixed to boiler.
 - 4. NFPA Compliance: Install oil fire cast iron boilers in accordance with NFPA Standard 31 "Standard for the Installation of Oil Burning Equipment".
 - 5. ASME Compliance: Construct cast iron boilers in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".
 - 6. UL and NEMA Compliance: Provide cast iron boiler ancillary electrical components, which have been listed and labeled UL, and comply with NEMA Standards.
 - 7. FM Compliance: Provide control devices and control sequences in accordance with requirements of Factory Mutual System (FM).
 - 8. IRI Compliance: Provided control devices and control sequences in accordance with requirements of Industrial Risk Insurance (IRI).
 - 9. AMCA Compliance: Test and rate air handling units in accordance with AMCA standards.
 - 10. AGA Compliance: Provide gas controls and devices in accordance with American Gas Associates.
 - 11. ARI Compliance: Test and rate air handling units in accordance with ARI 430 "Standard for Central-Station Air Handling Units", display certification symbol on units of certified models.
 - 12. ASHRAE Compliance: Construct and install refrigerant coils in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
 - 13. NFPA Compliance: Provide air handling unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
 - 14. UL and NEMA Compliance: Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA standards.
 - 15. NEC Compliance: Comply with National Electrical Code (NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of air handling units.
 - B. MSS Standard Practices: Comply with the following standards for valves:
 - 1. MSS SP-45: Bypass and Drain Connection Standard

2. MSS SP-67: Butterfly Valves
3. MSS SP-70: Cast Iron Gate Valves, Flanged and Threaded Ends
4. MSS SP-71: Cast Iron Swing Check Valves, Flanged
5. MSS SP-72: Ball Valves with Flanged or Butt-Welding Ends for General Service
6. MSS SP-78: Cast Iron Plug Valves, Flanged and Threaded Ends
7. MSS SP-80: Bronze Gate, Globe Angle and Check Valves
8. MSS SP-84: Steel Valves - Socket Welding and Threaded Ends
9. MSS SP-85: Cast Iron Globe and Angle Valves, Flanged with Threaded Ends
10. MSS SP-92: MSS Valve User Guide

- C. Automatic Temperature Control Contractor Qualifications: Firms specializing in manufacturing and installation of control system for not less than 5 years.

1. Codes and Standards:
 - a. Electrical Standards: Provide electrical components of control systems which have been UL-listed and labeled, and comply with NEMA standards.
 - b. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for pneumatic control systems.
 - c. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

1.09 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications conflict or are unclear, advise Architect in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted.
- B. Where Drawings or Specifications do not coincide with manufacturer's recommendations, or with applicable codes and standards, alert Architect in writing before installation.
- C. If the required material, installation, or work can be interpreted differently from drawing to drawing, for between drawings and specs, this contractor shall provide that material, installation, or work which is of the more stringent.
- D. It is the intent of these contract documents to have the contractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a system. In cases such as this, where the contractor has failed to notify the Architect of the situation in accordance with Paragraph (A) above, the contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner.

1.10 PHASING

- A. The mechanical subcontractor shall construct the subject project in phases as directed by the Architect to suit the project progress schedule, as well as the completion date of the project.
- B. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architectural drawings.

1.11 CONTRACT DRAWINGS

- A. All work shown on the Drawings is intended to be approximately correct to scale, but shall be taken in a sense as diagrammatic. Sizes of ductwork and pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make complete working systems ready for use.

- B. The HVAC Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.
- C. Refer to the Architectural, Structural, and other Mechanical and Electrical Drawings which indicate the construction in which this work shall be installed. Locations shown on the plans shall be checked against the general and detailed Drawings of the construction proper. All measurements must be taken at the building.

1.12 ACCESSIBILITY

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- B. Extend all grease fittings to an accessible location.

1.13 ROUGH IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

1.14 NOTIFICATION OF RELATED TRADES

- A. Notify all other trades responsible for installing chases, inserts, sleeves, anchors, louvers, etc. when ready for such installation and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation. Provide all concrete pad layout drawings and anchor locations to Concrete Trade Contractor.
- B. Leave openings in walls for pipes, ducts, etc. for mechanical and electrical work as shown on Drawings or required by layout of mechanical or electrical systems.
- C. Provide, with the initial shop drawing / submittal package, drawings depicting the required in-wall blocking needed for the work of this Bid Package. This Trade Contractor is responsible for coordinating locations of in-wall blocking with other trades. Furnishing and installing of blocking within drywall partitions will be by others. Any blocking not in place as a result of a lack of coordination will be installed by this Trade Contractor at no cost to the Owner or CM.
- D. Cutting of ceiling tile is by ACT Subcontractor.
- E. Provide any Roof Opening Layout information required for the installation of any HVAC or related work within two weeks of contract award.

1.15 MECHANICAL INSTALLATIONS

- A. Coordinate mechanical equipment and materials installation with other building components.
- B. Verify all dimensions by field measurements.
- C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

- F. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.
- G. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- H. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- I. Coordinate connection of mechanical system with overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.16 CUTTING AND PATCHING

- A. Drilling, coring, and cutting of new and existing structures (through walls, floors, ceiling, etc.) where the largest dimension does not exceed 12" shall be by this Contractor.
- B. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the existing walls, floors, overhead structure, and other structural components, which are to remain, is maintained until permanent work is installed. Prior to any coring or cutting verify all locations of same with the General Contractor. All cutting and coring is to be performed in accordance with approved coordination drawings. All cutting or coring of structural must receive approval of the Architect prior to proceeding.
- C. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- D. Patching of surfaces shall be by the trade responsible for the surface penetrated.
- E. Refer to various architectural sections for additional reference.

1.17 SUBMITTALS

- A. Refer to Section 013300 – SUBMITTAL REQUIREMENTS for submittal definitions, requirements, and procedures. The following paragraphs supplement the requirements of Section 013300.
- B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by the General Contractor. Data submitted by Sub-contractors and material suppliers directly to the Architect/Engineer will not be processed.
- C. Provide submittals for the following equipment:
 - 1. Energy Recovery Ventilators
 - 2. Boiler and Accessories
 - 3. Hangers and Attachments
 - 4. Mechanical Identification
 - 5. Mechanical Insulation
 - 6. Ductless Cooling Units
 - 7. Piping, Valves and Accessories
 - 8. Terminal Heating Units
 - 9. Power and Gravity Ventilators
 - 10. Metal Ductwork
 - 11. Ductwork Accessories
 - 12. Air Outlets and Inlets
 - 13. Vehicle Exhaust System
 - 14. Automatic Temperature Controls

15. Testing, Adjusting, Balancing, and Commissioning

- D. If a Shop Drawing is not accepted after two submissions, a third submission from the same manufacturer will not be considered.
- E. Check Shop Drawings and other submittals to assure compliance with contract documents before submittal to A/E.
- F. Review of Shop Drawings is final and no further changes shall be considered without written application. Shop Drawings review does not apply to quantities, nor relieve this Contractor of his responsibility for furnishing materials or performing his work in full compliance with these Contract Drawings and Specifications. Review of these shop drawings shall not be considered a guarantee of the measurements of this building or the conditions encountered.

1.18 SUBSTITUTIONS

- A. Refer to, Section 013300 – SUBMITTAL REQUIREMENTS for requirements in requesting substitutions. The following paragraphs supplement the requirements of Section 013300.
- B. If materials or equipment are substituted for specified items that alter the systems shown or its physical characteristics, or which have different operating characteristics, clearly note the alterations or difference and call it to the attention of the a/e. Under no circumstances shall substitutions be made unless material or equipment has been successfully operated for at least three consecutive years.
- C. Any modifications to the design, as a result of approving a substitution, shall be the responsibility of this contractor. Any additional cost to this contractor or any other contractor, directly or indirectly, as a result of such substitutions, shall be the responsibility of this contractor.

1.19 PRODUCT LISTING

- A. Prepare listing of major mechanical equipment and materials for the project.
- B. Provide all necessary information.
- C. Submit to the A/E through the General Contractor, within twenty (20) days of signing contract, this listing indicating all equipment and manufacturers, as a part of the submittal requirement. If the product list is not submitted, it will be the responsibility of the sub-contractor to submit one (1) of the three (3) named equal manufacturers.
- D. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.
- E. Provide products, which are compatible within systems and other connected items.

1.20 NAMEPLATE DATA

- A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, mode, number, serial number, capacity, operating, and power characteristics labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.21 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section General Conditions for delivery, storage, and handling of equipment. The following paragraphs supplement the requirements of Section General Conditions.
- B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- C. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
- D. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.22 RECORD DOCUMENTS

- A. Refer to 01 78 00, the general conditions, and the supplementary conditions for requirements for record documents. The following paragraphs supplement the above.
- B. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.

1.23 COORDINATION DRAWINGS

- A. Before materials are purchased or work is begun, the respective Subcontractor shall prepare and submit to the Architect Coordination Drawings showing the size, elevation and location of his equipment, fixtures, ductwork, conduit, and piping lines relevant to the complete system. He shall ensure that these drawings are compatible and correctly annotated and cross-referenced at their interfaces.
- B. Coordination drawings are for the Contractor's and the Architect's use during construction and shall not be construed as replacing any shop or record drawings required elsewhere in the Contract Drawings.
- C. All coordination drawings shall be prepared in a large enough scale to accurately identify work of each trade and in addition to each sub-contractors systems, shall also show architectural floor plan, reflected ceiling plan, and structural framing with grid identification.
- D. The coordination drawing shall be started by the sheet metal sub-contractor and after applying all ductwork, the drawing shall be submitted for ductwork approval by the engineer. After approval, the drawing shall be circulated to the remaining sub-contractors for application of their work.
- E. During coordination drawing preparation the sub-contractors shall meet periodically to discuss overall coordination of all sub systems, and shall adjust their systems accordingly. When all drawings are complete the general contractor shall submit to the architect and engineers for review.
- F. Areas of conflict that cannot be resolved between the sub-contractor must be flagged on the drawings with adequate information to assist the architect and engineer in resolving noted issues.
- G. Areas that are in conflict and require additional drafting or modifying shall be completed at no additional cost to the project or owner.

- H. Refer to Division 01 of these Contract Documents for additional procedures relative to the preparation of Coordination Drawings.

1.24 OPERATION AND MAINTENANCE DATA

- A. Refer to Section 017700 – CONTRACT CLOSEOUT for procedures and requirements for preparation and submittal of maintenance manuals. The following paragraphs supplement the requirements of Section 017700.
- B. In addition to the information required by Section 017700 for maintenance data, include the following information:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and user summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and trouble-shooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions and lubrication charts and schedules.
 - 5. Videotape all demonstrations and training sessions and provide (3) DVD copies to the Owner

1.25 ENERGY REBATE PROGRAM

- A. This project has been designed to incorporate equipment approved for energy rebate such as boilers, high efficiency motors, chillers, etc. Meet with Utility Company prior to submitting shop drawing to ascertain that submittal meets program guidelines.

1.26 WARRANTIES

- A. The contractor shall provide a two (2) year minimum warrantee on all product (unless otherwise stated in the product specification for a specific product) and labor for work under this section.
- B. Refer to Section General Conditions and Section 017700 – CONTRACT CLOSEOUT for additional procedures and submittal requirements for warranties.

1.27 WELDING QUALIFICATIONS:

- A. Piping shall be welded in accordance with qualifications procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operations qualified by another employer may be accepted as permitted by ASME B31.1. The Owner's Representative shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Division 1.
- B. When open-flame or spark producing tools such as welding equipment, and the like are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant fire watch/fire detail (by the Local Fire Department) where work is being performed and until it is completed. This Contractor shall be responsible for obtaining required permit and paying all permit fees and fire watch detail expenses.

1.28 STAGING AND SCAFFOLDING

- A. Unless otherwise specified, each sub-contractor shall provide all lifts and man-lifts, and furnish, erect and maintain in safe condition, all staging and scaffolding as specified under Section 015000 Temporary Facilities and Controls, as needed for proper execution of the work of this Section. Staging and scaffolding shall be of adequate design, erected and removed by experienced stage builders having all accident prevention devices required by Federal, state and local laws.

1.29 COMMISSIONING

- A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 018100 – Commissioning.
- B. Complete installation and startup checks and functional tests according to Section 018100 Commissioning and manufacturers written instructions.
- C. Operational Test: After electrical system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the startup procedure.
- D. Verify that equipment is installed and commissioned as per requirements of section 018100 and manufacturers written instructions/requirements.
- E. Includes all costs for commissioning, testing, manufacturer's representation on site, test devices, test reports and the like as it relates to your work, shall be included in the base bid. Cost for commissioning agent by owner.

1.30 TRADE RESPONSIBILITY FOR INTERCONNECTIONS MATRIX

Device	Furnished By	Installed By	Power Wiring	Control Wiring	Fire Alarm Wiring	Notes
Smoke Detectors (Area type)	260001	260001	260001	230000 (ATC)	260001	
Smoke Detectors (Duct mounted)	260001	230000	260001	230000 (ATC)	260001	
Smoke & Fire/Smoke Dampers	230000	230000	N/A	N/A	N/A	
Smoke & Fire/Smoke Damper Actuators	230000	230000	260001 & 230000 (ATC)	230000 (ATC)	260001	2
Fire Dampers	230000	230000	N/A	N/A	N/A	
VAV Boxes	230000	230000	260001	230000 (ATC)	N/A	2
VAV Box Damper Actuator	230000 (ATC)	Box Mfr	230000 (ATC)	230000 (ATC)	N/A	2
VAV Box DDC Controller	230000 (ATC)	Box Mfr	230000 (ATC)	230000 (ATC)	N/A	2
Hydronic Control Valves	230000 (ATC)	230000	N/A	230000 (ATC)	N/A	1

Device	Furnished By	Installed By	Power Wiring	Control Wiring	Fire Alarm Wiring	Notes
Hydronic Control Valve Actuator	230000 (ATC)	230000 (ATC)	230000 (ATC)	230000 (ATC)	N/A	1
Sheet Metal Damper	230000	230000	N/A	N/A	N/A	1
Sheet Metal Damper Actuators	230000 (ATC)	230000 (ATC)	230000 (ATC)	230000 (ATC)	N/A	1
Natural Gas Energy Meters	220001	220001	260001 & 230000 (ATC)	230000 (ATC)	N/A	3
Electrical Energy Meters	260001	260001	260001 & 230000 (ATC)	230000 (ATC)	N/A	3
Domestic Water Meters	220001	220001	260001 & 230000 (ATC)	230000 (ATC)	N/A	3
HVAC Hydronic Energy Meters	230000	230000 (ATC)	260001 & 230000 (ATC)	230000 (ATC)	N/A	3
Airflow Measuring Stations	230000 (ATC)	230000 (ATC)	N/A	230000 (ATC)	N/A	
DDC Panels	230000 (ATC)	230000 (ATC)	260001 & 230000 (ATC)	230000 (ATC)	N/A	4
VFDs at AHU, EFs	230000 (ATC)	230000 (ATC)	260001	230000 (ATC)	N/A	
Elevator Hoistway Vent Damper	230000	230000	N/A	N/A	N/A	
Elevator Hoistway Vent Damper Actuator	230000 (ATC)	230000 (ATC)	230000 (ATC)	230000 (ATC)	260001	
Boiler/DHW Intake & Exhaust Breeching	220001	220001	N/A	N/A	N/A	
Generator Exhaust Breeching	220001 (if gas fired) 230000 (if diesel fired)	220001 (if gas fired) 230000 (if diesel fired)	260001	260001	260001	
Kitchen Emergency Gas Valve	220001	220001	260001	260001	260001	

Notes:

1. Division 230000 and Division 230000 (ATC) Contractors shall fully coordinate all airflow damper and hydronic valves sizes and quantities.
2. Smoke Damper and VAV Box power wiring shall be provided by Division 260001 to junction box locations shown on electrical drawings; Division 230000 (ATC) Contractor shall provide final power wiring from junction box to end device location.

3. Division 260001 Contractor shall provide all line-voltage power wiring required for meters; Division 230000 (ATC) Contractor shall provide all low-voltage power wiring required for meters.
4. Division 260001 shall provide power at main DDC Panel. Division 230000 (ATC) shall provide power to all other DDC Panels.

PART 2 PRODUCTS

2.01 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT (Refer to Section 018100 Commissioning for additional contract requirements)

- A. Pursuant to Massachusetts General Laws Chapter 141, a Massachusetts Licensed electrician shall install all low and line voltage wiring required by this section.
- B. General: The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

1. All motors for all mechanical equipment shall be premium efficiency matching the following:

	HP	RPM	Efficiency
a.	1	1800	85.5%
b.	1.5	1800	86.5%
c.	2	1800	86.5%
d.	3	1800	89.5%
e.	5	1800	89.5%
f.	7.5	1800	91.0%
g.	10	1800	91.7%
h.	15	1800	93.0%
i.	20	1800	93.0%
j.	25	1800	93.6%
k.	30	1800	94.1%
l.	40	1800	94.1%
m.	50	1800	94.5%

2. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
3. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
4. 2-speed motors shall have 2 separate windings on poly-phase motors.
5. Temperature Rating: Rated for 40 deg. C. environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).
6. Starting Capability: Frequency of starts as indicated by automatic control system and not less than 5 evenly time spaced starts per hour for manually controlled motors.
7. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.
8. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
9. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
10. Bearings:
 - a. Ball or roller bearings with inner and outer shaft seals.
 - b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
 - c. Designed to resist thrust loading where belt drivers or other drives produce lateral or axial thrust in motor.

- d. For fractional horsepower, light duty motors, sleeve type bearings are permitted.
11. Enclosure Type:
 - a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
 - b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
 - c. Weather protected Type I for outdoor use, Type II where not housed.
 12. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
 13. Noise Rating: "Quiet".
 14. Efficiency: "Energy Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, Test Method B.
 15. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
- C. Starters, Electrical Devices, and Wiring: (Provided by the HVAC Contractor for Each Packaged Piece of HVAC Equipment Requiring Such):
1. Motor Starter Characteristics:
 - a. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have NEC proper class and division.
 - b. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
 2. Manual Switches shall have:
 - a. Pilot lights and extra position for multi-speed motors.
 - b. Overload Protection: Melting alloy type thermal overload relays.
 3. Magnetic Starters:
 - a. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
 - b. Trip-free thermal overload relays, each phase.
 - c. Interlocks, switches and similar devices as required for co-ordination with control requirements of Division 23 Controls Sections.
 - d. Built-in 120 volts control circuit transformer, fused from line side, where service exceeds 240 volts.
 - e. Externally operated manual reset.
 - f. Under-voltage release or protection.
 4. Capacitors:
 - a. Individual unit cells.
 - b. All welded steel housing.
 - c. Each capacitor internally fused.
 - d. Non-flammable synthetic liquid impregnant.
 - e. Craft tissue insulation.
 - f. Aluminum foil electrodes.
 - g. KVAR size shall be as required to correct motor power factor to 90% or better and shall be installed on all motors 1 horsepower and larger, that have an uncorrected power factor of less than 85% at rated load.

5. Disconnect Switches (Those specified under this Section):
 - a. Fusible Switches: Fused, each phase; general duty; horsepower rated; non-teasible quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated.
 - b. Non-fusible Switches: For equipment 2 horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated. For equipment larger than 2 horsepower, switches shall be the same as fusible type.

2.02 HANGERS & ATTACHMENTS

A. Horizontal-Piping Hangers and Supports:

1. General: Except as otherwise indicated, provide factory-fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacture for each piping service. Select size of hangers and supports to exactly fit pip size for bare piping, and to insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
 - a. Adjustable Steel Clevises Hangers: MSS Type 1.
 - b. Steel Pipe Clamps: MSS Type 4.
 - c. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
 1. Plate: Unguided type.
 2. Plate: Guided type.
 3. Plate: Hold-down clamp type.
 - d. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast-iron floor flange.
 - e. Pipe Stanchion Saddles: MSS Tube 37, including steel pip base support and cast-iron floor flange.
 - f. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast-iron floor flange.
 - g. Single Pipe Rolls: MSS Type 41.
 - h. Adjustable Roller Hangers: MSS Type 43.
 - i. Pipe Roll Stands: MSS Type 44.
 - j. Pipe Rolls and Plates: MSS Type 45.
 - k. Adjustable Pipe Roll Stands: MSS Type 46.
2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - a. Carpenter and Patterson, Inc.
 - b. Corner & Lada Co., Inc.
 - c. Elcen Metal Products Co.
 - d. Fee & Mason Mfg. Co.; Div. Figgie International
 - e. ITT Grinnel Corp.
 - f. Or equal.

B. Vertical-Piping Clamps:

1. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps, complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
 - a. Two-Bolt Riser Clamps: MSS Type 8.
 - b. Four-Bolt Riser Clamps: MSS Type 42.
2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - a. Carpenter and Patterson, Inc.
 - b. Corner & Lada Co., Inc.
 - c. Elcen Metal Products Co.
 - d. Fee & Mason Mfg. Co.; Div. Figgie International
 - e. ITT Grinnel Corp.
 - f. Or equal.

C. Hanger-Rod Attachments:

1. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-pipe hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
 - a. Steel Turnbuckles: MSS Type 13.
 - b. Swivel Turnbuckles: MSS Type 15.
 - c. Malleable Iron Sockets: MSS Type 16.
2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - a. Carpenter and Patterson, Inc.
 - b. Corner & Lada Co., Inc.
 - c. Elcen Metal Products Co.
 - d. Fee & Mason Mfg. Co.; Div. Figgie International
 - e. ITT Grinnel Corp.
 - f. Or equal.

D. Building Attachments:

1. General: Except as otherwise indicate, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
 - a. Concrete Inserts: MSS Type 18.
 - b. Top Beam C-Clamp: MSS Type 19.
 - c. Side Beam or Channel Clamps: MSS Type 20.
 - d. Center Beam Clamps: MSS Type 21.
 - e. Welded Beam Attachments: MSS Type 22.
 - f. C-Clamps: MSS Type 23.
 - g. Top Beam Clamps: MSS Type 25.
 - h. Side Beam Clamps: MSS Type 27.

- i. Steel Beam Clamps W/Eye Nut: MSS Type 28.
 - j. Linked Steel Clamps W/Eye Nut: MSS Type 29.
 - k. Malleable Beam Clamps: MSS Type 30.
 - l. Steel Brackets: One of the following for indicated loading:
 - 1. Light Duty: MSS Type 31.
 - 2. Medium Duty: MSS Type 32.
 - 3. Heavy Duty: MSS Type 33.
 - m. Side Beam Brackets: MSS Type 34.
 - n. Plate Lugs: MSS Type 57.
 - o. Horizontal Travelers: MSS Type 58.
2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
- a. Carpenter and Patterson, Inc.
 - b. Corner & Lada Co., Inc.
 - c. Elcen Metal Products Co.
 - d. Fee & Mason Mfg. Co.; Div. Figgie International
 - e. ITT Grinnel Corp.
 - f. Or equal.
- E. Saddles and Shields:
- 1. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
 - 2. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
 - 3. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
 - 4. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
 - a. Elcen Metal Products Co.
 - b. Pipe Shields, Inc.
 - c. Carpenter Patterson, Inc.
 - d. ITT Grinnel Corp.
 - e. Or equal.
- F. Miscellaneous Materials:
- 1. Metal Framing: Provide products complying with NEMA STD ML 1.
 - 2. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A 36.
 - 3. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
 - 4. Heavy Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.
 - 5. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.03 MECHANICAL IDENTIFICATION (Refer to Section 018100 Commissioning for additional contract requirements)

A. Plastic Pipe Markers:

1. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1
2. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1
3. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
4. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - b. Adhesive lap joint in pipe marker overlap.
 - c. Laminated or bonded application of pipe marker to pipe (or insulation).
 - d. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

B. Plastic Equipment Markers:

1. General: Provide manufacturer's standard laminated plastic, color-coded equipment markers. Conform to the following color code:
 - a. Green: Cooling equipment and components.
 - b. Yellow: Heating equipment and components.
 - c. Yellow/Green: Combination cooling and heating equipment and components.
 - d. Blue: Equipment and components that do not meet any of the above criteria.
2. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 1. Other design parameters such as pressure drop, entering and leaving conditions, rpm, etc.
3. Size: Provide approximate 2-1/2" x 6" markers for each piece of equipment.
4. Application: Provide equipment labels for the following equipment:
 - a. Rooftop Units
 - b. Exhaust Fans
 - c. Ductless Cooling Units
 - d. Boilers
 - e. Pumps

2.04 MECHANICAL INSULATION

A. Piping Insulation Materials:

1. Glass Wool Piping Insulation:
 - a. Manufacturers:
 1. Knauf Insulation; Earthwool 1000° Pipe Insulation with ECOSE Technology
 2. Knauf Insulation; Earthwool Redi-Klad 1000° Pipe Insulation with ECOSE Technology
 3. Or similar as manufactured by Johns Manville, Manson, or Owens Corning

4. Or equal
 - a. UL/ULC Classified per UL 723 or FHC 25/50 per ASTM E 84; EPD Certified by UL Environment; Living Building Challenge – Declare Red List Free for unjacketed Earthwool Pipe and composite Redi-Klad Pipe; meeting ASTM C 547, Type IV (1000° F.) or Type I (850° F.) ; ASTM C 585; ASTM C 411 and ASTM C 795; Verified to be formaldehyde free by UL Environment.
 - b. Vapor Retarder Jacket: ASJ+/SSL+ conforming to ASTM C 1136 Type I,II, III, IV, &VIII secured with self-sealing longitudinal laps and matching butt strips.
 - c. Redi-Klad Jacket: VentureClad 5-ply weather and abuse resistant with self-sealing lap. Zero permeability per ASTM E 96-05; puncture resistance 35.4 kg (189.3 N) per ASTM D 1000; tear strength 4.3 lb (19.4 N) per ASTM D 624; thickness 14.5 mils (0.0145"); tensile strength 68 lb/inch width [306 N (32 kg)/25 mm]
2. Flexible Unicellular Piping Insulation: ASTM C 534, Type as required.
 - a. Type I - tubular; Type II - sheet. For use between -40 degrees F and 200 degrees F.
3. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations.
4. Encase straight pipe insulation, where exposed in occupied areas, using Redi-Klad Pipe Insulation or cover "standard" insulation with one piece 20-mil thick PVC Jacketing. Fasten and seal as per manufacturer's recommendations.
5. Encase exterior piping insulation with an aluminum jacket with weather-proof construction.
6. Staples, Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.
7. Adhesives, Sealants and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
- B. Piping Insulation Application and Thickness:
 1. Application: Cold Piping (40 Degrees F to Ambient):
 - a. Insulate the following cold HVAC piping systems:
 1. Air conditioner condensate drain piping.
 2. Refrigerant liquid and suction piping.
 - b. Insulate piping system specified above with the following type and thickness of insulation:
 1. Glass Wool: 1-1/2 in. thick for all pipe sizes.
 2. Flexible Unicellular: (Refrigerant piping only) 1 in. thick.
 2. Application: Hot HVAC Piping (to 200 Degrees F)
 - a. Insulate the following hot HVAC piping systems
 1. Hot gas refrigerant piping.
 - b. Insulate each piping system specified above with the following type and thickness of insulation:
 1. Flexible Unicellular: (Refrigerant piping only) 1 in. thick.
- C. Insulation on Piping Exposed to Weather: Protect outdoor insulation from weather by installing Redi-Klad Pipe Insulation or adding an outdoor protective finish aluminum jacketing installed to "standard" insulation as recommended by the manufacturer. Insulation thickness shall be increased by one size versus specified pipe insulation thickness.
- D. Ductwork and Equipment Insulation Materials:
 1. Glass Wool Manufacturers:
 - Knauf Insulation
 - Or similar as manufactured by CertainTeed, Johns Manville, Manson or Owens Corning, Or equal

2. Rigid Glass Wool Ductwork Insulation (R-9.1): UL/ULC Classified unfaced, ASJ+, ASJ and FSK; FHC 25/50 per ASTM E 84 for PSK only; meeting ASTM C 612, Type IA and IB; rigid. Verified to be formaldehyde free by UL Environment, Living Building Challenge – Declare Red List Free.
 3. Flexible Glass Wool Ductwork Insulation (R-6): UL/ULC Classified; meeting ASTM C 553 Types I, II and III; ASTM C 1136 Type II and ASTM C 1290. UL GREENGUARD Gold Certified; Verified to be formaldehyde free by UL Environment; does not contain polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE; Certified to meet all requirements of EUCEB. Flexible, limited combustible.
 4. Jackets for Ductwork Insulation: ASTM C 1136 Type II, with vapor barrier.
 5. Ductwork Insulation Accessories: Provide staples, bands, wire, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
 6. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.
- E. Ductwork Insulation Application and Thickness:
1. Application: Ventilation and AC System Ductwork:
 - a. Insulate the following ductwork:
 1. Outdoor air intake ductwork between air entrance and air handling unit inlet.
 2. HVAC supply ductwork between HVAC unit discharge and room terminal outlet.
 3. Insulate neck and bells of supply diffusers.
 4. HVAC return ductwork between room terminal inlet and HVAC unit inlet; except omit insulation on return ductwork located in return air ceiling plenums.
 5. HVAC plenums and unit housing not pre-insulated at factory or lined.
 6. Exhaust ductwork between in-line exhaust fan and point of exit in building.
 - b. Insulate each ductwork system specified above with the following type and thickness of insulation:
 1. Rigid Glass Wool: In machine rooms, fan rooms, and mechanical spaces insulate all supply air, return air and outside air ductwork with 2 in. thick rigid (minimum R-9.1). All exposed outdoor ductwork in occupied areas shall be insulated with same thickness and material.
 2. Flexible Glass Wool: 2 in. nominal thickness, 1-1/2 in. installed thickness (minimum R-6), application limited to concealed locations which shall include above ceilings, in chases, and shafts.
 3. All outside air ductwork shall be 2 in. rigid (R-9.1).
 2. Equipment Insulation Materials:
 3. Rigid Glass Wool Equipment Insulation (R-9.1): UL/ULC Classified; unfaced, ASJ+, ASJ and FSK; FHC 25/50 for PSK only; meeting ASTM C 612, Type IA and IB : rigid. Verified by UL Environment to be formaldehyde free, Living Building Challenge – Declare Red List Free.
 4. Flexible Glass Wool Equipment Insulation (R-5): UL/ULC Classified; meeting ASTM C 553 Types I, II and III; ASTM C 1136 Type II and ASTM C 1290. UL GREENGUARD Gold Certified; Verified to be formaldehyde free by UL Environment; does not contain polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE; Certified to meet all requirements of EUCEB. Flexible, limited combustible.
 5. Flexible Unicellular Equipment Insulation: ASTM C 534, Type as required.
 - TYPE I - TUBULAR.
 - TYPE II - SHEET.

6. Jacketing material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, Laminated Self-Adhesive Water and Weather Seal jacketing or metal jacket at Installer's option, except as otherwise indicated.
 7. Equipment Insulation Compounds; Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
 8. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.
- F. Equipment Insulation Application and Thickness:
1. Application: Cold Equipment (Below Space Temperature):
 - a. Insulate the following cold equipment:
 1. Drip pan under chilled equipment.
 - b. Insulate each item of equipment specified above with the following type and thickness of insulation:
 1. Glass Wool: 2 in. thick for cold surfaces above 35 degrees F and 3 in. thick for surfaces 35 degrees F and lower.
 2. Flexible Unicellular: Same thicknesses as for Glass Wool.

2.05 GREASE DUCT INSULATION

A. MATERIAL

1. Thermal Material: 2192 degrees F rated core blanket, manufactured from patented bio-soluble Superwool chemistry (Calcium Magnesium Silicate).
 - a. Product: FireMaster FastWrap XL or Pyroscat Duct Wrap XL as manufactured by Thermal Ceramics.
 - b. Fully encapsulated thermal material in fiberglass reinforced aluminum/polypropylene scrim (FSP).
 1. Encapsulation FSP marked with UL Classification Mark.
 2. Encapsulation FSP marked with ICC-ES report number ESR 2213 or ESR 2832.
 3. Collars supplied in 6 in. (150 mm) wide by 25 ft.t (7620 mm) long rolls.
2. Product Characteristics:
 - a. Thickness: 1-1/2 in. (38 mm).
 - b. Nominal Density: 6 pcf.
 - c. R-Value: 7.35 per layer of FireMaster FastWrap XL or Pyroscat Duct Wrap XL when tested in accordance with ASTM C 518 at 75 F.
 - d. Flame Spread: <25 when tested in accordance with ASTM E 84.
 - e. Smoke Development: <50 when tested in accordance with ASTM E 84.

B. ACCESSORY MATERIALS:

1. Glass Filament Tape: Minimum 3/4 in. (19 mm) wide - used to temporarily secure blanket until permanent attachment using steel banding and/or steel insulation pins.
2. Aluminum Foil Tape: Minimum 3 in. (76 mm) used to seal cut edges.
3. Carbon Steel or Stainless Strapping Material Minimum: 1/2 in. (13 mm) wide and 0.015 in. (.38 mm) thick
4. Steel Insulation Pins: Minimum 12-gauge, length sufficient to penetrate through duct wrap insulation.
5. Insulation Clips: Galvanized steel, minimum 1-1/2 in. (38 mm) round or square.

6. Through Penetration Firestop Sealants:
 - a. Packing Material: Remove encapsulation material from FireMaster FastWrap XL or Pyroscat Duct Wrap XL, use core blanket (white) as penetration packing material.
 - b. Firestop sealants per applicable building code report and/or laboratory design listings.
7. Grease and HVAC Duct Access Doors:
 - a. Thermal Ceramics FastDoor XL Access doors; Supplied in standard door sizes of 6 by10 in. (152 mm by 254 mm), 8 by12 in. (203 mm by 305 mm), 12 by12 in. (305 mm by 305 mm) 12 by16 in. (305 mm by 406 mm), and 20 by20 in. (508 mm by 508 mm).

2.06 HYDRONIC PIPING AND ACCESSORIES

A. PIPE AND TUBING MATERIALS

1. Copper Tubing: ASTM grade B 88, Type L hard drawn temper copper tubing.

B. FITTINGS

1. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.
2. Solder Filler Metals: ASTM B 32, 50-50, Tin-Lead, for condenser water, chilled water, and make-up water and drain piping.
3. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony, for heating hot water and low pressure steam piping.
4. Brazing Filler Metals: AWS A5.8.

WARNING: Some filler metal contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.

5. Gasket Material: Thickness, material, and type suitable for fluid to be handled, and design temperatures and pressures.

C. PIPE SLEEVES AND ESCUTCHEONS

1. General: Provide schedule 40 black steel or 18 gage galvanized pipe sleeve large enough to accept pipe along with specified pipe insulation at each point where pipe penetrates a wall or floor. Sleeve shall be large enough to allow for free movement of pipe however minimized to prevent leakage of smoke and fire during a fire emergency. For all piping exposed to view provide a chrome plated escutcheon that will surround insulation where applicable on pipe for a neat finished appearance. Where piping is concealed above ceilings no escutcheons are required.

2.07 REFRIGERANT PIPING

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for refrigeration piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigerant piping systems. Where more than one type of materials and products are indicated, selection is Installer's option.

- B. Material: Provide pipes and pipe fittings in accordance with the following listing:

1. Tube Size 4-1/8" and Smaller: Copper tube; Type ACR, hard-drawn temper; wrought-copper, solder-joint fittings; brazed joints.

- C. Soldered Joints: Solder joints using silver-lead solder, ASTM B32, Grade 96 TS.
- D. Brazed Joints: Braze joints using American Welding Society (AWS) classification BCUO-4 for brazing filler metal.
- E. Piping Specialties: Provide piping specialties complying with Division-23 "Hydronic Piping & Accessories" in accordance with the following listing:
1. Pipe escutcheons.
 2. Drip pans.
 3. Sleeves.
 4. Sleeve seals.
- F. Refrigerant Valves: Special valves required for refrigerant piping include the following types.
1. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300 degrees F (149 degrees C) temperature rating, 500 psi working pressure.
 2. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided piston and stainless steel spring, 250 degrees F (121 degrees C) temperature rating, 500 psi working pressure.
 3. Manufacturer: Subject to compliance with requirements, provide globe and check valves of one of the following:
 - a. Henry Valve CO.
 - b. Parker Hannifin Corp.; Refrigeration & Air Cond. Div.
 - c. Sporlan Valve Co.
 - d. Or equal.
 4. 2-Way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, Teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL-listed, ½" conduit adapter, 250 degrees F (121 degrees C) temperature rating, 400 psi working pressure.
 5. Manufacturer: Subject to compliance with requirements, provide solenoid valves of one of the following:
 - a. Alco Controls Div.; Emerson Electric Co.
 - b. Automatic Switch Co.
 - c. Sporland Valve Co.
 - d. Or equal.
 6. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL-listed, 350 psi working pressure.
 7. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL-listed, 200 degrees F (93 degrees C) temperature rating, 500 psi working pressure.
 8. Refrigerant Filter-Driers: Steel shell, ceramic fired desiccant core, solder connections, UL-listed, 500 psi working pressure.
 9. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron coverplate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.
 10. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.
 11. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL-listed.
 12. Manufacturer: Subject to compliance with requirements, provide refrigeration accessories of one of the following:
 - a. Alco Controls Div.; Emerson Electric CO.
 - b. Henry Valve CO.
 - c. Parker-Hannifin Corp.; Refrigeration & Air Conditioning Div.
 - d. Sporlan Valve Co.

e. Or equal.

- G. Basic Vibration Control: Provide vibration control products as required in accordance with the following listing:
1. Isolation hangers.
 2. Riser isolators.
 3. Riser support isolators.
 4. Flexible pipe connectors.
- 2.08 VARIABLE REFRIGERANT FLOW (VRF) UNIT SYSTEM (Refer to Section 018100 Commissioning for additional contract requirements)
- A. The basis of design Heat Recovery Variable Refrigerant Flow system is a three pipe system consisting of a single or multiple outdoor units, multiple indoor units of various types and capacities, and multiple Flow Selector boxes, individual or central indoor unit controls with on/off temperature settings, all connected by fully insulated refrigerant lines utilizing factory supplied, fully insulated, branching kits. Indoor units are connected to condensate piping that shall be terminated to the nearest drain point.
- B. The system shall be fully capable of simultaneous heating and cooling operation as requested by the individual indoor zones that can consist of single or multiple indoor units. Refer to scheduled performance data for additional information.
- C. Evaporator:
1. General: The unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board, and fan motor. The unit in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from factory.
- D. Cabinet: The casing shall be ABS plastic factory finish. Cabinet shall be designed for suspension mounting and horizontal operation. The rear cabinet panel shall have provisions for a field installed filtered outside air intake connection.
- E. Fan: The evaporator fan shall have three high performance, double inlet, forward curve fans driven by a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of three (3) speeds: low, medium, and high.
- F. Vane: There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall provide a choice of five (5) vertical airflow patterns selected by remote control. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.
- G. Filter: Return air shall be filtered by means of an easily removable washable filter.
- H. Coil: The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

- I. Control: The control system shall consist of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. For A-Control, a three (3) conductor 14 ga. AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units. Where separate power is supplied to the indoor and outdoor units, a two (2) 20 ga. AWG wire shall be run between the units to provide forbid-directional control communication. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.
- J. Outdoor Condensing Units:
1. Stand Alone: The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions. The outdoor unit shall be capable of operating at 0°F, (-18°C) ambient temperature with additional low ambient controls. The outdoor unit shall be able to operate with a maximum height difference of 100 feet and have maximum refrigerant tubing length of 165 feet between indoor and outdoor units without the need for line size changes, traps or additional oil. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.
 2. VRF condensing units
 - a. Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and the multiple inverter driven twin rotary compressors.
 - b. The maximum sound pressure rating for a single module shall not exceed 63.5dBa sound pressure in cooling and 65.5dBa in heating. For twinned systems the sound pressure numbers should not exceed 66.5 dBa and 68.5 dBa.
 - c. The outdoor unit shall include an oversized accumulator and a liquid tank for proper heating performance while allowing the indoor unit PMV valve (metering device) to shut off completely when a zone is satisfied.
 - d. The outdoor unit shall be protected by a High-pressure switch, High-pressure sensor, Low-pressure sensor, Fusible plug, PC board fuse, and an inverter overload protector.
 - e. The outdoor unit shall be capable of operating in cooling mode down to 14°F ambient air temperature and down to -4°F WB ambient air temperature in heating. For simultaneous heating and cooling the unit shall be capable of operating between 14°F and 60°F ambient air temperature.
 - f. The outdoor unit shall include a total oil management system that balances oil between compressors within a module, replenishes compressor oil to the compressors in a module from the oil separator if required, and allows to move oil and refrigerant between twinned units if required even if one of the units is not running. 2
- K. Cabinet: The casing shall be constructed from galvanized steel plate, coated with a finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a factory finish. The fan grille shall be of ABS plastic.
1. Unit cabinet shall be constructed of pre-coated steel, finished on both inside and outside.
 2. Unit access panels shall be removable with minimal screws and shall provide full access to the compressors, fan, and control components.
 3. Compressors shall be isolated in a compartment and have an acoustic wrap to assure quiet operation.
 4. The outdoor unit control panel shall include a sliding window to access adjustable controls and an LED display for setup and diagnostics.
 5. Unit cabinet shall be capable of withstanding 500-hour salt spray test per Federal Test Standard No. 141 (method 6061).

- L. Fan: The fan motor shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across if from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent contact with moving parts.
1. Outdoor fan shall discharge air vertically and be driven by a DC inverter variable speed motor with 64 steps that is capable of running down to 60 RPM.
 2. Outdoor fan motor shall be totally-enclosed with permanently-lubricated bearings.
 3. Motor shall be protected by internal thermal overload protection.
 4. Fan blade shall be non metallic and shall be statically and dynamically balanced.
 5. Outdoor fan shall be protected by a raised non metallic protective grille.
- M. Coil: The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be control by a microprocessor controlled step motor.
1. Coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.
 2. The coil configuration shall be 4 sided and fully separated from the machine compartment for more effective heat transfer and sound isolation.
 3. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
- N. Compressor: The compressor shall be a scroll compressor with variable speed inverter technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which results in vast energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor to maintain enough heat. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.
1. Each outdoor unit module shall be equipped with two or three inverter driven twin rotary compressors with full range control to a level of 0.1 Hz.
 2. Compressor shall be totally enclosed in the machine compartment.
 3. Compressors shall be equipped with factory mounted crankcase heaters.
 4. Internal overloads shall protect the compressor from over-temperature operation.
 5. Motor shall be suitable for operation in an R-410A refrigerant atmosphere.
 6. Compressor assembly shall be installed on rubber vibration isolators.
 7. To maximize compressor reliability, multiple compressors, within a module, shall be started and operated in variable patterns to ensure equal run time on all compressors.
 8. To ensure maximum efficiency throughout the system operation range, no compressor is required to run at maximum speed under any condition.
- O. Electrical: The electrical power of the unit shall be as indicated on the drawings. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.
1. All sizes shall utilize 208/230-3-60 or 460-3-60 field power supply.
 2. Twinned systems shall have separate field power supply to each module.
 3. Two core shielded low voltage cable is shall be required for communication between outdoor and indoor unit.
 4. All power and control wiring must be installed per NEC and all local electrical codes.

P. Variable Refrigerant Flow

1. System Description
 - a. The variable capacity, heating/cooling change-over system shall be a (Variable Refrigerant Flow).
 - b. Each indoor evaporative unit shall be provided with service isolation valves.
 - c. The system shall consist of a outdoor unit, Controller, multiple indoor units (-E models), and DDC (Direct Digital Controls). Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. The sum of connected capacity of all indoor air handlers shall range from 80% to 125% of outdoor rated capacity.
2. Quality Assurance
 - a. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
 - b. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
 - c. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
 - d. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.
 - e. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.
 - f. Units shall be listed in the AHRI directory.
 - g. All units shall meet the minimum Federal minimum efficiency standards and be tested per AHRI 1230 Standard.
3. Delivery, Storage and Handling
 - a. Unit shall be stored and handled according to the manufacturer's recommendation.
 - b. Units shall be shipped in one piece and shall be stored and handled per unit manufacturer's recommendations.
 - c. Units shall be supplied with a base rail that provides openings for moving the unit by fork truck or rigging the unit by crane
4. Warranty
 - a. The units shall be covered by the manufacturer's limited warranty for a period of one (1) year from date of installation. If the systems are:
 1. Designed by a certified equipment designer
 2. Installed by a contractor that has successfully completed the required training by the equipment manufacturer, and
 3. Verified with a completed commissioning report submitted to and approved by the equipment manufacturer, then the units shall be covered by an extended manufacturer's limited warranty for a period of five (5) years from date of installation by the equipment manufacturer. In addition the compressor shall have a manufacturer's limited warranty for a period of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty shall not include labor.

- b. Manufacturer shall have a minimum of five years of HVAC experience in the U.S. market.
- c. All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.
- d. The VRF system shall be installed by a contractor with extensive equipment manufacturer install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

5. Products

a. Outdoor Unit

- 1. General: The outdoor unit shall be used specifically with same equipment manufacturer's components. The outdoor units shall be equipped with multiple circuit boards that interface to the controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.

- a. The model nomenclature and unit requirements are shown on plans. All units requiring a factory supplied twinning kits shall be piped together in the field. If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.

Outdoor Unit Model Nomenclature Basis of Design					
		Twinning Kit	208 Volt		Twinning Kit
Model Number	Units		Model Number		
			Refer to dwgs	Refer to dwgs	

- b. Outdoor unit shall have a sound rating no higher than 66 dB(A) individually or 69 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
- c. All refrigerant lines from the outdoor unit to the indoor units controller shall be insulated.
- d. Outdoor unit shall be able to connect to up to 40 indoor units depending upon model.
- e. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
- f. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
- g. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet and have total refrigerant tubing length of 985 feet. The greatest length is not to exceed 575 feet between outdoor unit and the indoor units without the need for line size changes or traps.
- h. The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperature. The outdoor unit shall be capable of operating in cooling mode with required capacity down to -0°F with manufacturer supplied low ambient kit. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

- i. Manufacturer supplied low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
 - j. Manufacturer supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
 - k. Manufacturer supplied low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
 - l. Outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
 - m. Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend "no or reduced heating" periods shall not be allowed.
6. Unit Cabinet: The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models.
7. Fan: Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed. All fan motors shall be mounted for quiet operation. All fans shall be provided with a raised guard to prevent contact with moving parts. The outdoor unit shall have vertical discharge airflow.
8. Refrigerant: R410A refrigerant shall be required for unit systems. Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.
9. Coil: The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing. The coil fins shall have a factory applied corrosion resistant blue-fin finish. The coil shall be protected with an integral metal guard. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.
10. Compressor: Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed. A crankcase heater(s) shall be factory mounted on the compressor(s). The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size. The compressor will be equipped with an internal thermal overload. The compressor shall be mounted to avoid the transmission of vibration. Field-installed oil equalization lines between modules are not allowed.
 - a. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.
11. Electrical: The outdoor unit electrical power shall be 208 volts, 3-phase, 60 hertz refer to mechanical schedules. The outdoor unit shall be controlled by integral microprocessors. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.
12. Refrigerant: R410A refrigerant shall be required.

13. Refrigerant valves: The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and up to three indoor units. Branches may be twinned to allow more than 54,000 BTUH. Each branch shall have multiple two-position valves to control refrigerant flow. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation. Linear electronic expansion valves shall be used to control the variable refrigerant flow.
14. Integral Drain Pan: An integral condensate pan and drain shall be provided.
15. Electrical: The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 187-228 volts.
16. Controls Network: Controls Network consists of remote controllers, schedule timers, system controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The Controls Network shall support operation monitoring, scheduling, error email distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using BACnet® interfaces. The below figure illustrates a sample control network System Configuration.
17. Remote Controllers: Provide remote wired backlit controllers for all indoor evaporators.
18. Centralized Controller: The Centralized Controller shall be capable of controlling a maximum of 50 indoor units across multiple outdoor units. The Centralized Controller shall be approximately 8-1/2"x10" in size and shall be powered from a built-in power supply to the network transmission line. The Centralized Controller shall support operation superseding that of the remote controllers, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring. The Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic control set of operation controls for the Centralized Controller shall include on/off, operation mode selection (cool, heat, auto, dry, and fan), temperature setting, fan speed setting, and airflow direction setting. Since the GB-50ADA provides centralized control it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the GB-50ADA Centralized
 - a. Controller shall allow the user to define both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, vane, direction, fan speed, and permit/prohibit of remote controllers.

(Suggested Centralized Controller Settings Basis of Design)			
Item	Description	Operation	Display
ON/OFF		Each Block, Group or Collective	Each Group or Collective
Operation Mode	Switches between Cool/Dry Dry/Auto/Fan/Heat.	Each Block, Group or Collective	Each Group
Temperature Setting	Sets the temperature for a single group. Range of temperature setting from 57°F – 87°F dependent on operation mode and indoor unit model.	Each Block, Group or Collective	Each Group

(Suggested Centralized Controller Settings Basis of Design)			
Item	Description	Operation	Display
Fan Speed Setting	Models with 5 air flow speed settings: Hi/Mid-2/Mid-1/Low, Auto Models with 4 air flow speed settings: Hi/Mid-2/Mid-1/Low Models with 3 air flow speed settings: Hi/Mid/Low Models with 2 air flow speed settings: Hi/Low * Fan speed setting (including Auto) varies depending on the indoor unit model.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	Air flow direction angles, 4-angle or 5-angle Swing, Auto *1: Louver cannot be set. *Air flow direction settings vary depending on the indoor unit model.	*1 Each Block, Group or Collective	Each Group
Schedule Operation	Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized startup setting is also available. *2: The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can be scheduled per day, including ON/OFF, Mode, Temperature Setting, Operation Prohibition, Vane Direction, and Fan Speed. Two types of weekly schedule(Summer/Winter) can be set. Settable items depend on the functions that a given air conditioning unit supports.	*2 Each Block, Group or Collective	Each Group
Optimized Startup	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collective
Night Setback Setting	The function helps keep the indoor temperature in the temperature range while the units are stopped and during the time this function is effective.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *3: Centrally Controlled is displayed on the remote controller for prohibited functions.	Each Block, Group or Collective	*3 Each Group
Indoor Unit Intake Temp	Measures the intake temperature of the indoor unit when the indoor unit is operating.	N/A	Each Group
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed *4 When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection	N/A	*4 Each Unit or Collective

(Suggested Centralized Controller Settings Basis of Design)			
Item	Description	Operation	Display
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between "Hi", "Low" and "Stop". When setting a group of only free plan LOSSNAY units, you can switch between "Normal ventilation", "Interchange ventilation" and "Automatic ventilation".	Each Group	Each Group
Interlock	Operation of indoor groups or general equipment can be interlocked by the change of state (ON/OFF, mode, error of indoor groups/general equipment). (GB-50 will execute interlocking control depending on the interlocked setting.)	N/A	N/A
Multiple Language	Other than English, the following language can be chosen. Spanish, French, Japanese, Dutch, Italian, Russian, Chinese, and Portuguese are available.	N/A	N/A
External Input / Output	By using accessory cables you can set and monitor the following. Input By level: "Batch start/stop", "Batch emergency stop" By pulse: "batch start/stop", "Enable/disable remote controller" Output: "start/stop", "error/Normal" *5: Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collective
Collective ON/OFF	All the units can be operated / stopped with a DIP switch.	Collective	Collective (7 SEG)
Data back-up (USB Memory)	The initial setting data, operation data (charge parameter) can be stored to a USB memory. Initial setting data can be read from USB memory.	N/A	N/A

- 1) All Centralized Controllers shall be equipped with one Ethernet port to support interconnection with a network PC via a closed/direct Local Area Network (LAN). The Centralized Controller shall be capable of performing initial settings via a PC using the Centralized Controller's initial setting browser.
- 2) Standard software functions shall allow the building manager to securely log into each Centralized Controller via the PC's web browser to support operation monitoring, scheduling, error email, and online maintenance diagnostics. Standard software functions shall not expire.

19. Control Network: System Integration

- a. The Control Network shall be capable of supporting integration with Building Management Systems (BMS) via our LonWorks® and BACnet® interfaces.
- b. BACnet® Interface. The interface, shall be compliant with BACnet® Protocol (ANSI/ASHRAE 135-2004) and be Certified by the (BTL) BACnet® Testing Laboratories. The BACnet® interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address. HVAC contractor and ATC Contractor shall coordinate BMS system protocol requirements for integration into existing Automated Logic BMS System.

20. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Toshiba/Carrier
 - b. Mitsubishi CityMulti
 - c. Hitachi
 - d. Or Equal.
 21. Written prior approval required for alternate VRF System Manufacturer.
 22. Written prior approved alternate manufacturer is required to coordinate any changes from the basis of design with all associated trades. Any additional costs associated with the alternate equipment shall be covered by the HVAC contractor or equipment manufacturer. No additional costs shall be incurred by the owner.
 23. Shop drawings shall be submitted in accordance with 013300. Submittals should include equipment cutsheet information, proposed piping design layout and list of materials. Submittals shall be prepared by an authorized system designer and distributor.
- 2.09 ENERGY RECOVERY VENTILATOR (Refer to Commissioning for additional contract requirements)
- A. General:
 1. The ERV unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, control circuit board and blowers with motors, filters, and insulated foam air guides. Each unit will have an automatic by-pass damper system for economic operation under certain conditions. The unit shall have factory installed control board with functions for local, remote, and optional control modes.
 - B. Unit Cabinet:
 1. The cabinet shall be fabricated of galvanized steel, and covered with polyurethane foam insulation as necessary with steel mounting points securely attached
 - C. Blowers:
 1. The unit shall be furnished with four (4) direct drive centrifugal blowers running simultaneously supplying and extracting air at the same rate for balanced ventilation air flow.
 2. The blower motors shall be a directly connected to the blower wheels and have permanently lubricated bearings.
 3. The blowers and motors shall be mounted for quiet operation.
 - D. Heat Exchanger
 1. The heat exchanger element shall be constructed of specially treated cellulous fiber membrane separated by corrugated layers to allow total heat (sensible and latent) energy recovery from the exhaust air to the supply air or from the supply air to the exhaust air as determined by design conditions.
 2. The element shall have protective filters installed at both the supply and exhaust sides with an access cover to allow easy maintenance.
 - E. Bypass Damper
 1. The ERV shall have an automatic supply side by-pass damper to allow inbound ventilation air to by-pass the energy transfer core when outside weather conditions warrant.

2. The mechanism for opening and closing the bypass damper shall be a 208V-230V synchronous electric motor through an actuator. The motor will drive a steel cable connected to an mechanical damper flap to allow fresh air to bypass the Heat Exchanger element.
3. Supply and return air thermistor shall control the damper and may be interlocked with an LCD remote controller.

F. Filter

1. The ERV shall be equipped with factory installed MERV-6 air filters located at each intake face (both supply and exhaust sides) of the core to clean the air and prevent clogging.

G. Mounting

1. Mounting of the ERV shall be as indicated in the plans and drawings. The ERV shall not require and condensate pan or receptacle nor condensate drain or piping. Mounting may be horizontal or vertical and the unit may be inverted as required by ductwork connection.

H. Electrical

1. The units will require a 208-230Volt, 1 Phase, 60Hz power supply.

I. Control

1. Independent control by contact closure from ATC contractor.

- J. The units shall have a manufacturer's parts and defects warranty for a period one (1) year from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

- K. The Energy Transfer Core shall have an additional nine (9) year warranty against defects in material or workmanship. The total warranty period shall be ten (10) years from date of installation.

- L. Manufacturer: Subject to compliance with requirements, provide cabinet heaters of one of the following:

1. Mitsubishi
2. Renewaite
3. Greenheck
4. Or equal

2.10 TERMINAL HEATING UNITS (ELECTRIC)

A. Electric Radiant Heating Ceiling Panels

1. The electric ceiling heating panel shall be as manufactured by QMark, A Division of Marley Engineered Products, Bennettsville, SC. The construction and design shall permit it to be: recessed ceiling mounted with the use of Recessed Mounting Kit, fit into standard or custom designed modules of a T-bar suspended ceiling, or surface mounted with the use of a Surface Mounting Kit. Panels shall include the custom features listed below.

2. HEATING ASSEMBLY: The heating assembly shall be UL Listed and CSA Certified and shall consist of powdered graphite encapsulated in a plastic laminate with heavy duty copper buss bars running the entire length, backed by 1 inch, 1 pound density high temperature fiberglass insulation to insulate against heat loss to the ceiling and separated from the inside of the panel by a dielectric insulation to assure uniform heat transfer throughout the entire radiating surface of the heater. The rated input shall be: (62.5 watts/sq. ft. with an average temperature of not more than 165 degree F.) or (95 watts/sq. ft. with an average surface temperature of 200 degree F.), to assure long trouble free life.
3. The panel voltage shall be 277.
4. WIRING: For connection to the main power supply, the heater shall be completely prewired, with the lead wires housed in a 48 inch length of flexible metal conduit and connector for J-Box mounting. Appropriate wiring diagrams shall appear on the back of the panel.
5. PANEL ASSEMBLY: The metal heating panel, containing the completely prewired heating assembly, shall be of 22 gauge formed galvanized steel front and 24 gauge formed galvanized steel back. Sides are overlapping front and back panels riveted together.
6. FINISH: The front of the heating panel shall be QMark's unique multi-faceted crystalline type surface finished with high temperature silicone paint.
7. Manufacturers: Subject to compliance with requirements, provide electric radiant heating panels of one if the following:
 - a. Qmark
 - b. Chromalox Div.; Emerson Electric Co.
 - c. Federal Pacific Electric Co.
 - d. Gould Inc.
 - e. Markel Nuton Div.; Scoville Inc.
 - f. TPI Corporation.
 - g. Or Equal.

B. Electric Radiant Wall Panels

1. HEATING ASSEMBLY: The heating assembly shall be UL Listed and CSA Certified and shall consist of powdered graphite encapsulated in a plastic laminate with heavy duty copper buss bars running the entire length, backed by 1 inch, 1 pound density high temperature fiberglass insulation to insulate against heat loss to the ceiling and separated from the inside of the panel by a dielectric insulation to assure uniform heat transfer throughout the entire radiating surface of the heater. The rated input shall be: (62.5 watts/sq. ft. with an average temperature of not more than 165 degree F.) or (95 watts/sq. ft. with an average surface temperature of 200 degree F.), to assure long trouble free life.
2. The panel voltage shall be 208.
3. WIRING: For connection to the main power supply, the heater shall be completely prewired, with the lead wires housed in a 48 inch length of flexible metal conduit and connector for J-Box mounting. Appropriate wiring diagrams shall appear on the back of the panel.
4. PANEL ASSEMBLY: Welded steel construction and advanced powder coat finishes provide for long-lasting durability for both commercial and residential applications.
5. Manufacturers: Subject to compliance with requirements, provide electric radiant heating panels of one if the following:
 - a. Runtal
 - b. Q-Mark.
 - c. Federal Pacific Electric Co.
 - d. Gould Inc.
 - e. Markel Nuton Div.; Scoville Inc.
 - f. TPI Corporation.
 - g. Or Equal.

- 2.11 POWER AND GRAVITY VENTILATORS (Refer to Section 018100 Commissioning for additional contract requirements)
- A. General: Except as otherwise indicated, provide standard prefabricated power and gravity ventilator units of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation.
- B. Refer to Division-23 automatic temperature control for control sequence.
- C. Roof Fans (EF)
1. Type: Centrifugal fan, direct or belt driven as scheduled. Provide aluminum, or galvanized steel, weatherproof housings as scheduled. Provide square base to suit roof curb. Provide permanent split-capacitor type motor for direct driven fans; capacitor-start, induction-run type motor for belt driven fans.
 2. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.
 3. Bird Screens: Provide removable bird screens, 1/2" mesh, 16-ga. aluminum or brass wire.
 4. Gravity Operated Dampers: Provide gravity-actuated, felt edge, louvered dampers in curb bases.
 5. Motor Operated Dampers: Provide louvered dampers with linkage below curb base (maximum of 6").
 6. Manufacturer: Subject to compliance with requirements, provide centrifugal roof ventilators of one of the following:
 - a. Twin City.
 - b. Cook Co., Loren.
 - c. Greenheck Fan Corp.
 - d. Penn Ventilator Co., Inc.
 - e. Power Line Fans; Div. of Torin Corp.
 - f. Or equal.
- D. BELT DRIVE ROOF OR SIDEWALL UPBLAST CENTRIFUGAL EXHAUST FANS
1. Discharge air directly away from the mounting surface.
 2. Upblast fan shall be for roof mounted applications for fan sizes 099-480 or wall mounted applications for fan sizes 099-300.
 3. Performance capabilities up to 30,000 cubic feet per minute (cfm) and static pressure to 5 inches of water gauge.
 4. Fans are available in fourteen sizes with nominal wheel diameters ranging from 9 inches through 48 inches (098 - 480 unit sizes).
 5. Maximum continuous operating temperature is 400 Fahrenheit (204.4 Celsius)
 6. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number
- E. Wheel:
1. Material Type: Aluminum
 2. Non-overloading, backward inclined centrifugal wheel
 3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
 4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
- F. Motors:
1. AC Induction Motor
 - a. Motor Enclosure: Open drip proof (ODP) - opening in the frame body and or end brackets

- b. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase
 - c. Mounted on vibration isolators, out of the airstream
 - d. For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants
 - e. Accessible for maintenance
- G. Shaft and Bearings:
- 1. Fan Shaft shall be ground and polished solid steel with an anti-corrosive coating
 - 2. Permanently sealed bearings or pillow block ball bearings
 - 3. Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed
 - 4. Bearings are 100 percent factory tested
 - 5. Fan Shaft first critical speed is at least 25 percent over maximum operating speed
- H. Housing:
- 1. Constructed of heavy gauge aluminum includes exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable
 - 2. Housing shall have a rigid internal support structure
 - 3. Windband to be one piece uniquely spun aluminum construction and maintain original material thickness throughout the housing
 - 4. Windband to include an integral rolled bead for strength
 - 5. Curb cap base to be fully welded to windband to ensure a leak proof construction. Tack welding, bolting, and caulking are not acceptable
 - 6. Curb cap to have integral deep spun inlet venturi and pre-punched mounting holes to ensure correct attachment to curb
 - 7. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators
 - 8. Breather tube shall be 10 square inches in size for fresh air motor cooling, and designed to allow wiring to be run through it
- I. Vibration Isolation:
- 1. Double studded or pedestal style true isolators
 - 2. No metal to metal contact
 - 3. Sized to match the weight of each fan
- J. Disconnect Switches:
- 1. NEMA rated: NEMA 1: indoor application no water. Factory standard.
 - 2. Positive electrical shut-off
 - 3. Wired from fan motor to junction box installed within motor compartment
- K. Drive Assembly:
- 1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower
 - 2. Belt: Static free and oil resistant
 - 3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts
 - 4. Motor pulleys are adjustable for final system balancing
 - 5. Readily accessible for maintenance
- L. Drain Trough:
- 1. Allows for one-point drainage of water, grease, and other residues

M. Required Options/Accessories:

1. Auto Belt Tensioner:
 - a. Automatic tensioning device that adjusts for the correct belt tension, only for single drives

N. Centrifugal Ceiling Fans (EF)

1. Provide AMCA Certified Ratings Seal.
2. Type: Provide galvanized steel housing lined with acoustical insulation, adaptable for ceiling or wall installation. Provide centrifugal fan wheels mounted on motor shaft with fan shrouds, all removable for service. Provide integral backdraft damper fan discharge.
3. Grille: Provide stainless steel or painted aluminum louvered grille with flange on intake with thumbscrew attachment to fan housing.
4. Motor: Provide permanent split-capacitor motor, permanently lubricated, with grounded cord and plug.
5. Electrical: Provide junction box for electrical connection on housing, and receptacle for motor plug-in.
 - a. Furnish built-in fan speed control, for balancing purposes, of the solid state type capable of controlling fan speed from full speed to approximately half speed.
6. Accessories: Provide manufacturer's standard roof jack, wall cap, and transition fittings as indicated on drawings or schedules.
7. Manufacturer: Subject to compliance with requirements, provide centrifugal ceiling exhausters of one of the following:
 - a. Twin City
 - b. Cook Co., Loren.
 - c. ILG Industries.
 - d. Penn Ventilator Co. Inc.
 - e. Power Line Fans.
 - f. Greenheck Fan Corp.
 - g. Or equal.

O. Prefabricated Roof Curbs:

1. Manufacturer of ventilating unit shall provide his standard roof curb compatible with unit being provided. Curb shall be insulated and sloped to allow for level installation of device. Provide all necessary nailers, cants, etc. for a complete installation.

2.12 METAL DUCTWORK (Refer to Section 018100 Commissioning for additional contract requirements)

A. Reference Standards: Material, construction and installation shall meet requirements of most recent editions of the following standards and references, except for more stringent requirements specified or shown on Drawings:

Standard	As Applicable To:
SMACNA HVAC Duct	Sheet Metal Ductwork;
Construction Standards	Duct Liners; Adhesives;
Metal and Flexible	Fasteners; Flexible Ductwork.
SMACNA HVAC Air Duct Leakage Test Manual	Duct Leakage Testing

SMACNA Fibrous Glass Duct	Fibrous Glass Ductwork; Tapes
Construction Standards	
SMACNA Thermaoplastic Duct (PVC)	PVC Ductwork
Construction Manual	
ADC and TIMA Flexible Duct	Flexible Ductwork
Performance Standards	
NFPA 96	Kitchen Hood Exhaust Ductwork
NFPA 45	Laboratories using chemicals
SMACNA Guidelines for Welding	Welded Galvanized, Black Iron
Sheet Metal	and Stainless Steel Ductwork

B. General

1. Provide supporting and hanging devices necessary to attach entire HVAC system including ductwork and equipment, and to prevent vibration.
2. Provide vertical and horizontal supports as required by codes to meet minimum applicable earthquake resistance standards.
3. Ductwork shall be free from vibration under all conditions of operation. Dimensions shown on Drawings for lined ductwork are net inside dimensions. Increase ductwork to accommodate lining requirements.
4. Pipe or conduit crossing duct:
 - a. No pipe, conduit, hanger, Architectural element nor structural member shall pass through duct without Designer's written approval.
 - b. Where it is impossible to re route pipe or conduit and when written approval has been obtained, increase duct size to maintain constant cross sectional area at point of interference. Provide streamlined enclosure for pipe or conduit, as illustrated in SMACNA.
5. When making offsets and transformations necessary to accommodate structural conditions, preserve full cross sectional area of ductwork shown on Drawings.

C. Ductwork shall have pressure velocity classifications as follow:

DUCT CONSTRUCT- ION CLASS	STATIC PRESSURE RATING	PRESSURE	SMACNA SEAL CLASS	SMACNA LEAKAGE CLASS	VELOCITY
4"	4"	Pos.*	A	3	4000 fpm or less
3"	3"	Pos. or Neg.	A	3	4000 fpm or less
2"	2"	Pos. or Neg.	A	6	2500 fpm or less
1"	1"	Pos. or Neg.	A	6	2500 fpm or less
½"	½"	Pos. or Neg.	A	6	2000 fpm or less

*for negative pressures over 3" w.g., refer to SMACNA Round and Rectangular Industrial Duct Construction Standards for joint and intermediate reinforcement requirements.

1. Ductwork shall have pressure velocity classifications as follow:

DUCT CONSTRUCTION CLASS	STATIC PRESSURE RATING	PRESSURE	SMACNA SEAL CLASS	SMACNA LEAKAGE CLASS	VELOCITY
4"	4"	Pos. *	A	6	4000 fpm or less
3"	3"	Pos. or Neg.	A	6	4000 fpm or less
2"	2"	Pos. or Neg.	B	12	2500 fpm or less
1"	1"	Pos. or Neg.	B	12	2500 fpm or less
½"	½"	Pos. or Neg.	B	12	2000 fpm or less

*for negative pressures over 3" w.g., refer to SMACNA Round and Rectangular Industrial Duct Construction Standards for joint and intermediate reinforcement requirements.

- a. Unless otherwise specified or shown on the drawings, the following pressure classifications shall be used for the construction of the ductwork listed below:
 1. 4" Class: All supply ductwork from discharge of air handling unit to inlets of induction units and ceiling mounted diffusers.
 2. 3" Class: All kitchen hood exhaust ductwork, all hood related exhaust ductwork and all return air ductwork.
 3. 2" Class: All other ductwork.

2. Sealing Requirements for Class A, Leakage Class 3, Galvanized, Non-Welded Aluminum or Non-Welded Stainless Steel Ductwork:
 - a. Transverse Joints
 1. During assembly seal all flanged transverse joints with sealing tape of quality equal to Hardcast Inc. 1902-FR. Corners shall be sealed as described by SMACNA and when applicable per manufacturer's published procedures. After sealant has cured, seal entire joint with Hardcast Inc. RTA-50 adhesive on to Hardcast Inc. DT tape or approved equal.
 2. Seal all non-flanged transverse joints with Hardcast Inc. RTA-50 adhesive on to Hardcast Inc. DT tape or approved equal.
 - b. Longitudinal Seams
 1. Seal all longitudinal seams during ductwork fabrication with Hardcast Inc. Cold Seal 1001 or approved equal.
 - c. Joints and Ductwall Penetrations
 1. Seal all duct joints at takeoffs, access doors, damper bearing penetrations, flexible duct connections etc., with Hardcast Inc. Versa Grip 102 or approved equal.
 2. Note, access doors and damper rod penetrations shall be equipped with proper hardware for sealing.

3. Sealing Requirements for Class A, Leakage Class 6, Galvanized, Non-Welded Aluminum or Non-Welded Stainless Steel Ductwork.
 - a. Transverse Joints
 1. During assembly seal all flanged transverse joints with sealing tape of quality equal to Hardcast Inc. 1902-FR. Corners shall be sealed as described by SMACNA and when applicable per manufacturer's published procedures.
 2. Seal all non-flanged transverse joints with Hardcast Inc. Versa Grip 102 or approved equal.
 - b. Longitudinal Seams
 1. Seal all longitudinal seams during ductwork fabrication with Hardcast Inc. Cold Seal 1001 or approved equal.

- c. Joints and Ductwall Penetrations
 - 1. Seal all duct joints at takeoffs, access doors, damper bearing penetrations, flexible duct connections etc., with Hardcast Inc. Versa Grip 102 or approved equal.
- 4. Sealing Requirements for Class B, Leakage Class 12, Galvanized, Non-Welded Aluminum or Non-Welded Stainless Steel, Ductwork.
 - a. Transverse Joints
 - 1. During assembly seal all flanged transverse joints with sealing tape of quality equal to Hardcast Inc. 1902-FR. Corners shall be sealed as described by SMACNA and when applicable per manufacturer's published procedures.
 - 2. Seal all non-flanged transverse joints with Hardcast Inc. Versa Grip 102 or approved equal.
 - b. Longitudinal Seams
 - 1. Seal all longitudinal seams during ductwork fabrication with Hardcast Inc. Cold Seal 1001 or approved equal.
- 5. Support
 - a. Space hangers as required by SMACNA (8 ft max) for horizontal duct on 8 ft. centers, unless concentrated loadings require closer spacing.
 - b. Support vertical duct on each floor or slab it penetrates.
 - c. Supports for ductwork and equipment shall be galvanized unless specified otherwise.
- 6. Connections
 - a. Connect inlets and outlets of air handling units and fans to ductwork with flexible connections unless fan has vibration isolator mounts inside unit with flexible connections and no external vibration isolators. Exception: Do not use flex on life safety smoke exhaust fans.
 - b. Indoors, flexible connections shall be neoprene coated fibrous glass fire retardant fabric, by Ventfabrics, or Durodyne. Outdoors, flexible connections shall be Dupont hypalon coated fibrous glass fire, weather, and UV resistant by Ventfabrics or Durodyne.
 - c. Secure flexible connections tightly to air handlers with metal bands. Bands shall be same material as duct construction.
 - d. Connections from trunk to branch ducts shall be as detailed on Drawings.
- 7. Construction
 - a. No sharp metal edges shall extend into air streams.
 - b. Install drive slips on air leaving side of duct with sheet metal screws on 6" centers.
 - c. Spin in collars shall NOT be used for branch connections in 3" or higher pressure class ductwork.
- 8. Joints
 - a. Longitudinal lock seams shall be double locked and flattened to make tight joints.
 - b. Make transverse joints, field connections, collar attachments and flexible connections to ducts and equipment with sheet metal screws or bolts and nuts. Do not use rivets and staples.
- 9. Prefabricated Transverse Duct Joints
 - a. Transverse joints in galvanized sheet metal ductwork may be made with galvanized gasketed frame and angle duct joint system by Ductmate, TDF, TDC or approved equal. Angles shall be at least 20 gauge. Prefabricated transverse duct joints shall not be used for duct 16 GA. and heavier, nor for duct 23 GA. or lighter.

- b. Secure angles to duct with screws (using clutched arbor) or spot welds spaced as recommended by manufacturer for duct pressure class.
10. Elbows and Bends
- a. Elbows and bends for rectangular ducts shall have centerline radius of 1 1/2 times duct width wherever possible. Elbows for grease exhaust and fume hood exhaust shall be full radius. Vanes or mitered duct are not allowed.
- b. Where centerline radius is less than 1 1/2 times duct width (on supply, return and exhaust ductwork), elbows shall be radius throat (square throat allowed when turning around column or other close objects) with radius heel. For elbows whose width is greater than 48 inches and/or where shown on plans, provide splitter vanes. Install vanes in accordance with SMACNA. Where multiple elbows are separated by less than ten duct diameters use splitter (full length) vanes.
- c. For round ductwork provide stamped elbows, with centerline radii equal to 1 1/2 times duct diameter, or gored elbows as follows:
- | Elbow Angle | No. of Gores |
|-------------|--------------|
| 0° - 36° | 2 |
| 37° - 72° | 3 |
| 73° - 90° | 5 |
- d. Elbows for flat oval ducts shall have centerline radii equal to 1 1/2 times duct diameter in plane of bend, or gored elbows with gores as specified for round ducts.
11. Access Panels/Doors
- a. Provide proper pressure and leakage rated, gasketed, duct mounted access panels/doors for the following items with minimum sizes, as indicated. Access doors shall be of double wall construction doors in insulated ducts shall be insulated. Gauges of door materials, no. of hinges, no. and type of door locks shall be as required by the SMACNA Duct Construction Standards. Hinged doors are not acceptable, screwed or bolted access panels are not acceptable. Doors shall be chained to frame with a minimum length of 6" to prevent loss of door. For seal Class A, access doors shall be leakage rated, neoprene gasketed UL 94 HF1 listed, DUCTMATE "sandwich" or approved equal. Door metal shall be the same as the attached duct material. For grease and high temperature ducts, door assembly shall be rated for 2300°F. The minimum sizes are:
1. Fire dampers 12" x 12", or larger.
 2. Combination Fire/Smoke dampers 12" x 12", or larger.
 3. Smoke dampers 6" x 6" minimum.
 4. Automatic control dampers 6" x 6" minimum.
 5. Manual volume dampers 2 sq. ft. and larger 6" x 6" minimum.
 6. Inlet side to all coils 12" x 12", or larger.
 7. Suction and discharge sides of inline fans 24" x 24" minimum.
 8. At additional locations indicated on drawings, or specified elsewhere 12" x 12" minimum.
- b. Generally, access doors are not shown on the drawings, but shall be provided in accordance with the above.
12. Extractors shall have adjusting rod and locknut on outside of duct.

13. Connections to roof fans:
 - a. Shall be at least 22 ga. galvanized steel soldered watertight.
 - b. Solder side seams at least 12" up from bottom.
 - c. Provide suitable dielectric gaskets to join dissimilar materials.

14. Plenums and connections to louvers:
 - a. Shall be 18 ga. minimum cross broken and properly reinforced with galvanized angle irons to SMACNA requirements.
 - b. Shall have bottom and corner seams soldered watertight at least 12" up from bottom.
 - c. Shall have neoprene gaskets or other non corrosible material to make connections to louvers watertight.
 - d. Shall pitch connection back towards the louver. Provide half coupling drain connection at bottom of plenum unless noted otherwise. Pipe drain to nearest floor drain.
 - e. Shall have unused portions of louvers blocked-off with sheet metal; sealed air and water tight; insulated with 2" thick 6 lb. density rigid or board insulation.

15. Duct Pressure Tests
 - a. Pressure test all duct classes after takeoffs and wall penetrations are in place and before applying exterior insulation. Correct any leaks.
 - b. Pressure and leak test 100% of all duct work with a pressure class of 3" or higher as specified in paragraph 2.19.B.7.a. Duct shall be constructed so there is no joint or structural failure at the test pressure.

16. Duct Leakage Tests
 - a. Leak testing method shall be performed as outlined in the SMACNA HVAC Air Duct Leakage Test Manual. As specified in paragraph 2.19.B.7 & a, utilize Sealing Requirements for Class A and Leakage Class 6 for all ductwork. Provide orifice assembly including straightening vanes, orifice plate mounted in straight tube with properly located pressure taps, and U tube manometer or other device as specified by SMACNA. Orifice assembly shall be calibrated accurately and shall come with calibration curve. Leakage classes shall be as previously specified. Submit leak test report (per SMACNA format) for Designer review. Drawings of ductwork tested shall also be submitted with report, indicating presence of takeoffs, wall penetrations, joints, etc.

17. Materials
 - a. Sheet metal ducts shall be constructed of hot dipped galvanized sheet metal with G90 Commercial coating according to ASTM 527 unless specified otherwise.
 - b. Stainless steel (SS) ductwork shall be 18 gauge for kitchen hoods, and hood related exhaust systems; and as required by SMACNA for other ducts. Materials shall be 316/No. 4 finish for exposed duct, 304/No. 1 finish for concealed ducts. Joints and seams shall be welded as required by SMACNA Guidelines for Welding Sheetmetal.
 - c. Aluminum ductwork shall be Alclad 3003 1414 or alloy 5052 H32, for locker room exhaust ductwork systems. Thickness as required by the SMACNA duct construction standards with Alloy 6061 bracing angles, and Pittsburgh lock longitudinal corner and double side seaming.

d. Flexible Ductwork

1. Flexible ductwork, connecting to uninsulated or unlined duct, shall be polyester core with corrosion resistant helical wire reinforcing. The polyester core shall be minimum two ply and shall have a minimum thickness of 0.0017". Flex duct shall be U.L. rated for 6" W.C. positive pressure, 2" W.C. negative pressure with a maximum velocity of 4000 FPM. Flexduct must be listed as a Class 1 Connector according to UL 181 and shall meet the requirements of NFPA 90A maximum ASTM E 84 fire hazard rating shall be 25 flame spread, 50 fuel contributed and 50 smoke developed. Uninsulated flexible duct shall be equivalent to Wiremold, Type WB, or Flexmaster Types 2 and 4 (not type 9).
2. Flexible duct connected to insulated or lined duct shall also be insulated and shall be equivalent to Wiremold Type WK or Flexmaster Types 2 or 4 (not type 9), with 1 1/2", 3/4 lb. density fiberglass insulation and an aluminized reinforced vapor barrier.
3. Submittals shall include data on no. of polyester plies and minimum thickness of polyester core, in addition to other data listed above required to ensure that submitted product meets the requirements of these specifications.
4. If flexduct other than the model numbers of the vendors listed above is submitted, a sample of the flex shall be submitted to the Designer. The Designer shall have sole discretion in determining whether the submitted flex is equivalent to that of the named vendors above.
5. Unless otherwise indicated, flexible duct shall not exceed 5'-0" long.

D. 2" and Lower Pressure Class Ductwork, Rectangular:

1. Ducts wider than 19" with more than 10 square feet of unbraced panel shall be beaded or cross broken.
2. Internal stiffening struts shall only be used upon prior written approval of the Designer.
3. Make changes in duct size with tapered connections as required by SMACNA. Changes shall NOT exceed 30° from line of air flow. Take off to the diffusers shall be 45° leading edge type or Bellmouth type.
4. Transverse joints shall be TDF/TDC or slip joints; use flat or standing seam according to SMACNA. Where duct size requires standing seam but space restrictions dictate flat seam, notify Designer prior to fabrication.

E. 2" and Lower Pressure Class Ductwork, Round:

1. Joints
 - a. Longitudinal joints shall be spiral seam, butt welded, lap and seam welded, or ACME lock grooved seam. Snap lock seams shall be used on 1/2" w.g. pressure class duct only.
 - b. Transverse joints shall be beaded sleeve joint or other approved joints listed in SMACNA. Use three or more sheet metal screws at 15" uniform intervals along circumference of joints.
2. Branch fittings shall be conical tee (Buckley or equal) or combination tee as shown in SMACNA.

F. 3" and 4" Pressure Class Ductwork Rectangular

1. Joints
 - a. Joints shall be prefabricated type by TDC, TDF or Ductmate. See Prefabricated Joints paragraph for specific requirements.
2. Duct reinforcement spacing and type shall comply with SMACNA.
3. Ductwork on both sides of transitions shall be run in same horizontal axis.

4. Diverging section slope shall be 1 1/2" per foot or less if possible.
 5. Contraction section slope shall not exceed 7" per foot.
 6. Takeoffs shall be 45° leading edge type except that Bellmouths (Buckley or equal) may be used for takeoffs to terminal boxes if the distance between the box and point of takeoff is less than 8 ft.
 7. Ducts with an aspect ratio greater than 3:1 shall be minimum of 18 gauge unless a thicker gauge is required by SMACNA.
- G. 3" and 4" Pressure Class Ductwork, Flat Oval, Single Wall
1. Joints
 - a. Ducts shall have spiral lock seams or longitudinal seams. Seams and joints in fittings shall be continuously welded. If coating is damaged during welding, repair joints to prevent corrosion.
 - b. Transverse joints shall be slip or flanged.
- H. 3" and 4" Pressure Class Ductwork, Round, Single Wall
1. Joints
 - a. Longitudinal seams shall be lock spiral, lock longitudinal or butt welded longitudinal.
 - b. Transverse joints shall be slip joints. Draw band joints shall be used on longitudinal seam duct only. Loose flange Vanstone joints may be used on ducts over 36" in diameter.
 - c. Seams and joints in fittings shall be continuously welded. If coating is damaged during welding, repair joints to prevent corrosion.
 2. Branch fittings shall be conical tee or combination tee as detailed in SMACNA.
- I. Flexible Rigid Duct
1. Flexible ductwork shall be Flexmaster Triple Lock Buck Duct Flexible Air Duct (insulated) as manufactured by Buckley Associates or equal (617 878 5000). Flexible duct, non insulated, shall be Underwriters Laboratory Listed UL 181 Class 0 air duct and constructed in accordance with NFPA Standards 90A and 90B. It shall have a smoke/flame spread rating of 50/25.
 2. Duct shall be made from a tape of dead soft aluminum sheet, spiral wound into a tube and spiral corrugated to provide strength and stability. The joint shall consist of a triple lock mechanically performed without the use of adhesives to make a durable airtight seam. A double lock is not acceptable.
 3. Flexible duct connected to insulated or lined duct shall also be insulated. Flexmaster insulated flex shall have a gray Fire Retardant Polyethylene outer jacket with a ½ lb. density, 1 1/2" thick fiberglass insulation blanket, factory wrapped. Flexible Duct, insulated, shall be Underwriters Laboratory Listed and constructed in accordance with NFPA standards 90A and 90B. It shall have a smoke/flame spread rating of 50/25.
 4. The flexible duct shall be supported as required.
 5. Flexible duct work shall be rated at 12" positive pressure. Duct from 3 to 16" shall have a negative pressure of 12", 8" for duct work 18 and 20.
 6. All flexible duct shall be individually cartoned and labeled for delivery to the job site for maximum protection.
 7. Submittals shall include data on minimum thickness of aluminum core, in addition to other data listed above, required to ensure that submitted product meets the requirements of these specifications.
 8. Provide sealing compound for installation. See further paragraphs in this specification and details for other installation requirements.

J. Volume Dampers

1. Provide Young Regulator manual adjustable rectangular opposed blade dampers for duct heights less than 12" with factory installed locking hand quadrants extended 2" for all dampers installed in externally insulated duct:
 - a. On each supply, return and general exhaust duct take off.
 - b. At each take off to register, grille or diffuser (not all are shown on Drawing).
2. Dampers are manufactured approximately 5/16" smaller in width and 1/8" smaller in height than size of duct in which they are installed; e.g., nominal damper size is 24" x 10"; actual size is approximately 23 11/16" x 9 7/8".
3. Damper frame shall be constructed of #6063 extruded aluminum reinforced channel with minimum thickness of .050". Opposed damper blades shall be #6063 extruded aluminum with minimum thickness of .050" and shall include reinforcing ribs. Each blade shall be supported in the damper frame by individual Teflon axle bearings, and shall be driven by stainless steel connecting slide linkage controlled by 3/8" square steel control shaft.
4. Note: All required volume dampers may not be indicated on drawings but dampers shall be provided as necessary for systems balancing.
5. Dampers 12" and larger in height shall be opposed multi blade equal to Greenheck, Nailor, or Vent Products.
6. Where dampers are inaccessible, use Young Regulator locking type ceiling regulators and miter gear or worm gear for all horizontal dampers. Bearing coupling for bottom duct control may be used for shaft on vertical blade dampers. The 3/8" rod between ceiling regulator and damper shall be provided by contractor.
7. Damper blades shall be two gauges heavier than adjoining ductwork, and shall be riveted to supporting rods. Hem over edges parallel to rods.
8. Brackets shall be galvanized metal, secured to ductwork with sheet metal screw with locking quadrant arms (see seal class section for additional requirements). Provide 2" handle extension for all dampers on externally insulated ductwork.
9. Note: All required volume dampers may not be indicated on Drawings but dampers shall be provided as necessary for system balancing.

K. Automatic Dampers: Install automatic dampers furnished under Automatic Temperature Control Paragraph of this Section, as shown on Drawings, and as specified. Provide sealed wall penetrations for Seal Class A ductwork.

L. Locker Room Exhaust or Return Ductwork

1. Ductwork shall be aluminum, of types as detailed in this specification above and constructed in accordance with SMACNA except that Seal Class shall be "A" regardless of duct pressure rating.

M. Branch Duct Take off Fittings

1. Contractor shall provide Buckley Bellmouth Take offs at all branch duct locations.
2. Bellmouth Fitting shall be Model BMD with damper. In areas where sufficient duct height is not available, the contractor shall provide the Buckley Mini mouth fitting, Model M BMD with damper or the flat oval Bellmouth, Model FOBMD with damper.
3. Bellmouths shall be constructed of heavy duty galvanized steel. Bellmouths shall include an air tight Neoprene gasket to ensure a tight fitting with minimal leakage. Pre drilled holes shall be provided for quick mounting. Bellmouth shall be as manufactured by Buckley Associates or equal (617 878 5000).
4. Standard damper hardware to be constructed of 26 gauge galvanized material with a quadrant damper and tight fitting gasketing to ensure minimal leakage at damper pivot points.
5. Optional heavy duty hardware shall be provided at locations of higher static pressure where shown on the drawings.

6. Ninety degree take offs are not permitted on this project..
- 2.13 DUCTWORK ACCESSORIES (Refer to Section 018100 Commissioning for additional contract requirements)
- A. Dampers:
1. Low Pressure Manual Dampers: Provide dampers of single blade type or multiblade type, constructed in accordance with SMACNA "HVAC Duct construction Standards".
 2. Automatic Control Dampers: Refer to Division-23 section "Automatic Temperature Control" for control dampers; not work of this section.
 3. Backdraft Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at .05" static pressure. Construct blades of 16-ga. aluminum, provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Construct from 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under: 4" x 1-1/4" x 16 ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up. Provide felted or rubber trim to assure tight, leak-proof seal when closed.
 4. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
 - a. Air Balance, Inc.
 - b. Airguard Corp.
 - c. American Warming & Ventilating, Inc.
 - d. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.
 - e. Louvers & Dampers, Inc.
 - f. Penn Ventilator Co.
 - g. Ruskin Mfg. Co.
 - h. Or equal.
- B. Fire Dampers:
1. Fire Dampers: Provide fire dampers, of types and sizes indicated. Construct casings of 11-ga. galvanized steel. Provide fusible link rated at 160 to 165 degrees F (71 to 74 degrees C) unless otherwise indicated. Provide out of air stream type damper in open position and with positive lock in closed position, and with the following additional features:
 - a. Damper Blade Assembly: Curtain type.
 - b. Blade Material: Steel, match casing.
 - c. Blade Material: Stainless steel.
 2. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:
 - a. Air Balance, Inc.
 - b. American Warming & Ventilating, Inc.
 - c. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.
 - d. Louvers & Dampers, Inc.
 - e. Penn Ventilator Co.
 - f. Phillips-Aires
 - g. Ruskin Mfg. Co.
 - h. Or equal.
- C. Turning Vanes:
1. Manufactured Turning Vanes: Provide double thickness airfoil turning vanes constructed of 1-1/2" wide curved blades set at 3/4" o.c., supported with bars perpendicular to blades set at 2" o.c, and set into side strips suitable for mounting in ductwork.

2. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
 - a. Aero Dyne Co.
 - b. Airsan Corp.
 - c. Anemostat Products Div.; Dynamics Corp. of America.
 - d. Barber-Colman Co.
 - e. Duro Dyne Corp.
 - f. Environmental Elements Corp.; Subs, Koppers Co., Inc.
 - g. Hart & Cooley Mfg. Co.
 - h. Register & Grille Mfg. Co., Inc.
 - i. Souther, Inc.
 - j. Or equal.
- D. Duct Hardware:
1. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
 - a. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
 - b. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
 2. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
 - a. Ventfabrics, Inc.
 - b. Young Regulator Co.
 - c. Duro Dyne
 - d. Or equal.
- E. Duct Access Doors:
1. General: Provide duct access doors of a size as required to service and maintain device in duct. Provide on (1) access door at each control damper, humidifier, coil, fire damper, and any device that requires attention.
 2. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors.
 3. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
 - a. Air Balance, Inc.
 - b. Duro Dyne Corp.
 - c. Register & Grille Mfg. Co., Inc.
 - d. Ruskin Mfg. Co.
 - e. Ventfabrics, Inc.
 - f. Zurn Industries, Inc.; Air Systems Div.
 - g. Or equal.
- F. Flexible Connectors:
1. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibration of connected equipment.

2. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
 - a. American/Elgen Co.; Energy Div.
 - b. Duro Dyne Corp.
 - c. Flexaust (The) Co.
 - d. Ventfabrics, Inc.
 - e. Or equal.
- 2.14 AIR OUTLETS AND INLETS (Refer to Section 018100 Commissioning for additional contract requirements)
- A. Ceiling Air Diffusers:
1. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation. Stamped face diffusers will not be acceptable.
 2. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw, drop and noise criteria ratings for each size device as listed in manufacturer's current data.
 3. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
 4. Types: Provide ceiling diffusers of type, capacity, throw, blow and with accessories as listed on diffuser schedule.
 - a. Ceiling Diffusers shall be of the restricted multi-orificed jet induction and air mixing type consisting of louver sections with built-in diffusing vanes. The vanes shall be arranged to discharge air from adjacent louvers at an angle of 45 degrees in opposite directions to insure rapid mixing of primary and room air. Diffusing vanes shall be welded and mechanically fastened to the adjacent louver sections to make a rigid unit. The vanes shall extend to the discharge edges of the louvers. Where louver sections join the core frame, the louver ends shall be welded to the core frame. The leading edge of each louver shall be hemmed and the louver ends shall be rounded and hemmed before welding to the core frames.
 - b. Diffusers shall be fabricated of aluminum or steel-welded construction, and shall be provided with a removable core permitting easy access to the neck connection. The diffuser neck shall extend no less than 1" above the core to accommodate an internal duct connection to prevent leakage into the ceiling space.
 - c. Finish shall be baked enamel. Color as selected by A/E.
 5. Diffuser Dampers:
 - a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of diffuser. Provide in each ceiling diffuser.
 6. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
 - a. Tuttle & Bailey Agitair Series
 - b. Price
 - c. Nailor
 - d. Or equal

B. Wall Registers and Grilles:

1. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
2. Performance: Provide registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
3. Compatibility: Provide registers and grilles with border styles that are compatible with adjacent systems, and that are specifically manufactured to fit into wall and ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of construction which will contain each type of register and grille.
4. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule:
5. Pattern: Register and grille patterns shall have style as identified on Drawings.
6. Dampers: Opposed Blade adjustable assembly, key operated from face of register.
7. Accessories:
 - a. Plaster Frame: Perimeter frame designed to act as plaster stop and register or grille anchor. Provide where required.
 - b. Operating Keys: Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustment.
8. Finish: Register and Grille Finishes shall be baked enamel color as selected by the Architect.
9. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one the following:
 - a. Agitair (Air Devices)
 - b. Price
 - c. Nailor
 - d. Or equal

C. Ceiling Registers and Grilles:

1. General: Except as otherwise indicated, provide manufacturer's standard "Egg-Crate" type registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
2. Compatibility: Provide registers and ceiling grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling construction.
3. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.
4. Register and Grille Materials:
 - a. Aluminum Construction: Manufacturer's standard extruded aluminum frame and core.
5. Register and Grille Faces:
 - a. 1/2" x 1/2" "Egg-Crate" with 1" border frame.
6. Register and Grille Dampers:
 - a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of register (provide for registers only).
7. Register and Grille Finishes shall be baked enamel color as selected by the Architect.

8. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one of the following:
 - a. Titus
 - b. Price
 - c. Nailor
 - d. Or equal

2.15 WALL AND CEILING ACCESS DOORS

- A. Furnish access doors for access to all concealed control valves, motor operated dampers, fire doors, etc, and all other concealed parts of the HVAC system that require accessibility for the proper operation and maintenance of the system.
- B. Access doors shall be heavy gage steel with 1" frame. Door shall be fastened to frame with continuous piano hinge. Entire door and frame assembly shall be prime painted and be completed with cylinder lock and two (2) keys. Door and frame shall match fire rating of wall or ceiling installed into.
- C. Manufacturer: Subject to compliance with requirements, provide access doors of one of the following:
 1. Inland Steel Products Company, "Milcor"
 2. Walsh-Hannon-Gladwin Inc., "Way Lector"
 3. Nystrom
 4. Or equal

2.16 FIRESTOPPING AND SEALANTS

- A. General
 1. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed. For applications where combustible penetrants are involved, i.e. insulated and plastic pipe, a suitable intumescent material must be used.
 2. This section specifically addresses pipe, duct, cable, and wiring penetrations of fire wall firestops and smoke stops for all bearing and non-bearing walls and floors assemblies.
- B. References
 1. American Society For Testing and Materials Standards (ASTM):
ASTM E 814: Standard Test method For Fire Tests of Through-Penetration Firestops
ASTM E84: Standard Test Method For Surface Burning Characteristics of Building Materials
 2. Underwriters Laboratories Inc.:
UL 1479 Fire Tests of Through-Penetration Firestops
UL 723 Surface Burning Characteristics of Building Materials
 3. UL Fire Resistance Directory:
Through Penetration Firestop Device (XHJI)
Fire Resistive Ratings (BXUV)
Through Penetration Firestop Systems (XHEZ)
Fill, Void, or Cavity Material (XHHW)

C. Definitions

1. Firestopping: The use of a material or combination of materials in a fire-rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on that wall or floor.
2. System: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s), constitutes a "System".
3. Barrier: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.
4. Through-Penetration: Any penetration of a fire-rated wall or floor that completely breaches the barrier.
5. Membrane-Penetration: Any penetration in a fire-rated wall that breaches only one side of the barrier.
6. Construction Gaps: Any gap, joint, or opening, whether static or dynamic, where the top of a wall may meet a floor; wall to wall applications, edge to edge floor configurations; floor to exterior wall; or any linear breach in a rated barrier. Where movement is required, the firestopping system must comply with UL2079 for dynamic joints.

D. Quality Assurance

1. Firestopping systems (materials and design):
2. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
 - a. The F rating must be a minimum of one (10 hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). the fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.
 - b. For joints, must be tested to UL2079 with movement capabilities equal to those of the anticipated conditions.
3. Firestopping materials and systems must be capable of closing or filling through openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).
4. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
5. Firestopping sealants must be flexible, allowing for normal pipe movement.
6. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
7. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
8. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).
9. Installation of firestopping systems shall be performed by a contractor (or contractors) trained or approved by the firestop manufacturer.
10. Material used shall be in accordance with the manufacturer's written installation instructions.

E. Materials

1. Intumescent Firestop Sealants and Caulks:
 - a. STI SpecSeal S100 and S500 Sealant
 - b. 3M Fire Barrier Caulk CP25WB+

2. Latex Firestop Sealant:
 - a. STI SpecSeal LC150 Sealant
3. Silicone Firestop Sealants and Caulks:
 - a. STI SpecSeal Pensil 100 and 300
 - b. 3M Fire Barrier Silicone Sealants
4. Firestop Putty:
 - a. STI SpecSeal Firestop Putty Bars and Pads
 - b. 3M Fire Barrier Moldable Putty
5. Firestop Collars:
 - a. STI SpecSeal Firestop Collars
 - b. 3M Fire Barrier PPD's
6. Wrap Strips:
 - a. SpecSeal Wrap Strip
 - b. 3M Fire Barrier FS195 Wrap Strip
7. 2-Part Silicone Firestop Foam:
 - a. STI SpecSeal Pensil 200
 - b. 3M Fire Barrier 2001 Silicone Foam
8. Firestop Mortar:
 - a. STI SpecSeal Mortar
9. Composite Board:
 - a. 3M Barrier Sheet Material
 1. Accessories:
 - a. Forming/Damming Materials: Mineral Fiberboard or other type as per manufacturer recommendation.

2.17 AUTOMATIC TEMPERATURE CONTROLS (DDC)

A. Basic Components and Systems:

1. General: Provide control products in sizes and capacities indicated, consisting of dampers, thermostats, clocks, sensors, controllers, and other components as required for completed installation. Except as otherwise indicated, provide manufacturer's standard materials and components as published in their product information, designed and constructed as recommended by manufacturer and as required for application indicated. All equipment and systems shall be installed by factory trained contractors with the following functional and construction features.
2. The building automation system shall be based on the Tridium Niagara AX platform. Tridium provides an open automation infrastructure that integrates diverse systems and devices (regardless of manufacturer, communication standard or software) into a unified platform that can be easily managed in real time using a standard Web browser. Systems not developed on the Tridium Niagara AX platform are unacceptable. The building automation system shall not require licensing fees and shall be licensed indefinitely to the Owner for use at the project site.
3. Provide all required control wiring including CAT6 Ethernet wiring for any controllers requiring Ethernet connectivity. Terminate Ethernet cable in MDF and IDF closets on patch panels proceed under Technology Section 270000.
4. Install an open-protocol (BACNet) energy management system (EMS) to monitor and trend the energy consumed by the following systems throughout the building:
 - a. HVAC systems
 - b. Hot and cold domestic water systems
 - c. Main electric service meter

- d. Main gas meters
5. The ATC control and building EMS system shall have the following attributes with characteristics and performance as specified within this Specification section, related Electrical and Plumbing section specifications and the Control Diagram drawings:
 - a. Sensors as follows:
 1. Sensors to trend outdoor air temperature
 2. Sensors to monitor and trend equipment status for all equipment with motors greater than 1/2 hp (and for lower motor hp sizes where indicated in specifications and drawings).
 3. Indication and trending of damper and valve commanded positions.
 4. Sensors to monitor building electrical and natural gas consumption. Main service electrical meters shall be provided by the Electrical Contractor and control wiring from the meter to the EMS system shall be provided by the ATC contractor. Gas meters shall be furnished and installed by the Plumbing contractor. The ATC contractor shall provide control wiring from the meter to the BMS. Flow meters for building cold water consumption will be installed by the Plumbing Contractor and furnished and wired to the BMS by the ATC Contractor. For the domestic hot water heaters, the ATC contractor shall provide relays on each domestic water heater burner and through BMS programming utilize burner on/off operation to determine domestic hot water consumption. Programming, wiring and components provided by the ATC Contractor.
 5. Sensors to monitor indoor and outdoor CO₂.
 6. Sensors to monitor and trend (create trend logs) controlled variables at the operator interface. Control variables may include air and/or water flow, temperature, pressure, CO₂, and pump or fan speed. Relevant multiplexed data from microprocessors located in chillers, boilers, variable speed drives and other equipment with multiplexing capabilities may be used in lieu of specifying separate sensors.
 - b. Points matrix – including all hardwired input and output devices connected to the automation system, all set points, upper and lower control limits.
 - c. Trend capabilities – including a trend point list and preprogrammed sample of point (performed by controls contractor), sample rate, storage interval, upload interval, custom trend abilities, alarms, and automated trend data review and notification (automated diagnostics).
 - d. System architecture – capable of allowing sampling of these points to facilitate building commissioning and diagnostics without significantly affecting system performance.
 - e. Data storage system – with adequate capacity to record trend data for use by building operators. Data export requirements must facilitate user-friendly data access and manipulation.
 - f. Operator interface – designed for remote/web access, monitoring requirements, trend-log reporting and diagnosing building problems through a user-friendly interface. This includes providing a visual (non text based) operations and reporting interface to facilitate rapid system assessment that utilizes color-coding, diagrams of floor plans and graphing capabilities.
 - g. The remote access shall use a web browser only and not require a VPN with remote desktop application.

6. Electric Wiring: All electric wiring and wiring connections, either line voltage or low voltage, from the emergency electric panels to the ATC panels, and from the ATC related panels to the individual control devices i.e. rooftop units, exhaust fans, boilers, chillers, valves, and dampers required for the installation of the control system, as herein specified shall be provided by the control contractor unless specifically shown on the electrical drawings or called for in the electrical specifications.
 - a. The wiring installation shall be in accordance with National and Local Codes and with the Electrical portion of these specifications. All wiring shall be run concealed wherever possible. Exposed wiring in occupied areas shall be run in raceways. Raceways shall be Wiremold 200 series with all elbows, raceways, covers, mounting stops, box extensions and wiring for a complete and neat installation. All wiring located in mechanical spaces, boiler rooms, and fan rooms shall be installed in metal conduit
 - b. All wiring above ceilings, in boiler rooms, and all mechanical spaces shall follow routing of piping and where not possible shall be in conduit. All exposed wire shall be bundled and wire tied and shall be supported to adjacent piping. Draped and free floating wire will not be allowed.
 - c. All terminations of wire at control devices shall be looped and supported adequately.
 - d. All wiring shall comply with the requirements of the electrical section of the specification.
 - e. On VAV systems, the electrical sub-contractor will provide 120 VAC junction box with toggle switch at each location.
7. All appliances, controllers, and servers provided shall include the licenses for full, bidirectional (import & export) support for BACnet/IP and BACnet/MS/TP. These drivers shall be installed, tested, and commissioned to permit BACnet communications at the IP and MS/TP levels. ADD 1
8. BACnet MS/TP shall be used as the communications protocol between the network controllers and the field controllers. All objects in the field controllers shall be exposed as BACnet objects and accessible through network controllers. ADD 1
9. The controls contractor shall provide, install and configure fully licensed copies of all necessary BAS manufacturers' software and tools to engineer, develop, configure, program, and test control sequences in the network controllers and in the field controllers, and user interface screens and graphics in the network controllers and system server as provided on this project. The controls contractor shall provide full documentation and backup file copies of all system, controller, and user interface configuration, programming, screens, user interface screens and graphics. With the software tools and backup files, it will be possible for the owner or any trained person or company contracted by the owner to make any changes they deem necessary to the system, to the controllers, and/or to the user interface, without having to use the original controls contractor.

B. Controls Systems Wiring

1. All conduit raceways, wiring, accessories and wiring connections required for the installation of the Controls Systems shall be provided by the Controls Contractor except as shown on the Electrical Drawings. All wiring shall comply with the requirements of applicable portions of the Electrical Section 260001 and all local and national electric codes and the requirements of the AHJ.
2. All Controls Systems wiring materials and installation methods shall comply with the original equipment manufacturer recommendations and standards.
3. The sizing type and provision of cable, conduit, cable trays and raceways shall be the design responsibility of the Controls Contractor.
4. Class 2 Wiring
 - a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.

- b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5ft. from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines.
 - 5. Class 2 signal wiring and 24VAC power may be run in the same conduit. Power wiring 120VAC and greater shall not share the same conduit with Class 2 signal wiring.
 - 6. Perform circuit tests using qualified personnel only. Provide necessary instruments and equipment to demonstrate that:
 - a. All circuits are continuous and free from short circuits and grounds.
 - b. All circuits are free from unspecified grounds; that resistance to ground of all circuits is no less than 50 megaohms.
 - c. All circuits are free from induced voltages.
 - 7. Provide complete testing for all cables and wiring. Provide all equipment, tools, and personnel as necessary to conduct these tests.
 - 8. Provide for complete grounding of all signal and communication cables, panels and equipment so as to ensure integrity of Controls Systems operation. Ground cabling and conduit at panel terminations. Do not create ground loops.
- C. Line Voltage Power Sources
- 1. 120-volt AC circuits for the Controls Systems shall be taken by the Controls Contractor from electrical emergency panelboards and circuit breakers as designated on the electrical drawings.
 - 2. Circuits used for the Controls Systems shall be dedicated to these Controls Systems and shall not be used for any other services.
 - 3. Controls DDC terminal unit controllers may use 120-volt AC power from motor power circuits.
- D. Controls Systems Raceways
- 1. All wiring shall be installed in conduit or raceway except as noted elsewhere in the Specification. Minimum conduit size 3/4 in.
 - 2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
 - 3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the supporting surface.
 - 4. UL/ULC Listed Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 ft. in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls and for final connection to equipment.
- E. Penetrations
- 1. Firestopping for all penetrations used by dedicated Controls Systems conduits and raceways shall be by other trades.
 - 2. All openings in fire proofed or fire stopped components shall be closed by other trades using approved fire resistive sealant.
 - 3. All wiring passing through penetrations, including walls, shall be in sleeves, conduit or enclosed raceway.
 - 4. No penetrations through building structural elements, slabs, ceilings and walls shall be made before receipt of written approval from the Architect.
- F. Controls Systems Identification Standards
- 1. Node Identification: All nodes shall be identified by a permanent label fastened to the outside of the enclosure. Labels shall be suitable for the node environmental location.
 - 2. Cable shall be labeled at every termination with cross-referencing to record documentation.

3. Raceway Identification: Exposed covers to junction and pull boxes of the FMS raceways shall be identified at primary points.
4. Wire Identification: All low and line voltage wiring shall be identified by a number, as referenced to the associated shop and record drawing, at each termination.
5. Wires and cabling shall not be spliced between terminations. Cable shields shall be single end grounded – typically at the panel end outside the panel.
6. Suggested color coding, for use at the Contractors option, are:

a.	Analog Input Cable	Yellow
b.	Analog Output Cable	Tan
c.	Binary Input Cable	Orange
d.	Binary Output Cable	Violet
e.	24 VAC Cable	Gray
f.	General Purpose Cable	Natural
g.	Tier 1 Comm Cable	Purple
h.	Other Tier Comm Cable	Blue
i.	Ethernet cable	Blue
7. Provide permanent identification labels at all valve and damper actuators to indicate open and closed positions.

G. Field Panel And Device Installations And Locations

1. The Controls Systems panels, enclosures and cabinets shall be located as coordinated with the Architect at an elevation of not less than 2 ft. from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. All field devices shall be installed per the manufacturer recommendation and in accessible locations as coordinated with the Architect.
3. Panels to be located in damp areas or areas subject to condensation shall be mounted with wall standoffs.
4. Conduit configurations entering or leaving panels and devices shall be such as to preclude condensation traps.

H. Networking Communications

1. The design of the BAS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall consist of multiple levels for communication efficiency, a campus-wide (Management Level Network) Ethernet network based on TCP/IP protocol, high performance peer-to-peer building level network(s) and DDC Controller floor level local area networks with access being totally transparent to the user when accessing data or developing control programs.
2. System shall communicate with a BACnet network over Ethernet or BACnet/IP (according to Annex J). The intent is to use the system provided under this contract to communicate with control systems and/or devices provided by other vendors. A PICS must be provided describing the BACnet, ANSI/ASHRAE 135-95, implementation. The product shall be Network Application Engine level 1 controllers with field equipment controller for level 2 controllers no substitutions. Minimum system functionality must include monitoring, commanding, and alarming for daily operator functions from a common workstation.
 - a. System shall have the capability to be an OPC Client and Server for dynamic communication with OPC Clients or Servers over an Ethernet network. At a minimum, the following must be supported:
 1. Data Access 1.0 (96), 1.0A (97) and 2.0 (11/98)
 2. Alarms & Events 1.0 (1/99)
3. Network Switches
 - a. Provide HP ProCurve 2910 al series 2910-48G al 48 ports network switch Brocade, Cisco or equal in MDF/IDF rooms as required.

4. Ethernet Wiring
 - a. Ethernet wiring shall be CAT6 UTP cable plenum rated. CAT6 UTP cables shall conform to ANSI/TIA/EIA-568-B1, B2, B3 Commercial Building Telecommunications Cabling Standard (latest amendment and including all applicable addenda) and ISO/IEC 11801 (International) Generic Cabling for Customer Premises standard (latest amendment and including all applicable addenda).
5. Building Data Network:
 - a. All operator devices either network resident shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.
 - b. The network shall support a minimum of 100 DDC controllers and PC workstations
 - c. The system shall support integration of third party systems (fire alarm, security, lighting, PLC, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for interprocess control. All exchange points shall have full system functionality as specified herein for hardwired points.
 - d. Field panels must be capable of integration with open standards including Modbus, BACnet, and Lonworks as well as with third party devices via existing vendor protocols.
 - e. The Building Network shall use the TCP/IP over Ethernet. All devices must:
 1. Auto-sense 10/100/1000 Mbps networks.
 2. IP Address will be assigned by Owner's IT staff.
 3. DNS and Gateway IP address will be provided by Owner's IT staff. A VLAN will be setup by Owner's IT staff.
 4. Allow access using Telnet.
6. Internet access
 - a. Web Based Operator Interface
 1. The BAS shall provide a web based graphical interface that allows users to access the BAS data via the Internet. The interface shall use HTML based ASP pages to send and receive data from the BAS to a web browser.
 2. All information exchanged over Internet shall be encrypted and secure via SSL.
 3. Access to the web interface will be password protected. A users rights and privileges to points and graphics will be the same as those assigned at the BAS workstation. An option will exist to only allow users "read" access via the web browser, while maintaining "command" privileges via the BAS workstation.
 4. Commissioning of the Web interface shall not require modification or creation of HTML or ASP pages. All graphics available at the BAS graphical workstation shall be available to users via a web browser.
 5. The web-based interface shall provide the following functionality to users, based on their access and privilege rights:
 - a. Logon Screen – allows the user to enter their user name, password and Domain name for logging into the web server.
 - b. Alarm Display – a display of current BAS alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages, and informational and memo text. Any alarm acknowledgements initiated through the web interface will be written to the BAS central workstation activity log.

- c. Graphic Display – Display of system graphics, including animated motion, available in the BAS workstation will be available for viewing over the web browser. Software that requires creation of dedicated “web” graphics in order to display them via the browser interface will not be acceptable. A graphic selector list will allow users to select any graphics to which they have access. Graphic displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user accounts rights.
 - d. Point details – users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.
 - e. Point Commanding – users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the BAS central workstation activity log.
 7. The web server licensing options will allow concurrent access by 10 browser connections.
 8. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Owner as required to support the web access feature.
- I. DDC Controller Floor Level 2 Network
1. This level communication shall support a family of application specific controllers and shall communicate with the network through DDC Controllers for transmission of global data.
- J. DDC & HVAC Mechanical Equipment Controllers
1. The DDC and HVAC Mechanical Equipment Controllers shall reside on the Building Level Network.
 2. DDC and HVAC Mechanical Equipment Controllers shall use the same programming language and tools. DDC and HVAC Mechanical Equipment Controllers which require different programming language or tools on a network are not acceptable.
 3. DDC and HVAC Mechanical Equipment Controllers which do not meet the functions specified are not acceptable.
- K. DDC Controller
1. DDC Controllers shall be a 16-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of three Floor Level Application Specific Controller Device Networks.
 2. Each DDC Controller shall have 72 Megabytes of memory to support its own operating system and databases, including:
 - a. Control processes
 - b. Energy management applications
 - c. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - d. Historical/trend data for points specified
 - e. Maintenance support applications
 - f. Custom processes
 - g. Operator I/O
 - h. Dial-up communications
 - i. Manual override monitoring

3. Each DDC Controller shall support firmware upgrades without the need to replace hardware.
4. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.
5. DDC Controllers shall provide a RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.
6. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
 - a. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
 - b. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
7. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
8. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
9. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
 - a. RF-Conducted Immunity (RFCl) per ENV 50141 (IEC 1000-4-6) at 3 V
 - b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact
 - c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
 - d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)
 - e. Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:
 1. IEEE Standard 587-1980
 2. UL 864 Supply Line Transients
 3. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)
10. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 60 days.
 - a. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
 - b. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
11. Provide a separate DDC Controller for each AHU or other HVAC system as indicated in Section 3.02. It is intended that each unique system be provided with its own point resident DDC Controller.

L. HVAC Mechanical Equipment Controllers

1. HVAC Mechanical Equipment Controllers shall be a 12-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors.
2. Each HVAC Mechanical Controller shall have 72 Megabytes of memory to support its own operating system and databases, including:
 - a. Control processes
 - b. Energy management applications
 - c. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - d. Historical/trend data for points specified
 - e. Maintenance support applications
 - f. Custom processes
 - g. Operator I/O
 - h. Remote communications
3. HVAC Mechanical Equipment Controllers shall provide a RS-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.
4. HVAC Mechanical Equipment Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.
5. Each HVAC Mechanical Equipment Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all components. The HVAC Mechanical Equipment Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
6. In the event of the loss of normal power, there shall be an orderly shutdown of all HVAC Mechanical Equipment Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
 - a. Upon restoration of normal power, the HVAC Mechanical Equipment Controller shall automatically resume full operation without manual intervention.
 - b. Should HVAC Mechanical Equipment Controller memory be lost for any reason, the user shall have the capability of reloading the HVAC Mechanical Equipment Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

M. DDC and HVAC Mechanical Equipment Controller Resident Software Features

1. General:
 - a. The software programs specified in this Section shall be provided as an integral part of DDC and HVAC Mechanical Equipment Controllers and shall not be dependent upon any higher level computer for execution.
 - b. All points shall be identified by up to 30 character point name and 16 character point descriptor. The same names shall be used at the PC workstation.
 - c. All digital points shall have user defined two-state status indication (descriptors with minimum of eight characters allowed per state (i.e. summer/winter)).
2. Control Software Description:
 - a. The DDC and HVAC Mechanical Equipment Controllers shall have the ability to perform the following pre-tested control algorithms:
 1. Two-position control
 2. Proportional control
 3. Proportional plus integral control
 4. Proportional, integral, plus derivative control

5. Automatic tuning of control loops
3. DDC and HVAC Mechanical Equipment Controllers shall provide the following energy management routines for the purpose of optimizing energy consumption while maintaining occupant comfort.
 - a. Start-Stop Time Optimization (SSTO) shall automatically be coordinated with event scheduling. The SSTO program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by time of occupancy. The SSTO program shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period, and still maintain desired comfort conditions.
 1. The SSTO program shall operate in both the heating and cooling seasons.
 - a. It shall be possible to apply the SSTO program to individual fan systems.
 - b. The SSTO program shall operate on both outside weather conditions as well as inside zone conditions and empirical factors.
 2. The SSTO program shall meet the local code requirements for minimum outside air while the building is occupied.
 - b. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or groups of points according to a stored time.
 1. It shall be possible to individually command a point or group of points.
 2. For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start or stop within that group.
 3. The operator shall be able to define the following information:
 - a. Time, day
 - b. Commands such as on, off, auto, and so forth.
 - c. Time delays between successive commands.
 - d. There shall be provisions for manual overriding of each schedule by an appropriate operator.
 4. It shall be possible to schedule events up to one year in advance.
 - a. Scheduling shall be calendar based.
 - b. Holidays shall allow for different schedules.
 - c. Enthalpy switchover (economizer) The Energy Management Control Software (EMCS) will control the position of the air handler relief, return, and outside air dampers. If the outside air dry bulb temperature falls below changeover set point the EMCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly changeover to an economizer system based on dry bulb temperature and will be able to override the economizer cycle and return to minimum outside air operation at any time.
 - d. Temperature-compensated duty cycling.
 - The DCCP (Duty Cycle Control Program) shall periodically stop and start loads according to various patterns.
 - The loads shall be cycled such that there is a net reduction in both the electrical demands and the energy consumed.
 - e. Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.
 - f. Night setback control: The system shall provide the ability to automatically adjust setpoints for night control.

- g. The Peak Demand Limiting (PDL) program shall limit the consumption of electricity to prevent electrical peak demand charges.
 - PDL shall continuously track the amount of electricity being consumed, by monitoring one or more electrical kilowatt-hour/demand meters. These meters may measure the electrical consumption (kWh), electrical demand (kW), or both.
 - PDL shall sample the meter data to continuously forecast the demand likely to be used during successive time intervals.
 - If the PDL forecasted demand indicates that electricity usage is likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads.
 - Once the demand peak has passed, loads that have been shed shall be restored and returned to normal control.
4. DDC and HVAC Mechanical Equipment Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
- a. A single process shall be able to incorporate measured or calculated data from any and all other DDC and HVAC Mechanical Equipment Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC and HVAC Mechanical Equipment Controllers on the network. Database shall support 30 character, English language point names, structured for searching and logs.
 - b. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
 - c. DDC and HVAC Mechanical Equipment Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task orientated information from the user manual.
 - d. DDC and HVAC Mechanical Equipment Controller shall be capable of comment lines for sequence of operation explanation.
5. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC and HVAC Mechanical Equipment Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC and HVAC Mechanical Equipment Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.
- a. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
 - b. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller) to provide full flexibility in defining the handling of system alarms. Each DDC and HVAC Mechanical Equipment Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
 - c. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hours destinations) or based on priority.
 - d. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
 - e. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.

6. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.
 - a. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC and HVAC Mechanical Equipment Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to seven days shall be provided. Each DDC and HVAC Mechanical Equipment Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a sufficient number of data samples. All trend data shall be available for transfer to a Workstation without manual intervention.
 - b. DDC and HVAC Mechanical Equipment Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.
 1. Loop tuning shall be capable of being initiated either locally at the DDC and HVAC Mechanical Equipment Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.
7. DDC and HVAC Mechanical Equipment Controllers shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.
8. The peer to peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to access any data from or send control commands and alarm reports directly to any other DDC and HVAC Mechanical Equipment Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC and HVAC Mechanical Equipment Controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device. The peer to peer network shall also allow any DDC and HVAC Mechanical Equipment Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.
9. The network shall allow the DDC and HVAC Mechanical Equipment Controllers to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be accessible to any base building operators, but only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.

N. Floor Level Network Application Specific Controllers (FEC)

1. Each DDC Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (FECs) through Floor Level LAN Device Networks.
2. Each FEC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each FEC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Each FEC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.
3. Terminal Equipment Controllers:
 - a. Provide for control of each piece of equipment, including, but not limited to, the following:
 1. Motorized Dampers

2. Heating Coils
 3. Induction Units
 4. Exhaust Fans
 5. Radiant Heating Panels
 6. Unit Heaters, Cabinet Unit Heaters
- b. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, 3-15 psi pneumatic, 0-10v, allowing for interface to a variety of modulating actuators.
- c. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the FLN, BLN or MLN is not acceptable

O. Local User Display

Where specified in the sequence of operation or points list, the controllers on the peer to peer building level network shall have a display and keypad for local interface. A keypad shall be provided for interrogating and commanding points in the controller.

1. The display shall use the same security password and access rights for points in the display as is used in the associated controller.
2. The LCD display shall be a minimum of a 2 line 40 character display.
3. The LCD display shall include the full point name, value (numeric, digital or state text), point priority and alarm status on one screen.
4. The LCD shall dynamically update the value, priority, and alarm status for the point being displayed.
5. The display shall be mounted either on the door of the enclosure or remote from the controller.

P. Personal Computer Operator Workstation Hardware

1. Personal computer operator workstations shall be provided for command entry, information management, system monitor, alarm management and database management functions. All real-time control functions shall be resident in the DDC Controllers to facilitate greater distribution, fault tolerance and reliability of the building automation control.
 - a. Provide workstation(s): Manufactured by Dell, HP, Lenovo or equal.
 - b. Workstation shall consist of a personal computer with minimum 8.0GB RAM, hard drive with 1 TB available space, video card capable of supporting 1024 x 768 resolution with a minimum of 32 Bit color (Windows 7), DVD-ROM Drive, mouse and 101-key enhanced keyboard. Personal computer shall be a Windows 7 Compatible PC and shall include a minimum latest generation Intel Core i7 3.40 GHz processor.
 - c. The PC monitor shall support a minimum display resolution of no less than 1900 X 1280 pixels and shall be minimum 19 in. LCD display. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.
 - d. Also provide separate file server with available storage capacity to accommodate trending 15 min. interval of each control point for a period of one year for data archives, minimum 1 TB capacity.
2. Provide an HP LaserJet Pro 400 Color M451dn, Cannon, Brother or equal printer at each workstation location or on the network (Ethernet) for recording alarms, operator transactions and systems reports.
3. Alarm Display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message. The alarm display shall provide a mechanism for the operator to sort alarms.

4. Intranet/Internet access
 - a. Web Based Operator Interface
 1. The BAS shall provide a web based graphical interface that allows users to access the BAS data via the Internet, extranet, or Intranet. The interface shall use HTML based ASP pages to send and receive data from the BAS to a web browser.
 2. A web server computer will be supplied. The web server shall support browser access via Microsoft Internet Explorer 9.0 (or higher), or Navigator Netscape 6.0 (or higher).
 3. All information exchanged over Internet shall be optionally encrypted and secure via SSL (provided by Owner).
 4. Access to the web interface may be password protected. A users rights and privileges to points and graphics will be the same as those assigned at the BAS workstation. An option will exist to only allow users "read" access via the web browser, while maintaining "command" privileges via the BAS workstation.
 5. Commissioning of the Web interface shall not require modification or creation of HTML or ASP pages. All graphics available at the BAS graphical workstation shall be available to users via a web browser.
 6. The web-based interface shall provide the following functionality to users, based on their access and privilege rights:
 - a. Logon Screen – allows the user to enter their user name, password and Domain name for logging into the web server.
 - b. Alarm Display – a display of current BAS alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages, and informational and memo text. Any alarm acknowledgements initiated through the web interface will be written to the BAS central workstation activity log.
 - c. Graphic Display – Display of system graphics, including animated motion, available in the BAS workstation will be available for viewing over the web browser. Software that requires creation of dedicated "web" graphics in order to display them via the browser interface will not be acceptable. A graphic selector list will allow users to select any graphics to which they have access. Graphic displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user accounts rights.
 - d. Point details – users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.
 - e. Point Commanding – users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the BAS central workstation activity log.
 7. The web server licensing options will allow concurrent access by a minimum of 10 browser connections.
 8. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Owner as required to support the web access feature.

Q. Operators Laptop

1. A Lap Top Operators Terminal shall be provided for operator readout of system variables, override control and adjustment of control parameters and display graphics as called for in paragraphs following. Computer specification shall be similar to fixed station computer in Paragraph P.

2. Functionality to include ability to automatically display a sequential all point summary and a sequential alarm summary. The Lap Top shall also allow display and/or changing of digital point state, analog point value, time and date, application and DDC parameters, analog limits, time schedules, runtime counts and limits, daylight savings time changeover, time/event initiation, and programmable offset values. The Lap Top shall allow access into DCP initialization routines and diagnostics and enable/disable of points, initiators and programs, all similar to the fixed computer. Laptop shall have a minimum 15 in. color screen, 4GB ram, 500GB hard drive and Windows 7 Professional operating system.

R. Workstation Operator Interface

1. Basic Interface Description
 - a. Operator workstation interface software shall minimize operator training through the use of user-friendly and interactive graphical applications, 30-character English language point identification, on-line help, and industry standard Windows application software. Interface software shall simultaneously communicate with existing system and share data between the dedicated, modem autodial, and Ethernet-connected building level networks. The software shall provide, as a minimum, the following functionality:
 1. Real-time graphical viewing and control of the BAS environment
 2. Reporting
 3. Scheduling and override of building operations
 4. Collection and analysis of historical data
 5. Point database editing, storage and downloading of controller databases.
 6. Utility for combining points into logical Point Groups. The Point Groups shall then be manipulated in Graphics, trend graphs and reports in order to streamline the navigation and usability of the system.
 7. Alarm reporting, routing, messaging, and acknowledgment
 8. "Collapsible tree," dynamic system architecture diagram application:
 - a. Showing the real-time status and definition details of all workstations and devices on a management level network
 - b. Showing the real-time status and definition details of all DDC and HVAC Mechanical Controllers at the building level
 - c. Showing the status and definition details of all field-level application controllers
 9. Definition and construction of dynamic color graphic displays.
 10. Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.
 11. On-screen access to User Documentation, via online help or PDF-format electronic file.
 12. Automatic database backup at the workstation for database changes initiated at DDC Controller operator interface terminals.
 - b. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a "drag and drop" approach to inter-application navigation. Selection of applications within the workstation software shall be via a graphical toolbar menu – the application toolbar menu shall have the option to be located in a docked position on any of the four sides of the visible desktop space on the workstation display monitor, and the option to automatically hide itself from the visible monitor workspace when not being actively manipulated by the user.

- c. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BAS software shall run on a Windows XP, 2000 or NT 32 bit operating system. System database parameters shall be stored within an object-oriented database, which is compliant with the Open Database Connectivity (ODBC) or Structured Query Language (SQL) standards. Standard Windows applications shall run simultaneously with the BAS software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information
1. Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via adjustable user-sized windows. Operator shall be able to drag and drop information between the following applications, reducing the number of steps to perform a desired function (e.g., Click on a point on the alarm screen and drag it to the dynamic trend graph application to initiate a dynamic trend on the desired point):
 - a. Dynamic color graphics application
 - b. Alarm management application
 - c. Scheduling application
 - d. Dynamic trend graph data plotter application
 - e. Dynamic system architecture diagram application
 - f. Control Program and Point database editing applications
 - g. Reporting applications
 2. Report and alarm printing shall be accomplished via Windows Print Manager, allowing use of network printers.
- d. Operator-specific password access protection shall be provided to allow the administrator/manager to limit users' workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (up to 999 user accounts shall be supported). The administrator/manager shall be able to grant discrete levels of access and privileges, per user, for each point, graphic, report, schedule, and BAS workstation application. And each BAS workstation user account shall use a Windows 2000/NT user account as a foundation.
- e. Dynamic Color Graphics application shall include the following:
1. Must include graphic editing and modifying capabilities
 2. A library of standard control application graphics and symbols must be included
 3. Must be able to command points directly off graphics application
 4. Graphic display shall include the ability to depict real-time point values dynamically with animation, picture/frame control, symbol association, or dynamic informational text-blocks.
 5. Navigation through various graphic screens shall be optionally achieved through a hierarchical "tree" structure
 6. Graphics viewing shall include zoom capabilities
 7. Graphics shall automatically display the HAND status of points that have been overridden by a field HAND switch, for points that have been designed to provide a field HAND override capability.
 8. Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls), internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.
- f. Reports shall be generated on demand or via pre-defined schedule, and directed to CRT displays, printers or file. As a minimum, the system shall allow the user to easily obtain the following types of reports:
1. A general listing of all or selected points in the network
 2. List of all points currently in alarm

3. List of all points currently in override status
 4. List of all disabled points
 5. List of all points currently locked out
 6. List of user accounts and access levels
 7. List all weekly schedules and events
 8. List of holiday programming
 9. List of control limits and deadbands
 10. Custom reports from 3rd party software
 11. System diagnostic reports including, list of DDC panels on line and communicating, status of all DDC terminal unit device points
 12. List of programs
 13. List of point definitions
 14. List of logical point groups
 15. List of alarm strategy definitions
 16. List of DDC Control panels
 17. Point totalization report
 18. Point Trend data listings
 19. Initial Values report
 20. User activity report
- g. Scheduling and override
- h. Provide a calendar type format for simplification of time and date scheduling and overrides of building operations. Schedule definitions reside in the PC workstation, DDC Controller, and HVAC Mechanical Equipment Controller to ensure time equipment scheduling when PC is off-line -- PC is not required to execute time scheduling. Provide override access through menu selection, graphical mouse action or function key. Provide the following capabilities as a minimum:
1. Weekly schedules
 2. Zone schedules
 3. Event schedules – an event consists of logical combinations of equipment and/or zones
 4. Report schedules
 5. Ability to schedule for a minimum of up to 365 days in advance
 6. Additionally, the scheduling application shall:
 - a. Provide filtering capabilities of schedules, based on name, time, frequency, and schedule type (event, zone, report)
 - b. Provide sorting capabilities of schedules, based on name, time and type of schedule (zone, event, report)
 - c. Provide searching capabilities of schedules based on name – with wildcarding options
- i. Collection and Analysis of Historical Data
1. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals (up to four time-based definitions per point) or change of value, both of which shall be user-definable. Trend data shall be collected stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of zones, events, and reports. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

2. Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of selected points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. DDC contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. DDC contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.
 - j. The ATC contractor shall provide an additional 40 hours of ATC/BMS system programming time to assist the owner with customized programming of the ATC/BMS system.
2. Dynamic Color Graphic Displays
 - a. Create color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units and hot water boiler systems, and room level terminal units, shall be provided by the BAS contractor as indicated in the point I/O schedule of this specification to optimize system performance, analysis and speed alarm recognition.
 - b. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands. Graphics software shall permit the importing of Autocad or scanned pictures for use in the system.
 - c. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays, and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.
 1. Provide the user the ability to display real-time point values by animated motion or custom picture control visual representation. Animation shall depict movement of mechanical equipment, or air or fluid flow. Picture Control shall depict various positions in relation to assigned point values or ranges. A library (set) of animation and picture control symbols shall be included within the workstation software's graphics application. Animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for up to five rates of animation speed.
 2. Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the setpoint.
 3. Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.
 4. Equipment state or values can be changed by clicking on the associated point block or graphic symbol and selecting the new state (on/off) or setpoint.
 5. State text for digital points can be user-defined up to eight characters.
 - d. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.
 - e. Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls), internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.
 - f. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

- g. Off the shelf graphic software, html web-based graphic software shall be provided to allow the user to add, modify or delete system graphic background displays.
 - h. A clipart library of HVAC application and automation symbols shall be provided including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams. The user shall have the ability to add custom symbols to the clipart library. The clipart library shall include a minimum of 400 application symbols. In addition, a library consisting of a minimum of 700 graphic background templates shall be provided.
 - i. The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal Equipment controller's control values and parameters, without the need to create separate and individual graphic files for each controller.
3. System Configuration & Definition
 - a. A "Collapsible tree," dynamic system architecture diagram/display application of the site-specific BAS architecture showing status of controllers, PC workstations and networks shall be provided. This application shall include the ability to add and configure workstations, DDC Controllers or HVAC Mechanical Equipment controllers, as well as 3rd-party integrated components. Symbols/Icons representing the system architecture components shall be user-configurable and customizable, and a library of customized icons representing 3rd-party integration solutions shall be included. This application shall also include the functionality for real-time display, configuration and diagnostics of dial-up modems to DDC Controllers.
 - b. Network wide control strategies shall not be restricted to a single DDC Controller or HVAC Mechanical Equipment controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.
 - c. Provide automatic backup and restore of all DDC controller and HVAC Mechanical Equipment controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller or HVAC Mechanical Equipment Controller. Changes made at the user-interface of DDC Controllers or HVAC Mechanical Equipment Controllers shall be automatically uploaded to the workstation, ensuring system continuity.
 - d. System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system back-up must be done with the PC workstation off-line, the BAS contractor shall provide at least 2 operator workstations.
 - e. Point database configuration shall be available to the user within a dedicated point database editor application included in the workstation software. The editor shall allow the user to create, view existing, modify, copy, and delete points from the database. The point editor shall also allow the user to configure the alarm management strategy for each point. The editor shall provide the option for editing the point database in an online or offline mode with the DDC Controllers.
 1. The workstation software shall also provide the capability to perform bulk modification of point definition attributes to a single or multiple user-selected points. This function shall allow the user to choose the properties to copy from a selected point to another point or set of points. The selectable attributes shall include, but are not limited to, Alarm management definitions and Trend definitions.
4. Alarm Management
 - a. Alarm Routing shall allow the user to send alarm notification to selected printers or workstation location(s) based on time of day, alarm severity, or point type.

- b. Alarm Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each alarm point: name, value, alarm time and date, alarm status, priority, acknowledgement information, and alarm count. Each alarm point or priority shall have the ability to sound a discrete audible notification.
- c. Alarm Display shall have the ability to list and sort the alarms based on alarm status, point name, ascending or descending alarm time.
- d. Directly from the Alarm Display, the user shall have the ability to acknowledge, silence the alarm sound, print, or erase each alarm. The interface shall also have the option to inhibit the erasing of active acknowledged alarms, until they have returned to normal status. The user shall also have the ability to command, launch an associated graphic or trended graphical plot, or run a report on a selected alarm point directly on the Alarm Display.
- e. Each alarm point shall have a direct link from the Alarm Display to further user-defined point informational data. The user shall have the ability to also associate real-time electronic annotations or notes to each alarm.
- f. Alarm messages shall be customizable for each point, or each alarm priority level, to display detailed instructions to the user regarding actions to take in the event of an alarm. Alarm messages shall also have the optional ability to individually enunciate on the workstation display via a separate pop-up window, automatically being generated as the associated alarm condition occurs.
- g. Alarm Display application shall allow workstation operators to send and receive real-time messages to each other, for purposes of coordinating Alarm and BAS system management.
- h. Remote notification of messages
 - 1. Workstation shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point's alarm condition.
 - 2. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.
 - 3. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
 - 4. Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
 - 5. System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
 - 6. Message detail shall be configurable on a per user basis.
 - 7. During a "flood" of alarms, remote notification messages shall have the ability to optimize several alarms into an individual remote notification message.
 - 8. Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
 - 9. Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

S. Field Devices

- 1. Provide instrumentation as required for monitoring, control or optimization functions.

2. Room Temperature Sensors

- a. All spaces shall be provided with digital temperature, humidity and CO2 sensors and shall have LCD display, day / night override button, and setpoint slide adjustment. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment. Public areas such as corridors, vestibules, restrooms shall have chrome cover plate without adjustment or occupied/unoccupied capability. All sensors located in sallyport, locker rooms and cell block area shall be provided with tamper proof guard. All temperature sensors shall be BACnet compatible network type.

Temperature monitoring range +20/120 deg. F -13 deg. to 49 deg. C)
 Output signal Changing resistance
 Accuracy at Calibration point +0.5 deg. F (+/- 0.3 deg. C)
 Set Point and Display Range 55 deg. to 95 deg. F (13 deg. to 35 deg. C)

Liquid immersion temperature:

Temperature monitoring range +30/250 deg. F (-1 deg. /121 deg. C)
 Output signal Changing resistance
 Accuracy at Calibration point +0.5 deg. F (+/-0.3 deg. C)

Duct (single point) temperature:

Temperature monitoring range +20/120 deg. F (-7 deg. /49 deg. C)
 Output signal Changing resistance
 Accuracy at Calibration point +0.5 deg. F (+/-0.3 deg. C)

Duct Average temperature:

Temperature monitoring range +20 deg.+120 deg.F(-7 deg./+49 deg. C)
 Output signal 4 – 20 mA DC
 Accuracy at Calibration point +0.5 deg. F (+03 deg. C)
 Sensor Probe Length 25 ft. L (7.3m)

Outside air temperature:

Temperature monitoring range -58deg.+122deg.F(-50deg.Cto 50deg.C)
 Output signal 4 – 20 mA DC
 Accuracy at Calibration point +0.5 deg. F (+/-0.3 deg. C)

3. Liquid Differential Pressure Transmitter:

Ranges 0-5/30 in. H2O
 0-25/150 in. H2O
 0-125/750 in. H2O
 Output 4 – 20 mA DC
 Calibration Adjustments Zero and span
 Accuracy +/-0.2 percent of span
 Linearity +/-0.1 percent of span
 Hysteresis +/-0.05 percent of span

4. Differential pressure:

Unit for fluid flow proof shall be Penn P74.
 Range 8 to 70 psi
 Differential 3 psi
 Maximum differential pressure 200 psi
 Maximum pressure 325 psi

- Unit for air flow settings.
Set point ranges: 0.5 in. WG to 1.0 in. WG (124.4 to 248.8 Pa)
1.0 in. WG to 12.0 in. WG (248.8 to 497.6 Pa)
5. Static pressure sensor:
- Range 0 to .5 in.WG (0 to 124.4 Pa)
0 to 1 in.WG (0 to 248.8 Pa)
0 to 2 in. WG (0 to 497.7 Pa)
0 to 5" in.WG (0 to 1.2 kPa)
0 to 10" WG (0 to 2.5 kPa)
- Output Signal 4 – 20 mA VDC
Combined static error 0.5 percent full range
Operating Temperature -40 deg. to 175 deg. F (-40 deg. C to 79.5 deg. C)
6. Air Pressure Sensor:
- Range: 0 to 0.1 in. water (0 to 24.9 Pa)
0 to 0.25 in. water (0 to 63.2 Pa)
0 to 0.5 in. water (0 to 124.5 Pa)
0 to 1.0 in. water (0 to 249 Pa)
0 to 2.0 in water 90 to 498 Pa)
0 to 5.0 in. water (0 to 1.25 kPa)
0 to 10.0 in. water (0 to 2.49 kPa)
- Output signal 4 to 20 mA
Accuracy +1.0 percent of full scale
- Humidity Sensors: All room/zone humidity sensors shall be BACnet compatible network type.
- Range 0 to 100 percent RH
Sensing Element Bulk Polymer
Output Signal 4 – 20 mA DC
Accuracy At 77 deg. F (25 deg. C) + 2 percent RH
- Humidistat:
- Range 0 to 100 percent RH
Sensing Element Bulk Polymer
Output Signal 4 – 20 mA DC
Accuracy At 77 deg. F(25 deg. C) + 2 percent RH
7. Insertion Flow Meters (Equal to—Onicon F-5300)
- Sensing Method Impedance Sensing
Accuracy + 2 percent of Actual Reading
Maximum Operating Pressure 400 PSI
Output Signal 4 – 20 mA
- Bi-directional where required.
8. Pressure to Current Transducer
- Range 3 to 15 psig (21 to 103 kPa) or
3 to 30 psig (21 to 207 kPa)
- Output signal 4 – 20 mA
Accuracy + 1 percent of full scale (+ 0.3 psig)
9. Carbon Dioxide Sensor : All room/zone CO₂ and/or duct mounted sensors shall be BACnet compatible network type and shall have a minimum 5 year calibration period.
- Range 0 to 1500 ppm
Accuracy 20+ ppm

10. Control Valves (all control valves shall have electric actuators with position feedback to provide confirmation of valve position).

a. Electric Control

Rangeability	40: 1
Flow Characteristics	Modified. Equal percentage
Control Action	Normal open for hot water and normal closed for cooling
Medium	Water, glycol
Body Type	Screwed ends 2 in. and smaller, flanged Valves 2½ in. and larger
Body Material	Bronze
Body Trim	Bronze
Stem	Stainless Steel
Actuator	0-10 VDC, 4-20 MA 24 VAC/120VAC – Modulating for all hot water valves and 2 position for all chilled water valves.

- b. All automatic temperature control valves in water lines shall be provided with Characterized throttling plugs and shall be sized for minimum 25 percent of the system pressure drop or three psi, whichever is less.

11. Damper Actuators

- a. Electric control shall be direct coupled actuators with position feedback to BMS.
- b. Damper actuators shall be Brushless DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal housing, manual override, independently adjustable dual auxiliary switch.
1. The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard ½ in. diameter shaft or damper blade.
- c. Actuators shall be designed for mounting directly to the damper shaft without the need for connecting linkages.
- d. All actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator's output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed "v" shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with the damper shaft.
- e. All actuators having more than a 100 lb-in torque output shall accept a 1 in. diameter shaft directly, without the need for auxiliary adapters.
- f. All actuators shall be designed and manufactured by Belimo or approved equal using ISO900 registered procedures, and shall be Listed under Standards UL873 and CSA22.2 No. 24-93 I.

- T. Meters: Meters shall be provided to monitor and trend the energy consumed by the HVAC (heating, cooling, ventilation, fans) and Hot water (Heating and Domestic) serving the building. Provide the following meters (or connection to meters) and network these devices into the Building Management System.

1. Provide hydronic BTU Energy Meters (Ultrasonic, strap on type flow meters and temperature sensors) for the following systems. Hydronic system energy data obtained from meters and sensors shall be input to the building automation system for calculating, trending and storing energy consumption information of the following systems:
 - a. Heating Hot and Chilled Water systems
 - b. Cold Water Make-Up (Building Water Use)

2. Provide all necessary components and accessories required for connection to main electrical KYZ pulse consumption meters (kWh). Meters shall be provided by Division 26 00 00. Refer to Electrical Drawings for meter location. All necessary wiring, programming, conduits, controllers, protocol gateway devices and all other required components to/from the meter/BMS system for full consumption monitoring/reading shall be provided by the ATC contractor. Coordinate with electrical contractor for actual model being submitted and approved by engineer.
 3. Domestic hot water consumption shall be determined and calculated by the ATC contractor. Relays shall be installed on the domestic water heater burner to calculate usage. All necessary wiring, programming, conduits, controllers, and all other required components to/from the burner/BMS system for full consumption monitoring/reading shall be provided by the ATC contractor.
 4. Gas sub-meter shall be provided by the plumbing contractor. All necessary wiring, programming, conduits, controllers, protocol gateway devices and all other required components to/from the meter/BMS system for full consumption monitoring/reading shall be provided by the ATC contractor. Coordinate with plumbing contractor for actual model being submitted and approved by engineer.
 5. The energy consumption data obtained from all the meters shall be stored by the building automation system and displayed on the BMS graphics.
- U. Miscellaneous Devices
1. Thermostats (Stand-alone electric type - only where specified or indicated on drawings)
 - a. Room thermostats shall be of the gradual acting type with adjustable sensitivity.
 - b. They shall have a bi-metal sensing element capable of responding to a temperature change of one-tenth of one degree. (Provide all thermostats with limit stops to limit adjustments as required.)
 - c. Thermostats shall be arranged for either horizontal or vertical mounting.
 - d. In the vertical position thermostat shall fit on a mullion of movable partitions without overlap.
 - e. Mount the thermostat covers with tamper-proof socket head screws.
 2. Freezestats:
 - a. Install freezestats on each coil that mixes outside and return air (air handling units, fan coils, unit ventilators) and provide protection for every square foot of coil surface area with one linear foot of element per square foot of coil.
 1. Upon detection of low temperature, the freezestats shall stop the associated supply fans and return the automatic dampers to their normal position close outside air dampers and open coil valve for full flow. Provide manual reset.
 3. Firestats:
 - a. Provide manual reset, fixed temperature line voltage type with a bi-metal actuated switch.
 1. Switch shall have adequate rating for required load.
 4. Electronic Airflow Measurement Stations and Transmitters (Where indicated on Control Drawings).
 - a. Provide air flow moving stations as shown on drawings.

- b. Stations – each insertion station shall contain an array of velocity sensing elements and straightening vanes. The velocity sensing elements shall be of the RTD or thermistor type. The sensing elements shall be distributed across the duct cross section in a quality to provide accurate readings. The resistance to airflow through the airflow measurement station shall not exceed 0.08 in. water gage at an airflow of 2,000 fpm. Station construction shall be suitable for operation at airflow of up to 5,000 fpm over a temperature range of 40 to 120 degrees F, and accuracy shall be plus or minus 3 percent over a range of 125 to 2,500 fpm scaled to air volume. Each transmitter shall produce a linear, temperature compensated 4 to 40 mA DC, output corresponding to the required velocity pressure measurement. Provide local readout on unit.
- c. Fan inlet airflow sensing
1. Where mounted into controllable pitch axial inlet bells, or inlet cones of centrifugal fans, the traverse probe assemblies shall be complete with all necessary end mounting plates and master takeoff fittings. All mounting bolts, lock washers and nuts; interconnecting tubing and compression fittings to be provided by the installing contractor.
 2. Primary flow elements shall not be used on fan inlet applications where the narrowest diameter of the inlet cone is under ten in. without prior approval. Fan inlet sensors shall not be used on fans having inlet guide vanes. The use of only one static element and one total pressure element on fan inlets is prohibited. Fan primary elements shall not exceed .562 in. in diameter on fans having inlet cone diameters less than 30 in..
 3. Fan inlet airflow sensing similar to Ebtron GTX116F or Paragon Controls model FE-1050.
- d. Electronic Transducers
1. Provide individual differential static pressure and airflow transducers, selected for the required range of each of the above primary elements, and in accordance with the following:
 2. The transducer(s) shall be solid-state electronic type, with infinite output resolution, capable of performing dedicated static pressure and air volume control functions. Microprocessor based transducers with time-sharing of multiple square root extractors and/or controllers are not acceptable.
 3. Each transducer's output shall not be affected by direction of mounting (attitude) or external vibrations, and shall be furnished with a factory-calibrated range that matches the application.
 4. Airflow transducers shall be provided with an integral dual scale indicating meter operating independent of all other control devices. The top scale shall indicate the measured air volume in units of cubic ft. per minute (CFM), and the bottom scale shall indicate the air velocity in units of ft. per minute (FPM).
 - a. The meter shall be a differential pressure type that is diaphragm actuated, and is to be flush mounted on the enclosure door.
 - b. The meter shall be calibrated to an accuracy of +2 percent of span.
 5. Transducer performance shall be equal to or better than the following:
 - a. Accuracy: +/- 0.5 percent F.S. (Terminal Point) / +/- 0.35 percent F.S. (BFSL)
 - b. Temperature Effects: <0.03 percent F.S./deg F
 - c. Over-pressure: 5 PSIG Proof / 10 PSIG Burst
 - d. Response: <0.25 seconds for full scale input
 - e. Noise Filtration: Low Pass Filter, factory set @ 3.2Hz
 6. Each transducer shall be selected for its respective duty. Supply, Exhaust and/or Return Airflow Transducers shall provide analog output signal linear to air volume that are factory set for a full scale value equal to 110 percent of the maximum design capacity of the flow measuring element served for variable air volume applications, or 200 percent of the design operating value for constant volume applications.

7. Airflow transducers for operating velocities below 1266 ft. per minute shall provide the following features:
 - a. Local electronic indication of the measure airflow rate.
 - b. The indicating meter shall be one-half in. high, three and one half digit light emitting diode (LED) type.
 - c. The LED shall indicate the measured air volume in engineering units of cubic ft. per minute (CFM).
 - d. Automatic zeroing circuit that shall maintain the transducer output to within 0.1 percent of value, and shall be field configurable for frequency of activation between one and seventy two hours.
 - e. The transducer output shall be locked and maintained at the last given output value during the automatic zeroing period so as not to interrupt the automatic control process.
 - f. The meter shall be auto calibrated to an accuracy of +/- 1 count.
 - g. Transducer accuracy shall be +/- 0.25 percent F.S. (Terminal Point) / +/- 0.15 percent F.S. (BFSL)
5. Current Sensing Relay:
 - a. Provide solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
 - b. Adjust the relay switch point so that the relay responds to motor operation under load as an "on" state and so that the relay responds to an unloaded running motor as an "off" state. A motor with a broken belt is considered an unloaded motor.
 - c. Provide for status device for all fans and pumps.
6. Manufacturers: Subject to compliance with the requirements, provide an Automatic Temperature Control System as manufactured by:
 - a. Johnson Controls (Metesys)
 - b. Honeywell
 - c. Allerton
 - d. Or equal

PART 3 EXECUTION

3.01 INSTALLATION OF HANGERS AND ATTACHMENTS

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- B. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachments. Coordinate all concrete anchors with Concrete Trade Contractor.
- C. Prior to installation of hangers, supports, anchors, and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purposes of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

- D. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the tops of inserts.
- E. Install hangers, supports, clamps, and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
1. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
 2. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.
 3. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 4. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
 5. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
 6. Insulated Piping: Comply with the following installation requirements:
 - a. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - b. Shields: For pipe sizes up to and including 4" provide heavy gage shield at each hanger point.
 - c. Saddles: For all pipe sizes over 4" provide saddle at each hanger point. Completely fill void in saddle with loose insulation.
- F. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer for loading and stresses to connected equipment.
- G. Fabricate and install anchor by welding steel shapes, plates, and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- H. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- I. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.
- J. Provide concrete housekeeping bases for all floor-mounted equipment. Size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

- K. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.
- L. Adjusting and Cleaning:
 - 1. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
 - 2. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
 - 3. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.02 INSTALLATION OF MECHANICAL IDENTIFICATION

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- B. Mechanical Equipment Identification:
 - 1. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device.
 - 2. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2' - 0", 1\2" high for distances up to 6' - 0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
- C. Adjusting and Cleaning:
 - 1. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
 - 2. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.03 INSTALLATION OF MECHANICAL INSULATION

- A. Installation of Piping Insulation:
 - 1. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
 - 2. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
 - 3. Clean and dry pipe surfaces prior to insulating. Butt installation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
 - 4. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
 - 5. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
 - 6. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
 - 7. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

B. Installation of Ductwork Insulation:

1. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose. No duct insulation shall be installed prior to the completion of duct leakage testing as required by this specification.
2. Install insulation materials with smooth and even surfaces.
3. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
4. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
5. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
6. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

C. Protection and Replacement:

1. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
2. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

3.04 INSTALLATION OF GREASE DUCT INSULATION

A. EXAMINATION

1. Do not begin installation until substrates have been properly prepared.
2. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
3. Coordinate installation of the Thermal Ceramics FastDoor XL access door between sheet metal and insulation trades.

B. PREPARATION

1. Remove dirt and dust from surfaces of openings and items penetrating rated floors and rated walls.

C. INSTALLATION

1. Install FireMaster FastWrap XL or Pyroscat Duct Wrap XL in direct contact with the ductwork in accordance with manufacturer's instructions, applicable laboratory listings and building code reports, and referenced standards. For additional complex duct design installation recommendations, see the Thermal Ceramics' complete installation guide.
2. Install two layers of FireMaster FastWrap XL or Pyroscat Duct Wrap XL for zero clearance and a 1 and 2 hour commercial kitchen grease duct applications per ASTM E 2336.
 - a. General Installation Instructions for Double Layer Installations: The inside and outside layers of FireMaster or Pyroscat blankets are cut to a length that will fit around the duct and meet with a tight butt joint. Adjacent blankets on the inside and outside layers are tightly butted against each other. Joints between blankets on the outside layer shall be offset from joints on the inside layer by a minimum 6 in. (152 mm). Cut edges of the blanket shall be taped with aluminum foil tape. During installation the blankets are temporarily held in place with filament tape until the wrap is mechanically attached with steel bands or steel insulation pins.

3. Install 1 layer of FireMaster FastWrap XL or Pyroscat Duct Wrap XL for 1 and 2 hour air ventilation duct enclosures per ISO 6944-1985.
 - a. General Installation Instructions for Single Layer Installations: FireMaster or Pyroscat blankets are cut to a length that will fit around the duct and overlap itself no less than 3 in. (152 mm). Adjacent blankets overlap each other a minimum of 3 in. (152 mm), or they can be fitted together with a tight butt joint and covered with a 6 in. (305 mm) wide collar centered over the butt joint. Cut edges of the blanket are taped with aluminum foil tape. During installation the blankets are temporarily held in place with filament tape until the wrap is mechanically attached with steel bands or steel insulation pins.
4. Install one layer of Thermal Ceramics PlenumWrap+ on plastic pipe or plastic jacketed electrical cables per Intertek listing reports and testing to NFPA 262 and UL1887.
 - a. Cut plenum blanket to a length that will fit around the pipe or cable and overlap itself no less than 1 in. (25 mm). Adjacent blankets overlap each other a minimum of 1 in. (25 mm). Plenum blanket is secured using either 1/2 in. (12 mm) steel banding or 16 gauge carbon or stainless steel tie wire on maximum 11-1/2 in. (292 mm) spacing.
5. Mechanical Fastening of Enclosure Material to Ductwork:
 - a. Banding - Carbon steel or stainless steel banding is used to hold the outer layer of the blanket enclosure in place. Banding is minimum 1/2 in. (12.7 mm) wide, and is placed around the entire perimeter of the duct on maximum 10-1/2 in. (267 mm) centers and 1-1/2 in. (38 mm) from each blanket or collar edge.
 - b. Pinning - To prevent blanket sag on duct spans wider than 24 in. (610 mm), minimum 12-gauge steel insulation pins are welded to the duct along bottom horizontal and outside vertical runs in columns spaced 12 in. (305 mm) apart, 6 to 12 in. (152 to 305 mm) from each edge, and on 10-1/2 in. (267 mm) centers. Pins are locked in place with 1-1/2 in. (38 mm) diameter or 1-1/2 in. (38 mm) square galvanized steel speed clips or cup head pins. Pins are turned down or the excess cut off to eliminate sharp edges.
6. Grease Duct Access Door Installation:
 - a. Install Thermal Ceramics FastDoor XL per manufacturers' instructions, and applicable building code reports and laboratory design listings.
7. Through-Penetration Firestop System:
 - a. When the duct penetrates a concrete or dry wall fire rated floor, ceiling, or wall an approved firestop system shall be employed. FireMaster or Pyroscat insulation shall be installed directly to the duct through the penetration, or terminated on both sides of the penetration depending on the annular space allowance between the duct and the duct opening. When the FireMaster or Pyroscat enclosure system is terminated on both sides of the through penetration, the duct wrap material is mechanically attached to the duct at the termination points using either steel banding or steel pins.
 - b. To fire stop the through penetration void area, fill the annular space between the wrapped duct or bare duct and the periphery of the opening with scrap FireMaster or Pyroscat insulation firmly packed into the opening. Compress scrap blanket to percentage stated in the firestop listing for a minimum depth as specified in the firestop listing. Recess packing material below surface on both sides of walls or top side only for floors to the depth stated in the firestop listing. Seal over the packing material using an approved firestop sealant to a depth as stated in the firestop listing, flush with top side of a floor assembly and both sides of a wall assembly.

D. REPAIR PROCEDURES

1. Repair damaged FireMaster FastWrap XL or Pyroscat Duct Wrap XL in accordance with manufacturer's instructions.
2. Remove damaged section by cutting the bands and removing the anchor clips holding it in place. Apply a new section of the same dimension ensuring the same overlap and installation method that existed previously. Cut edges and tears in the foil must be taped with aluminum tape to prevent the insulation from wicking moisture or grease.

E. PROTECTION

1. Protect installed products until completion of project.
2. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 INSTALLATION OF HYDRONIC PIPING AND ACCESSORIES

A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section s and drawing VS.1.

B. Piping Installations:

1. Locations and Arrangements: Drawings indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design consideration. So far as practical, install piping as indicated.
2. Install piping at a uniform grade of 1" in 40' upward in the direction of flow.
3. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.
4. Install branch connections to mains using Tee fittings in main with take-off out the bottom, except for up-freed risers which shall have take-off out the top of the main line.
5. Install unions in pipes 2" and smaller, adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
6. Install strainers on the supply side of each control valve, pressure reducing valve, pressure regulating valve, solenoid valve, inline pump, and elsewhere as indicated.
7. Anchor piping to ensure proper direction of expansion and contraction. Expansion loops and joints are indicated on the Drawings
8. Install pipe sleeves at all wall and floor penetrations.
9. Install escutcheons at all exposed pipe wall penetrations.
10. Provide Dielectric couplings at all dissimilar piping/valve connections.

C. Pipe Applications:

1. Copper Tubing: Use Type L, drawn copper tubing with wrought copper fittings and solder joints for 2" and smaller, above ground, within building. Mechanical Fittings, such as Pro-press, are generally permitted, provided they meet the project performance specification requirements.

D. Grooved Ends:

1. Roll Groove pipe ends in accordance with the latest published instructions from manufacturer of grooved couplings.

E. Field Quality Control:

1. Preparation for Testing: Prepare hydronic piping in accordance with ASME B 31.9 and as follows:
 - a. Leave joints including welds uninsulated and exposed for examination during the test.
 - b. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
 - c. Flush system with clean water. Clean strainers.
 - d. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
 - e. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.
2. Testing: Test hydronic piping as follows:
 - a. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping system components.
 - b. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at point for complete removal of the liquid.
 - c. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.
 - d. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90% of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code for Pressure Piping, Building Services Piping.
 - e. After the hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connection for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.

F. Adjusting and Cleaning:

1. Clean and flush hydronic piping systems. Remove, clean, and replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.
2. Chemical Treatment: Provide a water analysis prepared by the chemical treatment supplier to determine the type and level of chemicals required for prevention of scale and corrosion. Perform initial treatment after completion of system testing.

3.06 INSTALLATION OF REFRIGERANT PIPING AND ACCESSORIES

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and drawing VS1.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and drawing VS.1.

B. Piping Installations:

1. Locations and Arrangements: Drawings indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, and other design consideration. So far as practical, install piping as indicated.
2. Install pipe sleeves at all wall and floor penetrations.
3. Install escutcheons at all exposed pipe wall penetrations.

3.07 INSTALLATION OF VARIABLE REFRIGERANT FLOW (VRF) UNIT SYSTEM

A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and drawing VS.1.

B. General:

1. Verify all dimensions by field measurements. Verify roof structure, mounting supports, wall structure, and membrane installations are completed to the proper point to allow installation of wall mounted and roof mounted units. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation. Do not proceed until unsatisfactory conditions have been corrected.
2. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Field Quality Control:

1. Provide the services, to include a written report, of a factory authorized service representative to examine the field assembly of the components, installation, and piping and electrical connections.
2. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.

D. Demonstration:

1. Provide the services of a factory authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel as specified below.
2. Start-up service: Place units into operation and adjust controls and safeties. Replace damaged or malfunctioning components and controls.

E. Training:

1. Train the Owner's maintenance personnel on start-up and shut-down procedures, troubleshooting procedures, and servicing and preventative maintenance schedules and procedures.
2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.

3.08 INSTALLATION OF ENERGY RECOVERY UNITS

A. VIBRATION CONTROL AND SEISMIC RESTRAINT: Refer to section 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS.1.

- B. General: Install units where indicated, in accordance with equipment manufacturer's published installation instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.
- C. Roof Curbs: Furnish roof curbs to roofing Installer for installation
- D. Coordination: Coordinate with other work, including ductwork, floor construction, roof decking, and piping, as necessary to interface installation of units with other work.
- E. Access: Provide access space around units for service as indicated, but in no case less than that recommended by manufacturer.
- F. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.
- G. Duct Connections: Provide ductwork, accessories, and flexible connections as indicated.
- H. Grounding: Provide positive equipment ground for unit components.
- I. Testing: Upon completion of installation of units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, than retest to demonstrate compliance.
- J. Provide one spare set of belts for each belt-driven unit, obtain receipt from Owner that belts have been received.

3.09 INSTALLATION OF TERMINAL HEATING UNITS (ELECTRIC)

- A. Installation of Electric Heating Terminals:
 - 1. Install electric heating terminal units including components as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices; complying with applicable installation requirements of NEC and NECA's "Standard of Installation".
 - 2. Coordinate with other electrical work, including wiring/cabbling, as necessary to properly interface installation of heating terminal units with other work.
 - 3. Clean dust and debris from each heating terminal as it is installed to ensure cleanliness.
 - 4. Comb out damaged fins where bent or crushed before covering elements with enclosures.
 - 5. Touch-up scratched or marred heating terminal enclosure surfaces to match original finishes.
 - 6. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminal to comply with tightening torques specified in UL Std. 486A.
- B. Grounding:
 - 1. Provide equipment grounding connections for electric heating terminals as indicated, Tighten connections to comply with tightening torque values specified in UL std. 486A to assure permanent and effective grounding.

C. Electrical Wiring:

1. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electric Installer.
 - a. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
 - b. Upon completion of installation of electric heating terminals, and after building circuitry has been energized, test heating terminals to demonstrate capability and compliance with requirements. Where possible, field correct malfunctioning units, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
 - c. Replace electric heating terminals and accessories which are damaged and remove damaged items from construction site.

D. Adjusting and Cleaning:

1. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
2. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
3. Install new filter units for terminals requiring same.

3.10 INSTALLATION OF POWER AND GRAVITY VENTILATORS

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and drawing VS.1.
- B. General: Except as otherwise indicated or specified, install ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that products serve the intended function.
- C. Coordinate ventilator work with work of roofing, walls and ceilings, as necessary for proper interfacing.
- D. Ductwork: Connect ducts to ventilators in accordance with manufacturer's installation instruction, and details on drawings.
- E. Roof Curbs: Furnish roof curbs to roofing Installer for installation.
- F. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- G. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.

- H. Testing: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of unit at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.
- I. Cleaning: Clean factory-finished surface. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- J. General: Furnish to Owner, with receipt, one spare set of belts for each belt driven power ventilator.

3.11 INSTALLATION OF METAL DUCTWORK

- A. Vibration Control and Seismic Restraint: Refer to section 23 05 48 and drawing VS-1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 23 05 48 and drawing VS-1.
- B. Installation of Metal Ductwork:
 - 1. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (five percent leakage for systems rated three in. and under; 1 percent for systems rated over three in.) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately with internal surface smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
 - 2. Sealing: All ductwork joints and seams shall be sealed with flexible duct sealer to assure an airtight installation.
 - 3. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 in.. Fasten to duct and substrate.
 - a. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate.
 - 4. Coordination: Coordinate duct installation with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
 - 5. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.
- C. Installation of Duct Liners:
 - 1. General: Install duct liners in accordance with SMACNA HVAC Duct Construction Standards.
- D. Installation of Flexible Ducts:
 - 1. Maximum Length: For any duct run using flexible ductwork, do not exceed four ft. – zero in. extended length.
 - 2. Installation: Install in accordance with Section II of SMACNA's, HVAC Duct Construction Standards, Metal and Flexible.

E. Installation of Kitchen Exhaust Ducts:

1. General: Fabricate joints and seams with continuous welds for watertight construction. Provide for thermal expansion of ductwork through 2000 deg. F (1093 deg. C) temperature range. Install without dips or traps which may collect residues. Provide access openings at each change in direction, locate on sides of duct 1-1/2 in. minimum from bottom, and fitted with grease-tight covers of same material as duct.
2. Kitchen exhaust hood ductwork shall be fabricated and installed in full accordance with the requirements of NFPA Bulletin 96. Duct work shall be fabricated of 16 gauge minimum thickness, black steel with all joints welded. Duct shall be properly attached to exhaust hoods and fans. Required clean-out access doors shall be installed in the vertical face of the ductwork.

F. Field Quality Control:

1. Leakage Tests: After each duct system, which is constructed for duct classes over three in. is completed, test for duct leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Repair leaks and repeat tests until total leakage is less than 1 percent of system design air flow.

G. Equipment Connections:

1. General: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery.

H. Adjusting and Cleaning:

1. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
2. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.
3. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until final connections are to be completed.
4. Balancing: Refer to Division 23 section Testing, Adjusting, and Balancing for air distribution balancing of metal ductwork. Seal any leaks in ductwork that become apparent in balancing process.

3.12 INSTALLATION OF DUCTWORK ACCESSORIES

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90 degree elbows in supply, return, and exhaust air systems, and elsewhere as indicated.
- C. Install splitter damper with adjusting rod in each supply branch. Install according to detail on drawings.
- D. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

- E. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.
- F. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
- G. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- H. Furnish extra fusible links to owner, one link for every 10 installed of each temperature range; obtain receipt.
- I. Provide fire dampers anywhere ductwork penetrates a fire-rated assembly.

3.13 INSTALLATION OF EXTRUDED ALUMINUM RAIN RESISTANT WALL LOUVERS

- A. Mechanical sheet metal Contractor is responsible for installation of Louvers in accordance with the following:
 - 1. EXAMINATION
 - a. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.
 - b. Notify Architect of unsatisfactory preparation before proceeding.
 - 2. PREPARATION
 - a. Clean opening thoroughly prior to installation.
 - b. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
 - 3. INSTALLATION
 - a. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.
 - b. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.
 - c. Install joint sealants as specified in Section 079200.
 - d. The General Contractor must be present to witness and provide guidance relative to the installation.
 - 4. CLEANING
 - a. Clean louver surfaces in accordance with manufacturer's instructions.
 - b. Touch-up, repair or replace damaged products before Substantial Completion.

3.14 INSTALLATION OF AIR OUTLETS AND INLETS

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

3.15 INSTALLATION OF WALL AND CEILING ACCESS DOORS

- A. Installation of Wall & Ceiling access doors shall be by the providing trade contractor for that surface.

3.16 INSTALLATION OF FIRESTOPPING AND SEALANTS

A. Examination

1. Examine the areas and conditions where firestops are to be installed and notify the architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the architect and in accordance with Section 078413.
2. Verify that environmental conditions are safe and suitable for installation of firestop products.
3. Verify that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

B. Installation

1. General:
 - a. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
 - b. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
 - c. Unless specified and approved, all in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
 - d. Seal holes and penetrations to ensure an effective smoke seal.
 - e. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
 - f. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
 - g. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.
2. Dam Construction: When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

C. Field Quality Control

1. Prepare and install Firestopping system in accordance with manufacturer's printed instructions and recommendations.
2. Follow safety procedures recommended in the Material Safety Data Sheets.
3. Finish surfaces of firestopping which are to remain exposed in the completed work to a uniform and level condition.
4. All areas of work must be accessible until inspection by the applicable Code Authorities.
5. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification.
6. Cleaning
7. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
8. Leave finished work in neat, clean condition with no evidence of spill overs or damage to adjacent surfaces.

3.17 INSTALLATION OF AUTOMATIC TEMPERATURE CONTROLS (DDC)

A. Installation of Control Systems:

1. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings. Coordinate the locations of all control devices and space mounted sensors with the Architectural Drawings and Construction Manager.
2. Control Wiring: Install control wiring, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code.
 - a. Install circuits over 25-volt with color-coded No. 12 wire in electric metallic tubing.
 - b. Install circuits under 25-volt with color-code No. 18 wire with 0.031 in. high temperature 105 deg, F. (41 deg. C) plastic insulation on each conductor and plastic sheath over all.
 - c. Install electronic circuits with color-coded No. 22 wire with 0.023 in. polyethylene insulation on each conductor with plastic-jacketed copper shield over all.
 - d. Install low voltage circuits, located in concrete slabs and masonry walls, or exposed in occupied areas, in electrical conduit.
 - e. Power sources from lighting circuits and wall outlets shall not be used to power DDC controllers.
3. Controllers and safety devices:
 - a. All safety devices such as freezestats, duct mounted heat detectors, smoke detectors, shall be hard wired to shut down the fans/units independently. Provide audible alarm with silence switch as well as DDC indication.
 - b. Humidifier controls shall be hard wired through fan proof flow differential switch and starter auxiliary contacts to disable humidifier system on fan shutdown. Provide DDC indication.
 - c. All supply, return and exhaust fans shall be provided with pressure differential switches. Current sensing devices, starter auxiliary contacts, and relay contacts are unacceptable proof of fan operation.
 - d. Primary and standby pumps shall be selectable through the DDC control system. Provide local pilot light to indicate selected pump as well as alarm and silence switch for failed pump. Provide differential pressure switch to prove flow.

B. Adjusting and Cleaning:

1. Start-Up: Start-up, test, and adjust control systems in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
2. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
3. Final Adjustment: After completion of installation, adjust thermostats, control valves, motors, dampers, actuators and similar equipment provided as work of this section.
 - a. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.

C. Closeout Procedures:

1. Owner's Instructions: Provide services of a manufacturer's technical representative for 40 hours to instruct Owner's personnel in operation, maintenance and instruction on running and basic troubleshooting of DDC control system.

2. Validation: The automatic temperature control contractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequence of operation submitted.
 - a. Witnessed validation demonstration shall consist of:
 1. Execute digital and analog commands in English and graphic mode.
 2. Demonstrate all specified diagnostics.
 3. Demonstrate scan, update, and alarm responsiveness.

D. Training:

1. All training shall be by the automatic temperature control contractor and shall utilize specified manuals and as-build documentation.
2. Operator training shall include:
 - a. Sequence of Operation review.
 - b. Sign on-Sign off.
 - c. Modifying warning limits, alarm limits and start-stop times.
 - d. System initialization.
 - e. Use of Portable Operators Terminal.
 - f. Troubleshooting of sensors (determining bad sensors).
 - g. Point disable/enable.
 - h. Software review of Sequence of Operation programs.
 - i. Modification of control programs.
 - j. Add/Delete/Modify data points.
 - k. Use of diagnostics.
 - l. Review of initialization.
3. Training shall be for Owner-designated personnel at the subject site, and shall be scheduled by the Owner with two week notice.
4. All training sessions shall be videotaped using a high quality camera and filmed by a properly trained personnel from the field of video recording. All videos shall be burned onto a DVD and turned over to the owner as part of the operation and maintenance manuals.

E. Seasonal Site Visits:

1. In addition to the one year warranty period against component and/or workmanship defects, 40 hours of training and 40 hours of additional programming as it relates to the control system and as indicated in section 230000 paragraph 2.26 & 3.26, the ATC contractor shall provide a seasonal site visit to confirm, verify and modify as required the sequence and/or programming of each piece of equipment to ensure the system is functioning as required and per the sequence of operations. The ATC contractor shall provide 16 labor hours per season (four times within a year, total of 64 hours). During each visit they shall, for each piece of equipment confirm operation and functionality, modify and/or repair any control related issues and/or programming and provide training as requested by the owner. This requirement will ensure the equipment/building is operating properly and efficiently as it cycles through each season. These seasonal site visits shall begin the following season after substantial completion of the project is issued. Upon substantial completion the engineer of record shall issue four dates to the ATC contractor and owner. Signatures and time logs will be kept by both parties to ensure these visits occur.

3.18 TESTING, ADJUSTING, AND BALANCING

A. Requirements:

1. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet specifications, and recording and reporting the results.

2. Test, adjust and balance the following mechanical systems:
 - a. Supply air systems.
 - b. Return air systems.
 - c. Exhaust air systems.
 - d. Outside air systems.
 - e. Verify temperature control system operation.
 3. Do not include:
 - a. Testing boilers and pressure vessels for compliance with safety code.
 - b. Installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing. Contact Mechanical Contractor and the Engineer for direction.
- B. Report:
1. Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
 - a. General Information and Summary.
 - b. Air Systems.
 - c. Temperature Control Systems.
 2. Contents: Provide the following minimum information, forms and data:
 - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentation used for the procedures along with the proof of calibration.
 - b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC for each respective item and system.
 - c. Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.
- C. Quality Assurance:
1. An independent testing, adjusting, and balancing agency certified by the AABC or NEBB as a Test and Balance Engineer in those testing and balancing disciplines required for this project.
 2. Codes and Standards:
 - a. AABC: "National Standards For Total System Balance".
 - b. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.
 3. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and Mechanical Contractor. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

4. System Operation: Systems shall be fully operational prior to beginning procedures. All new automatic temperature controls shall be fully operational. Test, adjust and balance the air systems before refrigerant systems. Test, adjust and balance air conditioning systems during summer season, and heating systems during winter season, including at least a period of operation at outside conditions within 5° F. wet bulb temperature of maximum summer design condition, and within 10° F. dry bulb temperature of minimum winter design condition. Take final temperature reading during seasonal operation.

D. Preliminary Procedures:

1. Air Systems:

- a. Obtain drawings and become thoroughly acquainted with the systems.
- b. Compare drawings to installed equipment and field installations.
- c. Walk the system from the system air handling equipment to terminal units to determine variations in installation.
- d. Check filters for cleanliness.
- e. Check all dampers (volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
- f. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a cross check with required fan volumes.
- g. Determine best locations in main and branch ductwork for most accurate duct traverses. Traverses shall be performed in each supply and return duct main and sub-mains for each AHU and return air fan.
- h. Place outlet dampers in the full open position.
- i. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
- j. Verify lubrication of all motors and bearings.
- k. Check fan belt tension.
- l. Check fan rotation.

2. Measurements:

- a. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerance specified in the referenced standards. Instruments shall be properly maintained and protected against damage.
- b. Provide instruments meeting the specifications of the referenced standards.
- c. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
- d. Apply instrument as recommended by the manufacturer.
- e. Use instruments with minimum scale and maximum subdivisions and with scaled ranges proper for the value being measured.
- f. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5%. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.
- g. Take all reading with the eye at the level of the indicated value to prevent parallax.
- h. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.
- i. Take measurements in the system where best suited to the task.

E. Performing Testing, Adjusting, and Balancing:

1. Test, adjust and balance all noted systems according to SMACNA standards and as follows:
 - a. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.
 - b. Cut insulation and ductwork for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

- c. Patch insulation, ductwork, and housings, using materials identical to those removed.
 - d. Seal ducts and test for and repair leaks.
 - e. Seal insulation to re-establish integrity of the vapor barrier.
 - f. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
 - g. Retest, adjust and balance system subsequent to significant system modifications, and resubmit test results.
2. System Deficiencies:
- a. The Balancing Contractor shall advise the Mechanical Contractor and the Engineer of all system deficiencies in writing. Report all motors not running, missing dampers, inoperative valves and controls, lack of access, etc.
 - b. Upon completion of system deficiencies, Balancing Contractor shall balance and record data.
- F. Subject to compliance with the above requirements and certifications, provide the services of air and water testing and balancing of one of the following:
1. Thomas Young
 2. Leonhardt Co.
 3. Arden Engineering
 4. American Testing and Balancing
 5. Or equal.

END OF SECTION

SECTION 26 0000

ELECTRICAL
 (Filed Sub-Bid Required)

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SECTION 26 0000

ELECTRICAL
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.02 FILING SUB-BIDS

- A. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Public Agency at a time and place as stipulated in the "Instructions to Bidders."
2. Each sub-bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 44F of Chapter 149 of the General Laws, as amended.
3. Sub-bids filed with the Awarding Authority shall be accompanied by Bid Bond, Cash, Certified Check, Treasurer's Check, or Cashier's Check issued by a responsible bank or trust company payable to the Town of Boxford in the amount of 5 percent of the sub-bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.

- B. No Sub Sub-Bid Requirements for this Section

- C. Trade Sub-Bid Requirements:

CLASS OF WORK	PARAGRAPH NUMBER
Technology	Section 27 0000
Security	Section 28 0000

The Work of this Trade Bid is shown on the following Contract Drawings:

1. E0.1 - ELECTRICAL SYMBOL LIST
2. E0.2 - LIGHTING FIXTURE SCHEDULE
3. E0.3 - ELECTRICAL SITE PLAN
4. E0.4 - ELECTRICAL SITE DETAILS
5. E0.5 - ELECTRICAL SITE DETAILS
6. E1.1 - FIRST FLOOR PLAN – LIGHTING
7. E1.2 - SECOND FLOOR PLAN – LIGHTING
8. E2.1 - FIRST FLOOR PLAN – POWER
9. E2.2 - SECOND FLOOR PLAN - POWER
10. E2.3 - ROOF PLAN
11. E2.4 - LIGHTNING PROTECTION DETAILS
12. E3.0 - ONE-LINE POWER RISER
13. E3.1 - ELECTRICAL DETAILS
14. E3.2 - ELECTRICAL DETAILS
15. E3.3 - MECHANICAL AND PLUMBING SCHEDULE

16. E3.4 - GROUNDING RISER
17. E4.0 - FIRE ALARM RISER
18. E4.1 - FIRST FLOOR PLAN - FIRE ALARM
19. E4.2 - SECOND FLOOR PLAN - FIRE ALARM
20. E5.0 - SECURITY RISER AND DETAILS
21. E5.1 - FIRST FLOOR PLAN - SECURITY
22. T0.1 - TECHNOLOGY SYMBOL LIST AND DETAILS
23. T1.1 - FIRST FLOOR PLAN - TECHNOLOGY
24. T2.0 - TECHNOLOGY RISER
25. T2.1 - TECHNOLOGY DETAILS

1.03 SUMMARY

- A. Work described herein shall be interpreted as work to be done by the Electrical Contractor. Work to be performed by other trades will be referenced to a particular contractor.
- B. Provide all labor, materials, tools, and equipment, including scaffolding, to complete the installation of the electrical system. Install, equip, adjust, and put into operation the respective portions of the installation specified, and so interconnect various items or sections of work in order to form a complete and operating whole. Systems may be referenced in singular or plural terms, also refer to drawings to confirm quantities. The work shall consist of, but shall not necessarily be limited to the following:
 1. Primary, secondary and low tension ductbanks, handholes and manholes.
 2. Secondary distribution equipment, including metering, motor controls, Variable Frequency Drives, distribution panels, and panelboards, including feeders and subfeeders.
 3. Fire alarm system, addressable type.
 4. Emergency power system, including Natural gas emergency generator, emergency lighting and exit signs.
 5. Lighting systems exterior and interior, including lamps, fixtures, and controls.
 6. All raceway systems, including boxes, couplings, and fittings.
 7. All branch circuit wiring systems, including wiring devices and plates.
 8. Excavation and backfill within building foundation walls for any underground raceways not indicated on plans.
 9. Connections for all building equipment, including mechanical, plumbing, fire protection, Owner's equipment and the like.
 10. All testing of equipment installed.
 11. Any other item of work hereinafter specified or indicated on electrical drawings.
 12. Drilling, coring, and cutting of holes (where the largest dimension thereof does not exceed 12 inches) for electrical conduit systems, and equipment.
 13. Systems Identification.
 14. Scaffolding, Rigging, and Staging required for all Electrical Work.
 15. Fire stopping for all Electrical Work.
 16. Provide Seismic Restraints for all Electrical Systems conforming to the requirements of Section 230548 which Section is herein incorporated by reference.
 17. Coordination Drawings.
 18. Technology system provisions, including 120 volt power sources, raceways and backboxes, fireproofing, grounding, and all pathways required for voice, data, and video systems as indicated on plans and specified in Section 27 00 00 - Technology.
 19. Automated lighting control system.
 20. Temporary Light and Power, refer to Section 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.
 21. Integrated electronic security system IESS provisions including 120V power sources, cable tray, raceways, and back boxes, fireproofing, and grounding for security systems as indicated on plans and specified in Section 280000 – Security.
 22. Provisions for a BDA system as indicated on plans.

1.04 DEFINITIONS

- A. Most terms used within the documents are industry standard. Certain words or phrases shall be understood to have specific meanings as follows:
1. Provide: Furnish and install completely connected up and in operable condition.
 2. Furnish: Purchase and deliver to a specific location within the building or site.
 3. Install: With respect to equipment furnished by others, install means to receive, unpack, move into position, mount and connect, including removal of packaging materials.
 4. Conduit: Raceways of the metallic type which are not flexible. Specific types as specified.
 5. Connect: To wire up, including all branch circuitry, control and disconnection devices so item is complete and ready for operation.
 6. Subject to Mechanical Damage: Equipment and raceways installed exposed and less than eight ft. above finished floor in mechanical rooms or other areas where heavy equipment may be in use or moved.

1.05 ITEMS TO BE FURNISHED ONLY

- A. Furnish the following items for installation under designated sections.
1. Duct smoke detectors with sampling tube, SECTION 23 00 00 – HVAC.

1.06 ITEMS TO BE WIRED ONLY

- A. Install the following items furnished under designated sections.
1. Specialty backboxes, Section 27 00 00 – Technology.

1.07 RELATED WORK

- A. The following related work is to be performed under designated sections.
1. Temp. Controls – SECTION Division 01 – Section 01 50 00 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.
 2. Excavation and Backfill: DIVISION 31 - EARTHWORK (except within building foundation).
 3. Concrete Bases and Duct Envelopes: DIVISION 03 - CONCRETE.
 4. Insulation: SECTION 07 21 00- THERMAL INSULATION.
 5. Finish Painting: SECTION 09 91 00 – PAINTING.
 6. Payment for energy for temporary light and power will be made by General Contractor. Refer to Section 01 50 00.
 7. Cutting beyond 1.03, B.12 above and patching of all openings regardless of size will be by respective Sections of the trade responsible for the surface on which the penetration occurs.
 8. Automatic Temperature Control: SECTION 23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING.
 9. Hardware: SECTION 08 71 00 – FINISH HARDWARE.
 10. Communications system equipment and wiring: SECTION 270000 – TECHNOLOGY
 11. Integrated Electronic Security System equipment and wiring: Owner's Security Vendor under State Contract.
 12. Temporary Power and Lighting: SECTION 01 50 00

1.08 CONTRACT COST BREAKDOWN

- A. Submit a breakdown of contract price to aid Architect in determining value of work installed as job progresses.

1.09 INSPECTION OF SITE

- A. Electrical bidders will be permitted to inspect site. Failure to inspect existing conditions or to fully understand work which is required shall not excuse Electrical Subcontractor from his obligations to supply and install work in accordance with specifications and the drawings and under all site conditions as they exist.

1.10 CONTRACTOR'S REPRESENTATIVE

- A. Retain a competent representative on the project.

1.11 COOPERATION

- A. Work shall be carried on under usual construction conditions, in conjunction with other contractors work. Cooperate with other contractors, coordinate work and proceed in a manner as not to delay progress.
- B. Before proceeding, examine all construction drawings and consult other contractors to coordinate installation and avoid interference.
- C. In case of dispute, the Architect will render a decision in accordance with General and Supplementary General Conditions.

1.12 CODES, ORDINANCES, AND PERMITS

- A. Codes and Ordinances:
 - 1. All material and work provided shall be in accordance with all applicable codes including the following codes and standards as most recently amended.
 - Commonwealth of Massachusetts Building Code
 - Massachusetts Electric Code, 2020 Edition
 - State Department of Public Safety
 - NFPA 101 Life Safety Code
 - NFPA Standards
 - Standards of the Underwriters Laboratories (UL)
 - Occupational Safety and Health Act (OSHA)
 - Americans with Disabilities Act (ADA)
 - Energy Conservation Code
 - Town of Boxford
 - 2. Where contract documents indicate more stringent requirements than codes, the contract documents shall take precedence.
- B. Permits: Be responsible for filing documents and securing of inspection and approvals. Refer to Section 007390, Paragraph 1.17 for Permit fees.
- C. Refer to DIVISION 01 – GENERAL REQUIREMENTS. Utility company backcharges related to permanent service will be paid by Owner.

1.13 ELECTRICAL ROOMS OR SPACES

- A. Be responsible for ensuring that the dedicated space and clearances required in the NEC, Sections 110-26 are maintained for all electrical equipment.
- B. Call other contractors' attention to the requirements contained in the above mentioned code sections, prior to the installation of equipment by other contractors, in order to ensure no violations.

1.14 SUBMITTALS

- A. Refer to Supplementary General Conditions for information relative to submission of shop drawings. Six copies are required. No equipment shall be installed prior to approval, except at Contractor's own risk.
- B. Notwithstanding any restrictions upon contractor proposed substitutions, should apparatus or materials be permitted by Architect to be substituted for those specified for good cause, and such substitution necessitates changes in or additional connections, piping, supports, or construction, same shall be provided. Assume cost and entire responsibility thereof.
- C. Submit the following samples:
 - 1. Lighting fixtures as may be requested.
 - 2. Other items as may be requested.

1.15 GUARANTEE

- A. All parts of the work shall be guaranteed for a period of one (1) year from the date of acceptance of the job by Owner. If during that period of general guaranty, any part of the work fails, becomes unsatisfactory, or does not function properly due to any fault in material or workmanship whether or not manufactured or job built, the Owner shall upon notice from owner promptly proceed to repair or replace such faulty material or workmanship without expense to owner, including cutting, patching, and painting, or other work involved, and including repair or restoration of any damaged sections of the premises resulting from such faults.
- B. In the event that a repetition of any one defect occurs indicating the probability of further failure and which can be traced to faulty design, material, or workmanship, then repair or replacement shall not continue to be made but the fault shall be remedied by a complete replacement of the entire defective unit.
- C. In addition to the general guaranty, obtain and transmit to owner any guaranties or warranties from manufacturers of specialties, but only as supplementary to the general guaranty which will not be invalidated by same.

1.16 ELECTRICAL CHARACTERISTICS

- A. In general, and unless specifically indicated otherwise, all building service, heating, ventilating, air conditioning, and plumbing equipment shall be of the following characteristics:
 - 1. Motors up to and including 1/3 HP shall be suitable for 120 volts, one phase operation.
 - 2. Motors larger than 1/3 HP shall be suitable for 208 volts, three-phase operation.
 - 3. Electric heating equipment 1.5 KW and less shall be suitable for 120 volt single-phase operation. Over 1.5 KW shall be 208 volt three phase.

- B. Power Factor: All equipment provided rated greater than 1,000 watts and lighting equipment greater than 15 watts with an inductive reactance load component shall have a power factor of not less than 90 percent under rated load conditions.

1.17 TEMPORARY ELECTRICAL SUPPORT FACILITIES

1.18 Refer to Section Division 01, Section 01 50 00 – Construction Facilities and Temporary Controls.

- A. Provide own field office and/or storage facilities. Provide all tools, equipment, ladders, and temporary construction required for execution of the work.
- B. All scaffolding, ladders, and other temporary construction shall be rigidly built in accordance with all local and state requirements and shall be removed upon completion.

1.19 INSPECTIONS AND TESTS

- A. Inspection: If inspection of materials installed shows defects, such defective work, materials, and/or equipment shall be replaced and inspection and tests repeated.
- B. Tests: Make reasonable tests and prove integrity of work and leave electrical installation in correct adjustment and ready to operate. All panels and distribution panels shall have phases balanced as near as practical. A consistent phase orientation shall be adhered to at all terminations.

1.20 ENERGY REBATE PROGRAM

- A. This project has been designed to incorporate equipment approved for energy rebate such as fixtures, drivers, lamps and sensors. Provide accordingly and file all forms required by utility company on behalf of the Owner. Obtain Utility Co. approval for light fixtures and controls prior to submitting shop drawings.

1.21 INFORMATION TECHNOLOGY AND TECHNOLOGY SYSTEM PROVISIONS

- A. Electrical Contractor shall work closely with the Technology and Security System Contractors to assure a first class installation. Coordinate all back boxes and conduits required prior to installations. In general, the electrical contractor shall provide conduits from outlets to accessible ceiling spaces.
- B. Responsibilities of the Electrical Contractor: The Electrical Contractor shall be responsible for furnishing and installing all related system provisions including, but not limited to: power, cable trays, conduits with bushings, conduit stubs with bushings, sleeves with bushings, backboxes, plaster rings, pull strings, bonding, grounding, for a completely operational system. Specialty backboxes will be furnished by Technology and installed under Section 26 00 00.
- C. Responsibilities of the Technology and Security Systems Contractor: The Technology and Security Systems Contractor will be responsible for furnishing, installing, wiring, programming, troubleshooting, training and warranty service of all cabling and equipment, for a complete operational system.

1.22 RECORD DRAWINGS

- A. Provide two sets of black or blue line on white drawings to maintain and submit record drawings, one set shall be maintained at site and which shall be accurate, clear, and complete showing actual location of all equipment as installed. Record drawings shall be updated at least monthly. Record drawings shall show outlet from which homeruns are taken, and location of all junction boxes and access panels. These drawings shall be available to Architect/Engineer field representative. Refer to Division 01.
- B. Any addenda sketches and supplementary drawings issued during course of construction shall be attached to drawings.
- C. At completion, submit an accurate checked set of drawings.
- D. After approval of these drawings, photo reproductions of original tracings shall be revised to incorporate changes, including addenda sketches and supplementary drawings. These as-built drawings shall be certified as correct and delivered to the Architect along with one set of black line prints and an AutoCAD CD.

1.23 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Operating Instructions: Furnish operating instructions to Owner's designated representative with respect to operations, functions and maintenance procedures for equipment and systems installed. Cost of such instruction up to a full three days of Electrical Subcontractor's time shall be included in contract. Cost of providing a manufacturer's representative at site for instructional purposes shall also be included.
- B. Maintenance Manuals:
 - 1. At completion of the project, provide four copies of complete manuals containing the following:
 - a. Complete shop drawings of equipment.
 - b. Operation description of systems.
 - c. Names, addresses, and telephone numbers of suppliers of systems.
 - d. Vendors' P.O. numbers for equipment installed.
 - e. Preventive maintenance instructions for systems.
 - f. Spare parts list of system components.
 - 2. All information shall be in one binder.

1.24 COORDINATION DRAWINGS

- A. Before materials are purchased or work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly annotated and cross-referenced at their interfaces. Refer to Division 01 for additional requirements.
- B. The General Contractor will be responsible for the coordination of all mechanical and electrical work. Before materials are fabricated or work begun, he shall submit to the Architect complete Coordination Drawings in the form of reproducible (vellum) transparencies at not less than ¼ inch scale. Congested areas and sections through shafts shall be prepared at not less than 3/8 inch scale. The General Contractor may request electronic files, from the Architect, to generate the indication of the building shell background for the Coordination Drawings.

- C. Coordination Drawings shall indicate the necessary offsets for all ductwork, piping, conduit, and other items to clear the work of all other trades and to maintain the required ceiling height and partition layout. Each subcontractor shall indicate both top and bottom elevations of their equipment taking into account hangers, flanges, and other accessories.
 - D. Prepare Coordination Drawings as follows:
 - 1. The General Contractor shall require the HVAC Subcontractor to prepare original Drawings showing all his/her equipment, ducts, and piping on these transparencies.
 - 2. The General Contractor shall have vellum transparencies made therefrom.
 - 3. The General Contractor shall then require the Plumbing Subcontractor to indicate all Plumbing piping and heating lines.
 - 4. The General Contractor shall then require the Fire Protection Subcontractor to indicate all his/her equipment and piping on these transparencies.
 - 5. The General Contractor shall then require the Electrical Subcontractor to indicate all his/her equipment and conduit lines on these transparencies.
 - 6. The General Contractor shall resolve conflicts and then submit these transparencies to the Architect for review.
 - E. Coordination Drawings shall bear the signature of all Subcontractors involved indicating that all space conditions have been satisfactorily resolved. In addition, the Drawings shall bear the Contractor's stamp bearing the notation "Drawings Have Been Checked and Coordinated with All Trades". Drawings without these notations will not be accepted by the Architect.
 - F. If any space conflicts cannot be resolved by the Contractor, he shall immediately notify the Architect and request disposition of the conflict.
 - G. Coordination Drawings are for the Contractor's and Architect's use during construction and shall not be construed as replacing any Shop, As-Built, or Record Drawings required elsewhere in these Contract Documents.
 - H. Architect's review of Coordination Drawings shall not relieve the Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirement of the Contract.
- 1.25 RETURN AIR PLENUM
- A. All wiring in areas above suspended ceilings shall be UL Listed plenum rated cable or wiring shall be installed in conduit.
- 1.26 ALTERNATES
- A. Refer to Section 01 23 00 for Alternates affecting this section.
 - B. Include in your bid a separate price for amounts to be added or deducted from base bid amount for the following areas of electrical work:
 - 1. Alternate No. 1 – Provide work as indicated on plans for the fire protection system.

1.27 TRADE RESPONSIBILITY COORDINATION MATRIX

Device	Furnished By	Installed By	Power Wiring	Control Wiring	Fire Alarm Wiring	Notes
Smoke Detectors (Area type)	26 00 00	26 00 00	26 00 00	23 00 00 (ATC)	26 00 00	
Smoke Detectors (Duct mounted)	26 00 00	23 00 00	26 00 00	23 00 00 (ATC)	26 00 00	
Smoke & Fire/Smoke Dampers	23 00 00	23 00 00	N/A	N/A	N/A	
Smoke & Fire/Smoke Damper Actuators	23 00 00	23 00 00	26 00 00 & 23 00 00 (ATC)	23 00 00 (ATC)	26 00 00	2
Fire Dampers	23 00 00	23 00 00	N/A	N/A	N/A	
VAV Boxes	23 00 00	23 00 00	26 00 00	23 00 00 (ATC)	N/A	2
VAV Box Damper Actuator	23 00 00 (ATC)	Box Mfr	23 00 00 (ATC)	23 00 00 (ATC)	N/A	2
VAV Box DDC Controller	23 00 00 (ATC)	Box Mfr	23 00 00 (ATC)	23 00 00 (ATC)	N/A	2
Hydronic Control Valves	23 00 00 (ATC)	23 00 00	N/A	23 00 00 (ATC)	N/A	1
Hydronic Control Valve Actuator	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	N/A	1
Sheet Metal Damper	23 00 00	23 00 00	N/A	N/A	N/A	1
Sheet Metal Damper Actuators	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	N/A	1
Natural Gas Energy Meters	22 00 00	22 00 00	26 00 00 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	3
Electrical Energy Meters	26 00 00	26 00 00	26 00 00 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	3
Domestic Water Meters	22 00 00	22 00 00	26 00 00 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	3
HVAC Hydronic Energy Meters	23 00 00	23 00 00 (ATC)	26 00 00 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	3
Airflow Measuring Stations	23 00 00 (ATC)	23 00 00 (ATC)	N/A	23 00 00 (ATC)	N/A	
DDC Panels	23 00 00 (ATC)	23 00 00 (ATC)	26 00 00 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	4
VFDs at AHU, EFs, Pumps	26 00 00	26 00 00	26 00 00	23 00 00 (ATC)	N/A	
Elevator Hoistway Vent Damper	23 00 00	23 00 00	N/A	N/A	N/A	
Elevator Hoistway Vent Damper Actuator	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	26 00 00	

Device	Furnished By	Installed By	Power Wiring	Control Wiring	Fire Alarm Wiring	Notes
Boiler/DHW Intake & Exhaust Breeching	22 00 00	22 00 00	N/A	N/A	N/A	
Generator Exhaust Breeching	22 00 00 (if gas fired) 23 00 00 (if diesel fired)	22 00 00 (if gas fired) 23 00 00 (if diesel fired)	26 00 00	26 00 00	26 00 00	
Kitchen Emergency Gas Valve	22 00 00	22 00 00	26 00 00	26 00 00	26 00 00	

Notes:

1. Division 23 00 00 and Division 23 00 00 (ATC) Contractors shall fully coordinate all airflow damper and hydronic valves sizes and quantities.
2. Smoke Damper and VAV Box power wiring shall be provided by Division 26 00 00 to junction box locations shown on electrical drawings; Division 23 00 00 (ATC) Contractor shall provide final power wiring from junction box to end device location.
3. Division 26 00 00 Contractor shall provide all line-voltage power wiring required for meters; Division 23 00 00 (ATC) Contractor shall provide all low-voltage power wiring required for meters.
4. Division 26 00 00 shall provide power at main DDC Panel. Division 23 00 00 (ATC) shall provide power to all other DDC Panels.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Product specifications are written in such a manner so as to specify what materials may be used in a particular location or application and therefore do not indicate what is not acceptable or suitable for a particular location or application. As an example: non-metallic sheathed cable is not specified; therefore, it is not acceptable.
- B. For purpose of establishing a standard of quality and not for purpose of limiting competition, the basis of this Specification is upon specified models and types of equipment and materials, as manufactured by specified manufacturers.
- C. In all cases, standard cataloged materials and systems have been selected. Materials such as lighting fixtures specially manufactured for this particular project and not part of a manufacturers' standard product line will not be acceptable. In the case of systems, the system components shall be from a single source regularly engaged in supplying such systems. A proposed system made up of a collection of various manufacturers' products will be unacceptable.
- D. All material shall be new and shall be UL listed.

2.02 RACEWAYS AND FITTINGS

A. Raceways - General:

1. No raceway shall be used smaller than $\frac{3}{4}$ in. diameter and shall have no more than four 90 degree bends in any one run, and where necessary, pull boxes shall be provided. Only rigid metal conduit or intermediate metal conduit is allowed for slab work. Cable systems, if allowed to be used by other sections of this specification, shall not be used exposed or in slabs, whether listed by UL for such use or not.

2. Rigid metal conduit conforming to, and installed in accordance with, Article 344 shall be heavy wall zinc coated steel conforming to American Standard Specification C80-1 and may be used for service work, exterior work, slab work, and below grade level slab, wet locations, and in penthouse for drops down to equipment from elevations below eight ft. and also where raceway may be subject to mechanical damage.
3. Intermediate metal conduit conforming to, and installed in accordance with, Article 342, may be used for all applications where rigid metal conduit is allowed by these specifications.
4. Electrical Metallic Tubing (EMT), conforming to, and installed in accordance with, Article 358 shall be zinc coated steel, conforming to industry standards, may be used in masonry block walls, stud partitions, above furred ceilings, where exposed but not subject to mechanical damage, and may be used for fire alarm work.
5. Surface metal raceways conforming to, and installed in accordance with, Article 386 may be used where raceways cannot be run concealed in public spaces including corridors, offices, toilets.
6. Flexible metal conduit shall be used for final connections to recessed lighting fixtures from above ceiling junction boxes and for final flexible connections to motors and other rotating or vibrating equipment. Liquid tight flexible metal conduit shall be used for the above connections which are located in moist locations. All flexible connections shall include an insulated grounding conductor.
7. Rigid non-metallic conduit shall be used for underground electric and telephone services outside the foundation wall and shall be polyvinyl chloride (PVC) schedule 40, 90 degrees Celsius.
8. PVC Schedule 40 may also be used for below slab feeders and circuits within building confines. Below slab rigid non-metallic conduits do not require concrete encasement. Rigid non-metallic conduits may also be used for exterior feeders and branch circuits. Rigid non-metallic conduits shall not be used in-slabs, for elbows that penetrate slabs or thru-foundation walls. Raceways and fittings shall be produced by same manufacturer.
9. Acceptable manufacturers:
Pittsburgh Standard Conduit Company
Republic Steel and Tube
Youngstown Sheet and Tube Company
Carlton
Or Equal
10. Fittings:
 - a. Provide insulated bushings on all raceways 1 inch diameter or larger.
 - b. Manufacturer's standard fittings shall be used for raceway supports.
 - c. Expansion Fittings: Expansion fittings shall be used where structural and concrete expansion joints occur and shall include a ground strap.
 - d. Couplings for rigid metal and intermediate metal conduit shall be threaded type.
 - e. Threadless fittings for EMT shall be watertight compression type or set-screw type (dry-locations). All fittings shall be concrete tight. No diecast fittings allowed except for raceways larger than 1 inch diameter.
 - f. Cable supports in vertical raceways shall be of the split wedge type. Armored cable supports for vertical runs to be of wire mesh basket design.
 - g. Wall entrance seals shall be equal to O.Z. Gedney type WSK.
 - h. Couplings, elbows and other fittings used with rigid nonmetallic conduit shall be of the solvent cemented type to secure a waterproof installation.
 - i. Acceptable manufacturers:
O.Z.
Crouse Hinds
Appleton
EFCOR
Steel City
Or Equal

B. Outlets, Pull and Junction Boxes:

1. Outlets:

- a. Each outlet in wiring or raceway systems shall be provided with an outlet box to suit conditions encountered. Boxes installed in normally wet locations or surface mounted shall be of the cast-metal type having hubs. Concealed boxes shall be cadmium plated or zinc coated sheet metal type. Old work boxes with Madison clamps not allowed in new construction. Thru the wall boxes are not permitted. Surface mounted boxes below 8 ft. above finish floor in finish spaces shall be of the finish type without knockouts.
- b. Each box shall have sufficient volume to accommodate number of conductors in accordance with requirements of Code. Boxes shall not be less than 1-1/2 in. deep unless shallower boxes are required by structural conditions. Ceiling and bracket outlet boxes shall not be less than 4 in. octagonal except that smaller boxes may be used where required by particular fixture to be installed. Flush or recessed fixtures shall be provided with separate junction boxes when required by fixture terminal temperature requirements. Switch and receptacle boxes shall be 4 in. square or of comparable volume.
- c. Far side box supports shall be Caddy J-1A.
- d. Acceptable manufacturers:
Appleton
Crouse Hinds
Steel City
RACO
Or Equal

2. Pull and Junction Boxes: Where indicated on plans, and where necessary to terminate, tap off, or redirect multiple raceway runs or to facilitate conductor installation, furnish, and install appropriately designed boxes. Boxes shall be fabricated from code gauge steel assembled with corrosion resistant machine screws. Box size shall be per Code.

3. Boxes in moist or wet areas shall be galvanized type. Boxes larger than 4-11/16 inches square shall have hinged covers. Boxes larger than 12 inches in one dimension will be allowed to have screw fastened covers, if a hinged cover would not be capable of being opened a full 90 degrees due to installation location.
 - a. Acceptable Manufacturers:
 - b. Brasch
 - c. Hoffman
 - d. Keystone
 - e. Lee Products Co.
 - f. McKinstry Inc.
 - g. Eldon Inc.
 - h. Or Equal

2.03 CONDUCTORS

- A. All conductors shall be a minimum size of #12 AWG except for control wiring and fire alarm wiring where #14 AWG may be used. For all exit sign circuits, normal/emergency and/or emergency only circuits, exterior lighting circuits, and also where distance from panelboard to first outlet exceeds 100 ft. at 120 volts, #10 AWG shall be minimum size wire allowed. All feeder and branch circuit conductor shall be color coded as follows:

- | | | | |
|----|--------------------|---------|-------|
| 1. | 208Y/120V | Phase A | Black |
| 2. | 208Y/120V | Phase B | Red |
| 3. | 208Y/120V | Phase C | Blue |
| 4. | Grounded Conductor | 120/208 | White |
| 5. | Equipment Ground | 120/208 | Green |

6. Isolated Ground 120/208 Green with Orange Trace
- B. All conductors not installed in accordance with color scheme shall be replaced. All conductors larger than #6 AWG must be identified with colored tape.
- C. Connections throughout the entire job shall be made with solderless type devices.
1. For #10 AWG and smaller: spring type.
 2. For #8 AWG and larger: circumferential compression type.
 3. Acceptable manufacturers:
 - a. 3M "Scotchlock"
 - b. IDEAL "Wingnut"
 - c. BURNDY
 - d. MAC
 - e. Or equal
 4. Any splices made up in ground mounted pull boxes shall be resin cast waterproof type or waterproof pressure type.
- D. Conductors shall be copper, soft drawn, and annealed of 98 percent conductivity except for feeders rated at 100 amperes or greater where aluminum conductors are allowed. Conductors larger than #10 AWG shall be stranded; #10 AWG and smaller shall be solid. Conductors shall be insulated for 600 volts and be of following types:
1. All conductors shall have heat/moisture resistant thermoplastic insulation type THHN/THWN (75 degrees C) except as follows:
 - a. In sizes #1 AWG and larger: Crosslinked polyethylene insulation type XHHW (75 degrees C – 90 degrees C) may be used.
 - b. Fire alarm system conductors shall be #14 AWG, type THHN, solid. Color coding of fire alarm conductors shall be in accordance with fire codes.
 - c. Fixture whips #16AWG type "SF".
- E. Stranded conductors for all wiring systems except fire alarm will be allowed if installed and terminated as specified under Execution Section.
- F. Mineral-Insulated Metal-Sheathed Fire-Resistive Cables (Type MI) - Cables shall consist of a factory assembly of one or more solid copper conductors insulated with highly-compressed magnesium oxide and enclosed in a seamless, liquid-and-gas-tight continuous copper sheath. Cables shall be rated for 600 volts and less. Cables shall comply with Article 332 of the National Electrical Code. Cables shall be classified by Underwriters Laboratories, Inc. as having a 2-hour fire resistive rating. Cable terminations shall be made with UL listed mineral-insulated cable fittings. Approved Manufacturer - Pyrotenax USA, Inc. or equal.
- G. Type MC Cable may be used for concealed branch circuits in hollow spaces where allowed by code if installed and terminated as specified under Execution Section. Armor to be galvanized steel and shall be UL listed for 2 hour fire wall penetration. Light steel armor is acceptable.
- H. MC Cable may be used for fire alarm where concealed and allowed by Code and shall have red armor.
- I. Acceptable manufacturers:
1. AFC Cable Systems
 2. Cornish
 3. Crescent
 4. General Cable
 5. Okonite
 6. Or equal

2.04 ACCESS PANELS

- A. Provide access panels for access to concealed junction boxes and to other concealed parts of system that require accessibility for operation and maintenance. In general, electrical work shall be laid out so access panels are not required.
- B. Access panels shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that junction can be easily reached and size shall be sufficient for purpose (minimum size 12 in. x 12 in.). Access panels shall be prime painted and equipped with screwdriver operated cam locks.
- C. Acceptable manufacturers:

Inland Steel Products Company - Milcor
Miami Carey
Walsh-Hannon-Gladwin, Inc. - Way Locator
Or Equal
Specific types:
 - 1. Acoustical Tile Ceiling "Milcor Type AT"
 - 2. Plastered Surfaces "Milcor Type K"
 - 3. Masonry Construction "Milcor Type M"
 - 4. Drywall Construction "Milcor Type DW"
- D. Furnish access panel shop drawings.

2.05 SLEEVES, INSERTS, AND OPENINGS

- A. Sleeves: Provide sleeves of proper sizes for all openings required in concrete floors and walls. Sleeves passing through floors shall be set with top of sleeve 1 in. above finished floor. Core drilling will also be acceptable if in accordance with any structural standards. Any unsleeved openings shall be waterproofed.
- B. Inserts: Provide inserts or other anchoring devices in concrete and masonry construction to support raceways and equipment.
- C. Openings: Where an opening is required in concrete slabs to allow passage of a multitude of raceways, give adequate notice to General Contractor so he may box out opening in form work.
- D. Any openings through fire rated surfaces shall be closed off with fireproofing materials providing the same rating as the surface penetrated.
Acceptable Manufacturers:
Specified Technologies Inc.
Thomas & Betts
International Protective Coatings Corp.
3M Fire Protection Products
Dow Corning
Or Equal

2.06 WIRING DEVICES

- A. Receptacles: Receptacles shall be flush mounted. All standard 20 ampere devices to be of same manufacturer. Provide tamperproof receptacles where indicated on plans.
1. Acceptable Manufacturers:

Twenty ampere duplex grounding type NEMA 5-20R, - Tamper Resistant
Arrowhart 5362-V, - TR6352V
Hubbell 5362I, - 5362ITR
Pass and Seymour 5362I, - TR5362I
Leviton 5362-I - TCR20-T
Or equal

Thirty ampere, 250 volt NEMA 14-30R complete with plate,
Arrowhart AH1257,
Hubbell 9350,
Pass and Seymour 3853
GE 1439-3
Or equal
- B. Switches: 20 ampere,
1. Arrowhart AHWD 2221,
 2. Hubbell 1221,
 3. Pass and Seymour 20AC-2,
 4. Leviton 1221.
 5. GE 5951,
 6. Or equal
 7. Prewired devices with pigtails acceptable
- C. Composition material of wiring devices to be nylon with ivory finish. Outlets intended for computer use shall be grey finish.
- D. Coverplates: Brushed US 302 stainless steel
- E. Provide gaskets on all wiring device plates where devices are on walls separating conditioned and non-conditioned spaces and exterior walls.
- F. Dimmer Controls:
1. All devices shall be UL listed specifically for the required loads (i.e., incandescent, fluorescent, magnetic low voltage, electronic low voltage). Manufacturer shall provide file card upon request. Universal dimmers are not acceptable.
 2. All dimmers and switches shall incorporate an air gap switch. The air gap switch shall be capable of meeting all applicable requirements of UL 20 for air gap switches on incandescent dimmers.
 3. All dimmers and switches shall provide power- failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.

4. Dimmers and switches shall meet ANSI/IEEE Std. C62.41-1980, tested to withstand voltage surges of up to 6000V and current surges of up to 200A without damage.
5. Dimmers and switches shall meet the UL 20 limited short circuit test requirement for snap switches.
6. Dimmer shall provide a smooth and continuous Square Law dimming curve.
7. Dimmers shall be voltage regulated so that +10 percent variation in line voltage shall cause not more than + 5 percent variation in load voltage when dimmer is operating at 40V (5 percent light output).
8. Dimmers, where ganged, shall be derated in accordance with manufacturer's instructions. Ratings in watts listed on the drawings are the derated ratings.
9. Dimmers shall be Lutron, Leviton, Lightolier or approved equal.

G. Exterior Outlets with Lockable Covers:

1. Provide exterior outlets with lockable covers at all exterior outlet locations. Provide GFCI Circuit Breakers on all branch circuits. Provide in-use flush mounted weatherproof locking covers.

2.07 LIGHTING FIXTURES

A. General

1. Submit the following in accordance with project submittal procedures:
 - a. Catalog Data: Submit catalog data describing luminaires, lamps, and ballasts. Include data substantiating that materials comply with specified requirements. Arrange data for luminaires in the order of fixture designation.
 - b. Performance Curves/Data:
 1. Submit certified photometric data for each type of luminaire.
 2. Submit light level calculations when requested by Engineer in accordance with IESNA standards to support proposed fixtures are of equal performance to the specified products (applies to all fixture types in all spaces).
 - c. Drawings: Submit shop drawings for non-standard luminaires.
 - d. Warranty: Submit warranties for luminaires and for electronic ballasts.
2. All lamps, ballasts, led sources, drivers, and controls shall meet the latest utility company incentive requirements. Refer to the latest program requirements documentation and coordinate with the utility company to ensure compliance.

B. Quality Assurance

1. Comply with the National Electrical Code (NEC) and the Massachusetts Building Code (MBC) for components and installation.
2. Provide luminaires listed and labeled by a nationally recognized testing laboratory (NRTL) for the application, installation condition, and the environments in which installed.
3. Use manufacturers that are experienced in manufacturing luminaires, lamps and ballasts similar to those indicated for this Project and have a record of successful in-service performance.
4. Coordinate luminaires, mounting hardware and trim with the ceiling system.

C. Lamps

1. Furnish lamps that comply with requirements specified below and the luminaire schedule on the Drawings.

D. LED Assemblies

1. LED luminaires shall conform to UL 1598 and to UL 8250 – Safety Standard for Light-Emitting Diode (LED) Light Sources for Use in Lighting Products.
2. Products shall be lead and mercury free.
3. Photometric characteristics shall be established using IESNA LM-79-08, IESNA Approved Method for the Electrical and Photometric Measurement of Solid-State Lighting Products.
4. Color characteristics of LED luminaires shall be as follows in accordance with ANSI C78.377 – Specifications for the Chromaticity of Solid State Lighting Products.
5. LED and driver cooling system shall be passive and shall resist the buildup of debris.
6. LED luminaire output after 50,000 hours of operation shall be not less than 70 percent of the initial lumen output when determined in accordance with IESNA LM-80-08 – IESNA approved Method for Measuring Lumen Maintenance of LED Lighting Sources.
7. LED source package electrical characteristics:
 - a. Supply voltage: 120 V, 208 V, 240 V, 277 V, or 480 V as indicated on the Drawings. Provide step-down transformers if required to match driver input voltage rating.
 - b. Total harmonic distortion (current): Not more than 10 percent
 - c. Power factor: Not less than 90 percent
 - d. RF interference: Meet FCC 47 CFR Part 15/18
 - e. Transient protection: IEEE C62.41 Class A.
8. All LED assemblies shall be provided by Osram, Philips, GE, or equal

E. Extra Materials

1. Furnish the following extra materials matching products installed. Package with protective covering for storage and identify with labels describing contents.
 - a. Two of LED source drivers of each fixture type.
 - b. One (louver and lens of each fixture type).
 - c. Two Exit signs, single face.

F. Interior General:

1. Furnish interior luminaries that comply with requirements specified below, indicated on the Drawings, to meet conditions of installation.
2. Metal parts shall be free from burrs and sharp corners and edges.
3. Metal components shall be formed and supported to prevent sagging and warping.
4. Steel parts shall be finished with manufacturer's standard finish applied over a corrosion-resistant primer. Finish shall be free from runs, streaks, stains, holidays or defects.
5. Doors and frames shall be smooth operating and free from light leakage under operating conditions. Relamping shall be possible without the use of tools. Doors, frames, lenses and diffusers shall be designed to prevent accidental falling during relamping and when secured in the operating position.
6. Luminaires shall have minimum reflecting surface reflectance as follows unless specified otherwise on the Drawings:
 - a. White Surfaces: 85 percent
 - b. Specular Surfaces: 83 percent
 - c. Diffusing Specular Surfaces: 75 percent
7. Lenses, diffusers, covers and globes shall be 100 percent virgin acrylic unless specified otherwise on the Drawings. Lenses shall have 0.125 inches minimum thickness. Lenses for fluorescent troffers shall be injection molded.

8. Luminaires shall conform to UL 1598 - Luminaires. Provide product with damp location listing or wet location listing per installation location.

G. Interior Accessories

1. Provide stud supports, mounting brackets, frames, plaster rings and other accessories required for luminaire installation.
2. Furnish hangers as specified below and by conditions of installation:
 - a. Stem hangers shall be made of 1/2-inch steel tubing with 45 degrees swivel ball hanger fitting and ceiling canopy. Finish the same as the luminaire.
 - b. Rod hangers shall be made of 1/4 inch threaded zinc-plated steel rod.
 - c. For HID luminaires provide hook hangers that are integrated assemblies matched to the luminaire and line voltage; equip with threaded attachment, power cord and locking type plug. Provide a safety chain or cable for each luminaire that will attach to the building structure, the ballast housing, and to the reflector/diffuser assembly.
3. Use NRTL-listed T-bar safety clips for lay-in fluorescent luminaires.
4. Where indicated on the Drawings or where lamp breakage is detrimental, such as above food counters, provide open fluorescent luminaires with:
 - a. Self-locking sockets or lamp retainers, two per lamp, and
 - b. Clear polycarbonate protective lamp sleeves with end caps over each lamp. Sleeve shall have a light transmission of 95 percent and shall be rated for the thermal profile of the lamp and ballast.

H. Interior Installation

1. Install interior lighting system in accordance with the NEC, manufacturer's installation instructions, approved shop drawings, and NECA National Electrical Installation Standards.
2. Have the manufacturer's installation instructions available at the Project site.
3. Mounting heights specified or indicated on the Drawings are to the bottom of the luminaire for ceiling-mounted fixtures and to the center of the luminaire for wall-mounted fixtures.
4. Where the ceiling forms the protective membrane of a fire resistive assembly, install protective coverings over luminaires in accordance with NRTL requirements.
5. Install slack safety wires as described below for luminaires in or on suspended ceilings.
 - a. Wire shall be minimum 12 gage galvanized soft annealed steel wire conforming to ASTM A641.
 - b. Attach wire to the building structure directly above the attachment point on the box or luminaire; make trapezes of framing channel material to span obstacles
 - c. Secure wire(s) at each end with not less than three tight turns in 1-1/2 inches.
6. Support pendant-mounted or cable-supported luminaires directly from the structure above using a 9 gage wire or an approved alternate support without using the ceiling suspension system for direct support.
 - a. Install seismic restraints for pendant-mounted and cable-supported luminaires.
 - b. Pendants, rods, cables, or chains 4 ft or longer shall be braced to prevent swaying using three cables at 120 degrees separation.
7. Connect luminaires in suspended ceilings using 6 ft. lengths of flexible wiring method arranged accommodate not less than 4 inches of differential seismic movement in any direction.

I. Interior Quality Control

1. Make electrical connections, clean interiors and exteriors of luminaires, install lamps, energize and test luminaires, inspect interior lighting system, and deliver spare parts in accordance with manufacturer's instructions and NECA National Electrical Installation Standards:
2. Test electronic dimming ballasts for full range dimming capability.
 - a. Burn-in dimmer controlled fluorescent lamps at full output for not less than 100 hours before dimming.
 - b. Check for visually detectable flicker over the full dimming range.
3. Prior to turnover to Owner, replace lamps that were installed and used during construction if more than 15 percent of their rated lamp life has been used.

J. Exterior - General

1. Furnish exterior luminaires that comply with requirements specified in this Section and in the luminaire schedule on the Drawings.
2. Luminaire photometric characteristics shall be based on IESNA approved methods for photometric measurements performed by a recognized photometric laboratory.
3. Luminaire housing shall be primarily metal.
 - a. Metal parts shall be free from burrs and sharp corners and edges.
 - b. Sheet metal components shall be fabricated from corrosion-resistant aluminum, formed and supported to prevent sagging and warping.
 - c. Exposed fasteners shall be stainless steel.
4. Doors and frames shall be smooth operating and free from light leakage under operating conditions.
 - a. Relamping shall be possible without the use of special tools.
 - b. Doors, frames, lenses and diffusers shall be designed to prevent accidental falling during relamping and when secured in the operating position.
 - c. Door shall be removable for cleaning or replacing lens.
5. Luminaires shall have minimum reflecting surface reflectance as follows unless scheduled otherwise:
 - a. White surfaces: 85 percent
 - b. Specular surfaces: 83 percent
 - c. Diffusing specular surfaces: 75 percent
6. Provide lenses, diffusers, covers and globes as scheduled on the Drawings fabricated from materials that are UV stabilized to be resistant to yellowing and other changes due to aging or exposure to heat and ultraviolet radiation.
7. Doors shall have resilient gaskets that are heat-resistant and aging-resistant to seal and cushion lens and refractor.

K. Exterior Poles and Accessories

1. Furnish poles and accessories that comply with requirements specified in this Section and the luminaire schedule on the Drawings.
2. Pole, base, and anchorage shall carry the luminaires, supports, and appurtenances at the indicated height above grade without deflection or whipping.
3. Mountings, fastenings and other appurtenances shall be fabricated from corrosion-resistant materials that are compatible with poles and luminaires and will not cause galvanic action at contact points. Mountings shall correctly position luminaires to provide scheduled light distribution.
4. A reinforced access handhole shall be located in the wall of each metal pole.

5. A welded 1/2 inch grounding lug shall be accessible through the handhole of each metal pole. Grounding connection shall be designed to prevent electrolysis when used with copper ground wire.
6. Metal poles shall have anchor type bases and galvanized steel anchor bolts and leveling nuts.
7. Metal poles shall have a metal base cover that covers the entire base plate and anchorage.
8. Protect painted, anodized, or brushed pole finishes during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.
9. Aluminum poles shall be fabricated from corrosion resistant aluminum Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys or Alloy 356-T4 for cast alloys.
 - a. Poles shall be square or round, tapered or straight as indicated on the Drawings.
 - b. Aluminum poles over 30 ft. tall shall include factory-installed vibration dampers.
 - c. Poles shall be seamless extruded or spun seamless type with minimum 0.188 inch wall thickness.
 - d. Tops of shafts shall be fitted with a round or tapered cover.
 - e. Base shall be anchor bolt mounted, made of cast 356-T6 aluminum alloy in accordance with ASTM B 108/B 108M, Standard Specification for Aluminum-Alloy Permanent Mold Castings and shall be machined to receive the lower end of shaft. Joint between shaft and base shall be welded.
 - f. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel.
10. Anchor bolts shall be steel rod having minimum yield strength of 50,000 psi. The top 12 inches of the anchor bolt shall be galvanized in accordance with ASTM A153/A153M.
11. Manufacturers: Subject to compliance with requirements, provide products as scheduled or specified on the Drawings.
12. Fuses and Fuse holders
 - a. Furnish fuse overcurrent protection for each pole-mounted luminaire to isolate faulted ballasts from the lighting circuit.
 - b. Use 600 volt, Class CC, time-delay, current-limiting fuses.
 - c. Select fuses rated between 200 percent and 300 percent of the luminaire ballast or driver maximum current.
 - d. Manufacturer: Bussman LP-CC or approved equal.
13. Furnish in-line fuse holders for installation in pole hand hole or transformer base.
 - a. Use non-breakaway type fuse holders unless breakaway poles are indicated on the Drawings.
 - b. Use breakaway type fuse holders where breakaway poles are indicated on the Drawings.
 - c. Load and line terminal sizes and types shall correspond to line and load conductor sizes and quantities.
 - d. Both breakaway and non-breakaway fuse holders shall have insulating boots.
 - e. Manufacturers: Ferraz Shawmut "FEC" for phase conductor(s), "FEBN" for neutral conductor, or approved equal.

2.08 ELECTRICAL POWER EQUIPMENT

A. Motor Controls - Manual and Magnetic:

1. Individually-mounted magnetic starters shall be NEMA rated across-the-line type with thermal overload on each phase, single-speed, two-speed, or reduced voltage start as indicated.
2. Motor Starters shall be furnished by Electrical Sub-Contractor unless part of package mechanical equipment such as rooftop units.

3. Starters shall be of maintained contact type, of size and type required for particular motor horsepower and voltage. Minimum size starter to be size 1 FVNR, unless noted otherwise.
 - a. Starters shall have OL reset button, green push-to-test type pilot light to indicate "ON", and "HAND-OFF-AUTO" switch in cover.
 - b. Starters to have 120 volt control transformers with fused output being provided for those units operating on 277/480 volt system.
 - c. Provide Class 20 fixed heater overloads with auto/manual reset.
 - d. Provide four sets of auxiliary contacts of convertible type N.O. to N.C. for each starter.
 - e. Motor starters shall have NEMA I enclosures. Those in wet locations shall be NEMA 3R.
 - f. Acceptable Manufacturers:
Westinghouse
Square D/Groupe Schneider
Siemens
Allen Bradley
General Electric
Or Equal
 4. Manual motor starters shall have pilot lights and shall be furnished with thermal overloads on each phase.
- B. Motors: Each motor shall have disconnect switch and starter provided under this section.
1. Provide motor terminal boxes for each motor not furnished with same.
- C. Disconnect Switches:
1. Disconnect (safety) switches shall conform to industrial standards of NEMA, be UL listed and shall be heavy duty type, quick-make, quick-break type with interlocking cover mechanism and provisions for padlocking switch handle in "OFF" position. Three pole toggle switches are not acceptable as substitute for disconnect switches.
 2. Disconnect switches shall be of fused or unfused type as indicated with number of disconnecting poles indicated. The grounded conductor shall not be switched. Switches for use with current limiting fuses shall be rejection type and those used in conjunction with motors shall be horsepower rated. Provide oversize termination lugs if required by conductor size.
 3. Enclosures shall be of proper NEMA type for intended location and shall be phosphate coated or equivalent code gauge galvanized sheet steel with ANSI #24 dark gray baked enamel finish.
 4. Acceptable Manufacturers:
Westinghouse
Square D/Groupe Schneider
Siemens
Allen Bradley
Or Equal
- D. Fuses:
1. Provide a complete set of fuses for each item of fusible type equipment.
 2. Turn over to authorized representative of Owner upon completion a spare set of fuses of each different type and ampere rating installed. These spares shall be bound with twine and tagged.
 3. Secondary system fuses, rated at 600 volts or less, shall be UL listed and constructed in conformance with the applicable standards set forth by NEMA and ANSI. All fuses of a particular class shall be of same manufacturer.

4. All fuses in distribution panelboards and switchboards shall be class L above 600 amperes and class RK1 for 600 amperes and below.
5. Main, Feeder, and Branch Circuits:
 - a. Circuits 601 amperes and above shall be protected by (Bussmann type KRP-C LOW-PEAK) current limiting time delay fuses.
 - b. Circuits 0-600 amperes shall be protected by (Bussmann LOW-PEAK dual element), time delay current limiting fuses, LPN-RK (250 volts), LPS-RK (600 volts), UL class RK-1.
6. Acceptable Manufacturers:
Bussmann, Division of McGraw
Gould/Shawmut
GEC-ALSTHOM
Or Equal

2.09 ELECTRICAL SYSTEM CONTROLS AND INSTRUMENTS

- A. Provide a complete power system consisting of branch circuits, motor disconnect switches, pushbutton stations, motor starters, and other devices to connect up and leave in operating condition each piece of electrically operated equipment provided either under this section or other Divisions.
- B. All control wiring, not indicated in the electrical specifications or not shown on electrical drawings, will be provided by Temperature Control Subcontractor.

2.10 GROUNDING SYSTEM

- A. All equipment and systems shall be grounded. Refer especially to NEC Section 250 Requiring Connections to Building Steel, Foundation, Water Service, and Interior Piping. Provide transformer pad grounding in accordance with utility company standards.
- B. The grounded conductor shall be supplemented by an equipment grounding system.
- C. The equipment grounding system shall be installed so all conductive items in close proximity to electrical circuits operate continuously at ground potential and provide a low impedance path for ground fault currents.
- D. Grounding conductors shall be so installed as to permit shortest and most direct path to ground.
- E. Maximum measured resistance to ground of 5.0 ohms shall not be exceeded. Ground separately derived systems (dry type transformers) in accordance with Article 250-26 by grounding neutral to transformer ground lug and providing insulated grounding electrode conductor to nearest effectively grounded building steel or, if unavailable, to nearest available effectively grounded metal water pipe.
- F. Equipment grounding conductors and straps shall be sized in compliance with Code Table 250.
- G. Grounding conductors shall be insulated with green color. Grounding conductors for use on isolated ground receptacles shall be green with trace color to differentiate between normal ground conductors.

- H. Branch circuits shall consist of phase and grounded conductor installed in common metallic raceway. All circuits shall have a separate insulated grounding conductor installed. Any flexible cable system or non-metallic raceway system shall have an insulated grounding conductor. Any cable system for use on isolated ground circuits shall have both an isolated ground conductor as well as an equipment ground conductor, both of which shall be insulated.
- I. Each electrical expansion fitting shall be furnished with a bonding jumper. Provide grounding bushings and ground connections for all raceways terminating below equipment where there is no metal-to-metal continuity.
- J. Continuity between all metallic and non-metallic raceway systems and equipment shall be maintained.
- K. Outdoor lighting fixtures shall be grounded and bonded in common with building system via a separate grounding conductor.

2.11 PANELBOARDS

- A. Panelboards shall be dead front, door in door safety type equipped with single or multi pole circuit breakers suitable for 120/208 volt, 3 phase, 4 wire operation.
- B. Buses shall be copper. Panelboards shall have a circuit directory card mounted in a frame with plastic cover on inside of door. Panelboards to have a copper ground bus with terminals for each circuit. Panelboards serving isolated ground receptacles shall have a separate ground bus for terminations of the isolated grounds. The isolated ground bus shall be mounted to the panel tub via non conducting means with a separate grounding conductor run to the normal panel ground bus. Provide oversize lugs for any termination requiring same due to oversize conductors. Provide 200 percent neutral buses on all 120/208 volt panelboards.
- C. Cabinets shall be minimum of 20 inches wide and be made of code gauge steel. Surface type shall be ordered without knockouts.
- D. Trims shall be made of code gauge steel, surface or flush as indicated. Panelboards shall be keyed alike. Trims shall be provided with full length piano hinge on one side, and secured to tub with sufficient quantity of latches opposite the hinge side to allow trim to fit flush with tub and when released, allow full access to wiring gutters. Inner door shall allow access to circuit breakers only.
- E. Panelboards shall be of the following types with minimum circuit breaker frame sizes listed below. Refer to schedules for larger circuit breaker frame sizes due to fault current availability.

1. 120/208 volt, three phase, four wire. Symmetrical interrupting capacity 42,000 AIC.

Style

Eaton / Cutler-Hammer type PRL-1	BAB Breakers (bolt-on)
Square D type NQOD	QOB Breakers (bolt-on)
Siemens type CDP 7	BQ Breakers (bolt on)
General Electric Type AQ	HHQB Breakers (bolt-on)

2. Distribution Panels:
- a. Where scheduled as circuit breaker type, symmetrical interrupting capacity 42,000 AIC.
- | | |
|----------------------------|---------------|
| Westinghouse type PRL 3 | FD Breakers |
| Square D I Line type | FA Breakers |
| Siemens SPP | FXD6 Breakers |
| General Electrical Spectra | THED Breakers |

- F. Panelboards and distribution panels shall be of same manufacturer. Refer to drawings where higher interrupting are required.

2.12 ELECTRIC SERVICE

- A. Coordinate and cooperate with NGRID Electric, hereinafter called the utility company, with respect to providing service and metering.
- B. Provide all primary system raceways, elbows, pull wires and all pad grounding. Utility company will provide pad mounted transformer and primary conductors including making up of all terminations and connections.
- C. Provide secondary service complete including all conductors, raceways, and connectors at transformer. Provide oversized lugs if required due to conductor sizing. Attachment of secondary conductors to the transformer terminals will be done by utility company.
- D. General contractor will do all excavation and back filling in accordance with utility company standards.
- E. All work to be done in accordance with utility company standards.
- F. Metering: All usage will be on one secondary meter. C/Ts will be installed in transformer by Utility Company. Meter socket and meter will be located on pad mounted transformer by Utility Company.

2.13 STANDBY ELECTRICAL SYSTEM

- A. Provide one 150 KW, 187.5 KVA at .8 PF standby power rated natural gas, generator set, mounted in perfect alignment on an all welded, fabricated steel sub-base which shall allow for attachment of all necessary engine and generator accessories.

SPECIAL NOTE: Generator shall be warranted by manufacturer to develop full load performance while operating at 7.0 inches of available gas pressure at the inlet to the generator factory connection.

- B. Acceptable Manufacturers:
- Kohler
 - Caterpillar
 - Onan/Cummings
 - Generac
 - MTU Onsite Energy
 - Or Equal

C. Engine

Water cooled with unit-mounted radiator. Provide starter and all field wiring required by manufacturer

Dry-type replaceable element air cleaners.

Full flow lube oil filters and bypass oil filter.

12 volt starting motor, 12 volt, three ampere battery charging alternator.

Engine instrument panel to include ammeter, lube oil pressure gauge, lube oil temperature gauge, water temperature gauge, and hour meter.

Engine-mounted safety control to provide alarm signals for engine shutdown in event of low oil pressure, high coolant temperature, overspeed, over crank, and pre-alarms for high water temperature and low oil pressure.

Jacket water heater, 2000 watt, 120 or 208 volt, single phase or as recommended by generator manufacturer.

D. Generator: 150 KW, 187.5 KVA, 120/208 volt, 3 phase, 4 wire, 60 Hz, 1800 RPM revolving field type main generator with brushless exciter.

Voltage regulation + 1 percent from no load to full load.

E. Cooling System: Unit mounted radiator with flange attached.

F. Starting System: 12 volt heavy duty lead acid storage battery, connected for 12 volt DC output.

Battery rack, cables, and connectors shall be provided.

Provide 10 amp battery charger fed from a 120 volt, single phase, 60 Hz service. Battery charger to include high and low battery voltage alarm relays for derangement panel. Battery charger shall meet NFPA 110 Standards.

G. Exhaust System: Furnish one Maxim M-51 3 in. critical silencer, 3 in. side inlet, and one 3 in. end outlet complete with two 3 in. companion flanges. Furnish one 3 in. x 18 in. flexible stainless steel exhaust connector, flanged on one end, threaded nipple on opposite end.

H. Vibration Isolators: Set of four Korfund rubber type vibration isolators for installation between steel base and concrete foundation.

I. Generator Control Panel:

1. To completely control operation of engine generator set. Panel to have automatic start control, AC volt meter, AC ammeter, pointer type frequency meter, volt meter, ammeter and selector switch. Alarm signals to indicate pre-low oil pressure, pre-high coolant temperature, and alarm signals to shut down engine in event of a low oil pressure, high coolant temperature, engine overspeed, or overcrank. Lights on face of panel to indicate failure. Provide dry contacts for remote disarrangement signal and louvers. Locate remote annunciator in administration area.
2. Terminal strip shall be included with alarms and prewarning devices prewired for remote annunciator specified herein. Provide wiring between generator and remote annunciator panel. Generator control switch shall be mounted on control panel face. A flashing light for selector switch "OFF" shall be included.
3. Provide molded case line circuit breakers mounted on generator in oversized terminal box.
4. Life safety branch circuit breaker shall be electronic trip LSIG type.

5. Generator Overcurrent Protection: The generator set shall be provided with a UL Listed/CSA Certified protective device that is coordinated with the alternator provided to prevent damage to the generator set on any possible overload or overcurrent condition external to the machine. The protective device shall be listed as a utility grade protective device under UL category NRGU. The control system shall be subject to UL follow-up service at the manufacturing location to verify that the protective system is fully operational as manufactured. Protector shall perform the following functions:
 - a. Initiates a generator kW overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
 - b. Under single phase or multiple phase fault conditions, or on overload conditions, indicates an alarm conditions when the current flow is in excess of 110% of rated current for more than 10 seconds.
 - c. Under single phase or multiple phase fault conditions, operates to switch off alternator excitation at the appropriate time to prevent damage to the alternator.
 - d. The operator panel shall indicate the nature of the fault condition as either a short circuit or an overload.
 - e. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot greater than 120% of nominal voltage.

- J. Automatic Transfer Switches:
 1. Provide automatic transfer switches as shown on drawings for operation on 120/208 volts, 3 phase, 4 wire operation. Units to be housed in a NEMA 1 enclosure and shall be 3 pole. Transfer switches shall have an AIC rating of 42,000 ARMS or higher.
Entire switch shall be listed under UL 1008.
Acceptable Manufacturers:
Russ Electric
ASCO
Onan
Kohler
Or Equal
 2. Unit shall be provided with standard accessories as follows.
 - a. Voltage and Frequency Sensing:
 1. Close differential voltage sensing on all phases of normal pickup adjustable 85-100 percent. Dropout 75-98 percent
 2. Voltage sensing of emergency source. Adjustable pickup 85-100 percent.
 3. Frequency sensing of emergency source. Adjustable pickup 90-100 percent.
 - b. Time Delays:
 1. Time delay to override momentary normal source outages. Adjustable 0.5 to 6 seconds.
 2. Retransfer to normal with 5 minute cooldown timer.
 - c. Engine Control:
 1. Contact to close when normal source fails.
 2. Contact to open when normal source fails.
 3. Test switch to simulate normal source failure.
 - a. Indicators: Pilot lights to indicate switch in normal position or emergency position.
 - b. Auxiliary Contacts: Two to close on normal. Two to close on emergency.
 4. Optional Accessories:
 - a. Plant exerciser.
 - b. Option 27 – In-phase monitor (Motor Load Transfer).

- c. Option 6A – Manual transfer to normal source.
- K. Remote Annunciator Panel: A flush mounted panel shall include a visual signal that battery charger is functioning properly and both audible and visual signals. Annunciator shall meet NFPA 110 Standards.
 - 1. Audible signal shall have a silencing switch. A lamp test button shall be provided.
- L. Factory Testing: A certified factory test to be conducted at 1.0 power factor. Test for one hour, take readings at 25 percent, 50 percent, 75 percent and 100 percent load. Take standard readings and submit test reports for approval prior to shipment. Miscellaneous: Necessary lube oil and anti-freeze.
- M. Equipment Testing and Instruction Manual and Drawings:
 - 1. Operating instructions and maintenance manuals shall contain the following information:
 - Operating Instructions
 - Replacement Parts
 - Wiring Diagram
 - Maintenance
 - 2. Field Test: Perform field test with load bank at same ratings for two hours, take readings at 25 percent, 50 percent, 75 percent, and 100 percent loads.
 - 3. Facility Test: The entire emergency system shall be field test operated for two hours. A normal power failure shall be simulated. The engine generator unit shall automatically start, come up to speed, and assume full emergency load. Entire building shall be in operation during test. Perform field test with load bank at same ratings for two hours, take readings at 25 percent, 50 percent, 75 percent, and 100 percent loads.
 - 4. Custodians of the equipment shall be present during test. At that time they shall be instructed in operation and maintenance.
 - 5. Upon completion of tests, written reports containing results shall be submitted. Test reports shall contain readings taken at 30 minute intervals along with all other pertinent test information.
 - Ambient Temperature
 - Oil Pressure
 - Battery Charge Rate
 - AC Volts
 - AC Amperes All Phases
 - Frequency
 - Kilowatts
 - Power Factor
- N. Coordination of Trades:
 - 1. The following equipment shall be furnished by Electrical Contractor but shall be installed under other sections.
 - a. Anchor bolts to be installed by General Contractor.
- O. Generator Outdoor Housing
 - 1. The engine generating set shall be factory installed in a weatherproof outdoor housing. The housing shall provide year round generating set protection against adverse weather and environmental conditions. The enclosure shall be sound attenuated and meet Federal Specifications.
 - 2. The weatherproof shelter shall be constructed or welded and bolted of reinforced aluminum, 14 gauge walls and 14 gauge floor plate. All metal parts shall be prime coated and finished painted.

3. The shelter assembly shall have shuttered air openings on front and sides with mesh screens covering side shutters. The air shutters shall be opened by four 22 volt AC motors when the generating set operates. Motors shall be spring loaded to close shutters when set stops.
4. Hinged double doors on each side and one door in rear of the shelter shall allow easy access to engine generator and controls. All door handles shall be key lock design.
5. Vibration isolators of the open coil spring type, selected for 3 inch (76mm) static deflection, shall be furnished and installed. The number of isolators shall be as recommended by the generator set manufacturer, and complete details shall be included in the Submittals. Anchor bolts, nuts and sleeves shall be supplied with recommended Foundation Plan.
6. The weatherproof housing shall allow installation of the silencer inside the enclosure. Provide critical type silencer.
7. Provide sound deadening materials, baffles, hoods to reduce noise levels to 75DBA at 7 meters in any direction.

P. Training

1. Provide four hours of Owner training.

2.14 FIRE ALARM AND DETECTION SYSTEM

A. Description:

1. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm network equipment rearm initiating devices, alarm notification appliances, Network Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.
2. The fire alarm system shall comply with requirements of latest NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
3. The fire alarm manufacturer shall be of the highest caliber and insist on the highest quality. The system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
4. The FACP and peripheral devices shall be manufactured 100 percent by a single U.S. manufacturer (or division thereof).
5. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and shall be in compliance with the UL listing.
6. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

B. Scope:

1. A new network intelligent reporting, microprocessor controlled fire detection and alarm system shall be installed in accordance with the specifications and drawings.
2. Basic Performance:
 - a. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto NFPA Style 7 (Class A) Signaling Line Circuits (SLC).
 - b. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D).
 - c. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z).
 - d. Digitized electronic signals shall employ check digits or multiple polling.
 - e. Power for initiating devices and notification appliances must be from the main fire alarm control panel.
 - f. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

- g. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
3. System Functional Operation:
- When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
- a. The FACP alarm LED on the FACP shall flash.
 - b. A local piezo-electric signal in the FACP control panel shall sound.
 - c. The 80-character LCD display on the local FACP node and on the intelligent network display shall indicate all information associated with the fire alarm condition, including the type of alarm point, and its location within the protected premises. This information shall also be displayed on the network reporting terminal.
 - d. Printing and history storage equipment shall log the information associated with the fire alarm control panel condition, along with the time and date of occurrence.
 - e. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated on either local outputs or points located on other network nodes.
4. Software Modifications:
- a. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
 - b. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm network on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
5. Certifications:
- Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer and trained on network applications. Include names and addresses in the certification.
- a. Power supplies, relays, water flow switches and all accessories of the fire alarm system.
 - b. Each circuit in the fire alarm network shall be tested semiannually.
 - c. Each smoke detector shall be tested in accordance with the requirements of NFPA 72, Chapter 7.
- C. Applicable Publications:
- The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only.
- 1. National Fire Protection Association (NFPA) - USA:
 - No. 72 National Fire Alarm Code
 - No. 70 National Electric Code
 - No. 101 Life Safety Code
 - 2. Underwriters Laboratories Inc. (UL) - USA:
 - No. 50 Cabinets and Boxes
 - No. 268 Smoke Detectors for Fire Protective Signaling Systems
 - No. 864 Control Units for Fire Protective Signaling Systems
 - No. 268A Smoke Detectors for Duct Applications

- No. 521 Heat Detectors for Fire Protective Signaling Systems
 - No. 228 Door Closers-Holders for Fire Protective Signaling Systems
 - No. 464 Audible Signaling Appliances
 - No. 38 Manually Actuated Signaling Boxes
 - No. 346 Waterflow Indicators for Fire Protective Signaling Systems
 - No. 1481 Power supplies for Fire Protective Signaling Systems
 - No. 1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems
 - No. 1971 Visual Notification Appliances
3. Local and State Building Codes.
 4. All requirements of the Authority Having Jurisdiction (AHJ).
- D. Approvals:
1. The system must have proper listing and/or approval from the following nationally recognized agencies:
 - UL Underwriters Laboratories Inc.
 - FM Factory Mutual
 - MEA Material Equipment Acceptance (NYC)
 - CSFM California State Fire Marshal
 2. The fire alarm control panel shall meet the modular labeling requirements of Underwriters Laboratories, Inc. Each subassembly, including all printed circuits, shall include the appropriate UL modular label. Systems which do not include modular labels which may require return to the manufacturer for system upgrades, and are not acceptable.
- E. Equipment and Material, General:
1. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
 2. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.
 3. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
- F. Conduit and Wire:
1. Conduit:
 - a. Conduit shall be in accordance with the National Electrical Code (NEC), local and state requirements.
 - b. All wiring exposed shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
 - c. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.

- d. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
 - e. Conduit shall not enter any FACP, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
 - f. Conduit shall be 3/4 inch (19.1 mm) minimum.
2. Wire:
- a. All fire alarm system wiring must be new, unless specified herein.
 - b. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 16 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.32 mm) for notification appliance circuits.
 - c. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
 - d. Wiring used for the SLC multiplex communication loop shall be twisted and shielded unless specifically excepted by the fire alarm equipment manufacturer.
 - e. All field wiring shall be completely supervised.
3. Terminal Boxes, Junction Boxes and Cabinets:
All boxes and cabinets shall be UL listed for the intended purpose.
4. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.
5. The FACP shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution Panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The FACP cabinet shall be grounded securely to either a cold water pipe or grounding rod. Provide lock-on device on breaker
- G. Fire Alarm Control Panel:
1. Fire alarm control panel shall be Notifier, Simplex, Edwards, Autocall, Siemens or equal and shall contain a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, local and remote operator terminals, annunciators, and other system controlled devices.
 2. Node Capacity and General Operation:
 - a. Each node shall provide, or be capable of, expansion to 198 intelligent addressable devices and 198 monitor/control modules for a total of 396 intelligent devices per system. FACP shall have two intelligent loops.
 - b. Each FACP node shall include a full featured operator interface control and annunciation panel which shall include a backlit Liquid Crystal Display (LCD), individual, color coded system status LEDs, and an alpha-numeric keypad for field programming and control of the node.
 - c. All programming or editing of the existing programming the system shall be achieved without special equipment or interrupting the alarm monitoring functions of the fire alarm control panel.
 - d. Each FACP node shall provide the following features:

Block Acknowledge Printer Interface	
Control-by-Time	Non-Alarm Module Reporting
Day/Night Sensitivity	Periodic Detector Test
Device Blink Control	Remote Page

Drift Compensation	Trouble Reminder
NFPA 72, Sensitivity	Upload/Download to PC
Test	computer
System Status Reports	Verification Counters
Security Monitor Points	Walk Test
Alarm Verification	Maintenance Alert

3. Loop Interface Board (LIB):
 - a. Loop interface boards shall be provided to monitor and control each of the Signaling Line Circuit (SLC) loops in the network node. The loop interface board shall contain its own microprocessor and shall be capable of operating in local mode in the case of a failure in the main CPU of the control panel. In local mode, the loop interface board shall detect alarms and activate output devices on its own SLC loop.
 - b. The LIB shall not require any jumper cuts or address switch settings to initialize SLC Loop operations.
 - c. The loop interface board shall provide power to, and communicate with, all of the intelligent detectors and addressable modules connected to its SLC Loop over a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 4, Style 6, or Style 7.
 - d. The LIB shall be able to drive two Style 4 SLC loops, each up to 10,000 ft. in length, for an effective loop span of 20,000 ft..
 - e. The loop interface board shall receive analog information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The loop interface board software shall include software to automatically adjust and compensate for dust accumulation to maintain detector performance as it is affected by environmental factors. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
 - f. The LIB shall communicate with each intelligent addressable detector and addressable module on its SLC loop and verify proper device function and status. Communication with up to 198 intelligent devices shall be performed every 6 seconds or less.
4. Enclosures:
 - a. Control panels shall be housed in UL listed cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and the manufacturer's standard finish.
 - b. The back box and door shall be constructed of .060 steel with provisions for electrical conduit connections into the sides and top.
 - c. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
 - d. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.
5. FACP nodes shall be designed so that it permits continued local operation of remote transponders under both normal and abnormal network communication loop conditions. This shall be obtained by having transponders operate as local control panels upon loss of network communication.
6. FACP nodes shall be modular in construction to allow ease of servicing. Each CPU and transponder shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems which require use of external programmers or change of EPROM's are not acceptable.
7. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients including RFI and EMI.

8. Each peripheral device connected to the FACP node CPU shall be continuously scanned for proper operation. Data transmissions between network nodes, FACP CPUs, transponders, and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques. Failure of any transponder or peripheral device to respond to an interrogation shall be annunciated as a trouble condition.
9. FACP Power Supplies:
 - a. Main power supplies shall operate on 120 VAC, 60Hz, and shall provide all necessary power for the FACP.
 - b. Each main supply shall provide 3.0 amps of usable notification appliance power, using a switching 24 VDC regulator.
 - c. The main power supply shall be expandable for additional notification appliance power in 3.0 ampere steps. Provide dedicated power supplies for signal circuit.
 - d. Each main power supply shall provide a battery charger for 60 hours of standby using dual-rate charging techniques for fast battery recharge. It shall charge 55 Amp hour batteries with-in a 48 hour period.
 - e. The supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.
 - f. It shall provide meters to indicate battery voltage and charging current.
 - g. The main power supply shall be power-limited per 1995 UL864 requirements.
10. System Circuit Supervision:
 - a. Each FACP node shall supervise all circuits to intelligent devices, transponders, annunciators and peripheral equipment and annunciate loss of communications with these devices. The FACP CPU shall continuously scan the above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and print the information on the printer.
 - b. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off-normal position.
11. Field Wiring Terminal Blocks:
 - a. For ease of service, all wiring terminal blocks shall be the plug-in type and have sufficient capacity for 18 to 12 AWG wire. Fixed terminal blocks are not acceptable.
12. Field Programming:
 - a. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
 - b. All local FACP node programming shall be accomplished through the FACP keyboard.
 - c. All field-defined programs shall be stored in non-volatile memory.
 - d. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.
13. Specific System Operations:
 - a. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent detectors in the FACP node from each system keypad or from the keyboard of the video terminal. Sensitivity range shall be within allowed UL limits.
 - b. Alarm Verification: Each of the intelligent addressable detectors in the system may be independently selected and enabled for alarm verification. Each FACP shall keep a count of the number of times each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

- c. System Point Operations:
 - 1. All devices in the FACP node may be enabled or disabled through the local keypad or video terminal.
 - 2. Any FACP node output point may be turned on or off from the local system keypad or the video terminal.
- d. Point Read: The FACP node shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point will be annunciated for the parameters listed:
 - 1. Device Status
 - 2. Device Type
 - 3. Custom Device Label
 - 4. Software Zone Label
 - 5. Device Zone Assignments
 - 6. Detector Analog Value
 - 7. All Program Parameters
- e. System Status Reports: Upon command from a password-authorized operator of the system, a status report will generated, and printed, listing all local FACP system status.
- f. System History Recording and Reporting: Each FACP node shall contain a history buffer that shall be capable of storing a minimum of 400 system events. Each local activation will be stored and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and or printed.
- g. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
- h. Automatic Detector Maintenance Alert: Each FACP node shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular intelligent detector will be annunciated on the system display, network display and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

H. Addressable Devices – General:

- 1. Addressable devices shall use simple to install and maintain decade (numbered 1 to 10) type address switches.
- 2. Addressable devices which use a binary address setting method, such as a Dip switch, are difficult to install and subject to installation error. This type of device is not an allowable substitute.
- 3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the FACP signaling line circuit.
- 4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
- 5. Smoke detector sensitivity shall be set in the fire alarm control panel and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.

6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
 7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Class A applications.
 8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
 9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
 10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
 11. A magnetic test switch shall be provided to test each detector for 100 percent obscuration, reported to the FACP.
 12. Addressable devices shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
 13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100 percent of the alarm threshold.
- I. Addressable Pull Box (manual station):
1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
 2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
 3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.
 4. Stations shall be suitable for surface mounting or semiflush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.
 5. Manual pull stations shall be of the double action type.
- J. Intelligent Photoelectric Smoke Detector:
1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

K. Intelligent Thermal Detectors:

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit. Up to 99 intelligent heat detectors may connect to one SLC loop.

L. Intelligent Duct Smoke Detector:

1. The duct smoke detector housing shall accommodate intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

M. Duct mounted carbon monoxide detector:

1. Manufactured by Air Products and Controls Model SL-701 or Equal
2. Product Specifications

Voltages available: APPROVALS	230VAC, 115VAC, 24VAC, 24VDC Electrochemical Carbon Monoxide Sensor is a UL Recognized component in accordance with the requirements of UL2034. Also meets EN50291 requirements. SL-2000 Series Duct Smoke Detector Fire Alarm Certifications referenced side one: UL & CUL Listed (UL268A, UROX, UROX7) File # S2829 CSFM Listed (3240-1004:105); MEA Accepted (73-92-E, VOL. 27)
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SAMPLING TUBES Provide required length for duct coordinate with HVAC drawings	Sectional sampling tube Metal sampling tube for 6" to 2.5' duct width Metal sampling tube for 2.5' to 5.0' duct width Metal sampling tube for 5.0' to 10.0' duct width
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ACCESSORIES	MSR-50/CO remote accessory TG-701 aerosol test gas T-PB power supplies WP-2000 weatherproof enclosure (All available from Air Products and Controls Inc.)															
POWER REQUIREMENTS	<table border="0"> <tr> <td style="text-align: left;">Input Power</td> <td style="text-align: left;">Standby Current</td> <td style="text-align: left;">Alarm Current</td> </tr> <tr> <td>24VAC</td> <td>55mA</td> <td>190mA</td> </tr> <tr> <td>24VDC</td> <td>14mA</td> <td>68mA</td> </tr> <tr> <td>115VAC</td> <td>22mA</td> <td>32mA</td> </tr> <tr> <td>230VAC</td> <td>12mA</td> <td>18mA</td> </tr> </table>	Input Power	Standby Current	Alarm Current	24VAC	55mA	190mA	24VDC	14mA	68mA	115VAC	22mA	32mA	230VAC	12mA	18mA
Input Power	Standby Current	Alarm Current														
24VAC	55mA	190mA														
24VDC	14mA	68mA														
115VAC	22mA	32mA														
230VAC	12mA	18mA														

RELAY CONTACT RATING:

Alarm Contacts	Resistive load: 2 sets form "C" rated at 10 Amps @ 115VAC
Trouble Contacts	Resistive load: 1 set form "A" rated at 2 Amps Resistive load: 1 set form "C" rated at 10 Amps @ 115VAC

AIR VELOCITY	100 to 4,000 ft. /min.
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AMBIENT TEMPERATURE	32°F to 158°F (0°C to 70°C)
HUMIDITY	10% to 85% RH Non-Condensing / Non-Freezing
WIRING	Solid or stranded: #12 to #22 AWG terminals
MATERIAL	Grey plastic back box, clear plastic cover (Makrolon 94V-0)
	Do not expose to corrosive atmospheres.
DIMENSIONS	13 ½" L x 4 ½" W x 2 ¼" D
MAX. NET WT.:	2 ½ lbs.
HARDWARE	7" exhaust tube, FAST Tube starter sampling tube, sampling tube end cap, mounting template, and mounting hardware included.

N. Addressable Dry Contact Monitor Module:

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
2. The monitor module shall mount in a four in. square, 2-1/8 in. deep electrical box.
3. The IDC zone may be wired for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 in. x 1-1/4 in. x 1/2 in. This version need not include Style D or an LED.

O. Two-Wire Detector Monitor Module:

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional two wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The two-wire monitor module shall mount in a four in. square, 2-1/8 in. deep electrical box or with an optional surface backbox.
3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

P. Addressable Control Module:

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
2. The control module shall mount in a standard four in. square, 2-1/8 in. deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or two amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100 percent of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of .6 amps at 30 VDC.

Q. Isolator Module:

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

R. LCD Alphanumeric Display Annunciator:

1. The alphanumeric display annunciator shall be a supervised, backlit LCD display containing a minimum of eighty characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions from either the network node or complete network, via the INA.
3. Up to 32 LCD annunciators may be connected to a specific (terminal mode) EIA 485 interface. LCD annunciators shall not reduce the annunciation capacity of the system. Each LCD shall include vital system wide functions such as, system acknowledge, silence and reset.
4. LCD display annunciators shall mimic the local control panel 80-character display or network annunciator and shall not require special programming.

S. Batteries and External Charger:

1. Battery:
 - a. Batteries shall be 12 volt, Gell-Cell type.
 - b. The battery shall have sufficient capacity to power the fire alarm system for not less than 60 hours plus 10 minutes of alarm upon a normal AC power failure.
 - c. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills and leakage shall not be required.

T. Audio/Visual Unit (Xenon Strobe):

1. Combination horn strobe units - Provide Truealert Non-Addressable 75 Cd, Red Sync. Two Wire. Comprised of a 24 VDC Xenon Flash Tube entirely solid state. The unit shall require a sync. Control module. Provide True 75 Cd from all axis.
2. Combination horn strobe units - Provide Truealert Non-Addressable 110 Cd, Red Sync. Two-Wire. Comprised of a 24 VDC Xenon Flash Tube entirely solid state. The unit shall require a sync. Control module. Provide True 110 Cd from all axis.
3. Visual only – Provide Truealert Non-Addressable 15 Cd, Red Sync. Two-Wire comprised of a 24 VDC Xenon flash tube entirely solid state.

U. Magnetic Door Holders:

1. Provide Semi-Flush Wall Mounted, 24 V.D.C. with catch plate.

V. Provide clear plastic covers with local audible alarm for pull stations in apparatus area, and where indicated on drawings, or required by fire department.

W. Digital Dialer:

1. Provide a UL Listed Digital Dialer in accordance with local Fire Department requirements to be connected a remote central station with (2) CAT 5 telephone cables in 3/4" C.

X. Testing:

1. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
2. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
 - a. Factory trained and certified.
 - b. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
 - c. International Municipal Signal Association (IMSA) fire alarm certified.
 - d. Certified by a state or local authority.
 - e. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
3. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
4. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
5. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.
6. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
7. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.
8. Final Test, Certificate of Completion, and Certificate of Occupancy:
 - a. Test the entire system 100 percent including devices in the presence of the Authority Having Jurisdiction in order to obtain a certificate of occupancy.
9. Fire Alarm Testing and Maintenance Agreement
 - a. Provide a one-year inspection and testing agreement in accordance with local Fire Department requirements and NFPA 72 recommendations. The holder of the testing and maintenance contract shall be a properly licensed and NRTL certified provider of Fire Alarm services and acceptable to the Fire Department.
 - b. Fire alarm testing agreement shall provide for a minimum of four inspections per year. Upon completion of each test, list actual devices checked. Provide a report to the Owner.

Y. Training:

1. Provide four hours Owner training with Owner's Representative.

2.15 SURGE PROTECTION DEVICES

A. SCOPE

1. This section describes the materials and installation requirements for surge protective devices (SPD) for the protection of all main service and panelboards.

B. SUBMITTALS

1. Submit shop drawings and product information for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by customer name, customer location, and customer order number.
2. Submittals shall include UL 1449 3rd Edition Listing documentation verifiable by visiting www.UL.com, clicking "Certifications" link, searching using UL Category Code: VZCA and VZCA2:
 - a. Short Circuit Current Rating (SCCR)
 - b. Voltage Protection Ratings (VPRs) for all modes
 - c. Maximum Continuous Operating Voltage rating (MCOV)
 - d. I-nominal rating (I-n)
 - e. SPD shall be UL listed and labeled as Type 1 or Type 4 intended for Type 1 or Type 2 applications
3. Upon request, an unencapsulated but complete SPD formally known as TVSS shall be presented for visual inspection.
4. Minimum of a ten year warranty

C. RELATED STANDARDS

1. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,
2. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,
3. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
4. National Electrical Code: Article 285
5. UL 1283 - Electromagnetic Interference Filters
6. UL 1449, Third Edition, effective September 29, 2009 – Surge Protective Devices

D. QUALITY ASSURANCE

1. Manufacturer Qualifications: Engage a firm with at least five years of experience in manufacturing transient voltage surge suppressors.
2. Manufacturer shall be ISO 9001 or 9002 certified.
3. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
4. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

E. DELIVERY, STORAGE AND HANDLING

1. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One copy of this document to be provided with the equipment at time of shipment.

F. MANUFACTURERS

1. Provide an internally mounted Surge Protective Devices (SPD) formerly called Transient Voltage Suppressor (TVSS) by:
 - a. Siemens Industry.
 - b. Current Technology
 - c. LEA
 - d. Liebert
 - e. APT

f. Or Equal

G. ELECTRICAL DISTRIBUTION EQUIPMENT

1. Service Entrance

- a. SPD shall be UL 1449 labeled as Type 1 or Type 4 intended for Type 1 or Type 2 applications, verifiable at UL.com, without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- b. SPD shall be factory installed integral to electrical distribution equipment.
- c. SPD shall be UL labeled with 20kA I-nominal (I-n)
- d. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR).
- e. Standard 7 Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.
- f. True 10 Mode Protection paths: SPD shall provide “directly connected protection elements” between all possible modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.
- g. SPD shall be connected external of the distribution equipment with an appropriately sized 200kA SCCR rated disconnect.
- h. SPD shall meet or exceed the following criteria:

- 1. Maximum 7-Mode surge current capability shall be [300kA] [400kA] [500kA] per phase.
- 2. Maximum 10-Mode surge current capability shall be [300kA] [450kA] per phase.
- 3. UL 1449 - Third Edition Revision; effective September 29, 2009 Voltage Protection Ratings shall not exceed the following:

VOLTAGE	L-N	L-G	N-G	L-L	MCOV
208Y/120	800V	800V	800V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

- i. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (percent)	MCOV
208Y/120	25 percent	150V
480Y/277	15 percent	320V

- j. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz.
- k. Suppression components shall be heavy duty ‘large block’ MOVs, each exceeding 30mm diameter.
- l. SPD shall include a serviceable, replaceable module.
- m. SPD shall be equipped with the following diagnostics:
 - 1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
 - 2. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
 - 3. Form C dry contacts
 - 4. Optional – Surge Counter
- n. No other test equipment shall be required for SPD monitoring or testing before or after installation.
- o. SPD shall have a response time no greater than 1/2 nanosecond.

- p. SPD shall have a ten year warranty.
 - 2. Distribution Panel
 - a. SPD shall be UL 1449 labeled as Type 4 intended for Type 1 or Type 2 applications, verifiable at UL.com, without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
 - b. SPD shall be factory installed integral to electrical distribution equipment.
 - c. SPD shall be UL labeled with 20kA I-nominal (I-n)
 - d. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR).
 - e. Standard 7 Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.
 - f. SPD shall be connected to the buss of the distribution equipment with an appropriately sized 200kA SCCR rated disconnect.
 - g. SPD shall meet or exceed the following criteria:
 - 1. Maximum 7-Mode surge current capability shall be 100kA per phase.
 - 2. Maximum 10-Mode surge current capability shall be 150kA per phase.
 - 3. UL 1449 - Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

VOLTAGE	L-N	L-G	N-G	L-L	MCOV
208Y/120	800V	800V	800V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V
 - h. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (percent)	MCOV
208Y/120	25 percent	150V
480Y/277	15 percent	320V
 - i. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz.
 - j. Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.
 - k. SPD shall include a serviceable, replaceable module.
 - l. SPD shall be equipped with the following diagnostics:
 - 1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
 - 2. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
 - 3. Form C dry contacts
 - 4. Optional – Surge Counter
 No other test equipment shall be required for SPD monitoring or testing before or after installation.
 - m. SPD shall have a response time no greater than 1/2 nanosecond.
 - n. SPD shall have a ten year warranty.
3. Branch Panels
 - a. The panelboard shall be UL 67 Listed and the SPD shall be UL 1449 labeled as Type 1 or as Type 4 intended for Type 1 or Type 2 applications.
 - b. The unit shall be top or bottom feed according to requirements. A circuit directory shall be located inside the door.

- c. SPD shall meet or exceed the following criteria:
 - 1. Maximum 7-Mode surge current capability shall be 100kA per phase.
 - 2. Maximum 10-Mode surge current capability shall be 150kA per phase.
 - 3. UL 1449 - Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

VOLTAGE	L-N	L-G	N-G	L-L	MCOV
208Y/120	800V	800V	800V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

- 4. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

<u>System Voltage</u>	<u>Allowable System Voltage Fluctuation (percent)</u>	<u>MCOV</u>
208Y/120	25 percent	150V
480Y/347	15 percent	320V

- d. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz.
- e. Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.
- f. SPD shall include a serviceable, replaceable module.
- g. SPD shall be equipped with the following diagnostics:
 - 1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
 - 2. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
 - 3. Form C dry contacts
 - 4. Optional – Surge Counter

No other test equipment shall be required for SPD monitoring or testing before or after installation.
- h. SPD shall have a response time no greater than 1/2 nanosecond.
- i. SPD shall have a 10 year warranty.
- j. The unit shall have removable interior.
- k. The main bus shall be [copper] [aluminum] and rated for the load current required.
- l. The unit shall include a 200 percent rated neutral assembly with copper neutral bus.
- m. The unit shall be provided with a safety ground bus.
- n. The field connections to the panelboard shall be main lug or main breaker.
- o. The unit shall be constructed with flush or surface mounted trim and shall be in a NEMA Type 1 enclosure.

H. INSTALLATION

- 1. Install per manufacturer's recommendations and contract documents.

I. ADJUSTMENTS AND CLEANING

- 1. Remove debris from installation site and wipe dust and dirt from all components.
- 2. Repaint marred and scratched surfaces with touch up paint to match original finish.

J. TESTING

- 1. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacture's recommendations.
- 2. Check all installed panels for proper grounding, fastening and alignment.

K. WARRANTY

1. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of shipment.

2.16 WIREWAYS

A. Wireway:

1. This specification covers NEMA type 1 wireway used to house and protect communication cable. The wireway system shall consist of wireway and appropriate fittings to complete the installation per the electrical drawings.
2. Metal wireway (NEMA type 1) is to be utilized in dry interior locations only as covered in article 362 part a of the national electrical code, as adopted by the national fire protection association and as approved by the American National Standards Institute. The wiremold c or sp series is listed by underwriters' laboratories under file no. E137690 guide zoyx.
3. The wireway system specified herein shall be the c or sp system as manufactured by the wiremold company. Systems of other manufacturers may be considered equal if, in the opinion, and the written approval of the engineer, they meet all the performance standards specified herein.
4. The wireway and all system components must be UL Listed in full compliance with their standard ul870, electrical wireways, auxiliary gutters and associated fittings. It shall be manufactured from 16-gauge cold rolled steel, finished in ASA 61 gray powder coat paint. All sizes larger than 6 in. x 6 in. shall be manufactured from 14-gauge cold rolled steel, finished in ASA 61 gray powder coat paint. A factory installed divider shall be available to separate power and low voltage wiring housed in the same wireway sections.
5. A full complement of fittings for the raceway shall be available including, but not limited to, 45 degrees and 90 degrees flat, vertical inside and outside elbows, tee and cross fittings, couplings for joining sections of wireway, reducers, hangers, end blanks, a field installed divider and all other components necessary to make the system workable. The fittings shall have an ASA 61 gray powder coat paint finish to match the wireway.
6. Prior to and during installation, refer to system layout drawing containing all elements of the system. Installer shall comply with detailed manufacturer's instruction sheets which accompany system components as well as complete system instruction sheets, whichever is applicable.
7. All wireway systems shall be mechanically continuous and connected to all electrical boxes and cabinets, in accordance with manufacturer's installation sheets.
8. All connections shall be checked to make sure they are correctly tightened and to insure that all wireway shall be electrically continuous and bonded in accordance with the national electric code for proper grounding.
9. All wireway systems shall be installed complete. Work shall include fastening all wireway and appropriate fittings to install a complete wireway system as indicated on the electrical and/or communication drawings and in the applicable specifications

2.17 SEALS

A. Water Tight Seals

1. Conduits entering from the exterior or below grade shall have water tight fittings on the outside and on the inside of the conduit.
 - a. Fittings on the outside of the conduit shall be O-Z Gedney type FSK or approved equal. Provide type WSK if penetration is within two ft. of the high water table. Provide grounding attachment.

- b. Fittings on the inside of the conduit shall be O-Z Gedney type CSBI or approved equal. Provide type CSBG if penetration is within two ft. of the high water table. Provide a blank fitting to seal spare or empty conduits.
 - c. O-Z Gedney type CSM fitting may be used when sealing within a sleeve or cored hole.
 2. Submit on seals to be used.
 - B. Environmental Seals
 1. Provide seals on raceways exposed to widely different temperatures, as in refrigerating or cold storage areas. Install seal to prevent circulation of air from warmer to colder sections through the raceway.
 - C. Hazardous Area Seals
 1. Provide explosion proof seals per Code.
 - D. Smoke and Fire Stopping Seals
 1. Provide a seal around raceways or cables penetrating full height walls (slab to slab), floors or ventilation or air handling ducts so that the spread of fire or products of combustion shall not be substantially increased.
 2. Penetrations through fire-resistant-rated walls, partitions, floors or ceilings shall be firestopped using approved methods and NRTL listed products to maintain the fire resistance rating.
 3. Fire stopping in sleeves or in areas that may require the addition or modification of installed cables or raceways shall be a soft, pliable, non-hardening fire stop putty. Putty shall be water resistant and intumescent. Provide for all sleeves and raceways.
 4. Firestopping in locations not likely to require frequent modification shall be NRTL listed putty, caulk or mortar to meet the required fire resistant rating.
 5. Box penetrations into a fire rated wall or shaft shall have a fire stopping pad installed on the back of the box.
 6. Firestopping of cable trays or busways through walls shall be within a non-hardening putty or with seal bags.
 7. Firestopping materials shall be NRTL listed to UL 1479 (ASTM E814). Installation methods shall conform to a UL firestopping system. Submit specifications and installation drawings for the type of material to be used. Firestopping materials shall be as manufactured by 3M, International Protective Coatings Corp., RayChem or approved equal.
- 2.18 UNDERGROUND DUCTBANKS
- A. General: Furnish and install the ductbanks as herein specified and as shown on drawings.
 - B. Division of Work:
 1. The General Contractor shall be responsible for the work and material required for the following:
 - a. Excavation
 - b. Backfill
 - c. Installation of handholes/manholes
 - d. Brick or concrete collars to bring handhole frames and covers up to grade. Installation of frames and collars which are to be furnished by the Electrical Contractor.
 - e. Concrete Encasement.

2. All other material, equipment, and labor required for the complete ductbank shall be furnished and installed by the Electrical Contractor under this Section, including the following:
 - a. Service raceways.
 - b. Grounding material.
 - c. Ductbank warning tape.
 - d. Furnish pre-cast handholes/manholes.
 - e. Conduit spacers.
- C. Materials:
1. Conduit: UL listed, schedule 40 PVC in accordance with NEMA standard TC-2.
 2. See BASIC MATERIALS SECTION.
 3. Conduit Supports (duct system): Shall be molded plastic with interlocking lugs and skeletonized structure, minimum separation 3 in.
 4. Tags: Non-ferrous metal or fibre, 1/4 in. high letters.
 5. Warning tape shall be yellow polyethylene 4 mil thick, 6 in. wide terratape, similar to REEF Industries, Houston, Texas and shall be installed above all ductbanks both high and low tension.
- D. Duct System:
1. The duct system shall consist of Schedule 40 PVC conduit except where otherwise specified. The size and number of conduits shall be as indicated on the drawings. Provide a pull wire in each conduit.
 2. The entire length between handholes and end of ductbank shall be excavated and graded before any conduit is laid.
 3. The ductbank shall be set on undisturbed earth.
 4. The conduit shall be installed so that top is a minimum of 36 in. below finished grade unless otherwise indicated, and shall be laid to a minimum grade of 4 in. for each 100 ft. of length. Duct system shall drain to manholes/handholes.
 5. Changes in direction shall be made by long sweep bends, minimum radius 25 ft. except that at the end of a run, within 10 ft. of termination. Manufactured ends may be used having a minimum radius of 36 inches.
 6. Conduit base and intermediate spacers shall be installed a maximum of 5 ft. on centers. Spacers shall not be placed one above the other, but shall be staggered a minimum of 6 in.
 7. All conduit joints shall be made watertight by means of a sealing compound before the coupling is installed. Joints in conduit shall be staggered; minimum space between joints in adjacent conduit shall be 6 in.
 8. When the required number of conduits has been installed, securely tie the assembly together at distances not exceeding 7 ft. Tie shall consist of three turns of No. 18 iron wire. Separate ties required for low tension and high tension conduit runs.
 9. Duct envelope shall be vibrated to eliminate voids.
 10. Ductbanks shall not be covered until the conduit installation has been observed by the utility company and Architect.
 11. Warning tape shall be installed during backfilling and shall be placed approximately 12 in. above the conduits.
 12. After the installation is completed, each conduit shall be cleaned and identified. A standard flexible mandrel and a stiff bristle brush shall be pulled through each conduit. The mandrel shall not be less than 12 in. long and the diameter approximately 1/4 in. less than the conduit.

2.19 VARIABLE FREQUENCY DRIVES (VFD'S)

- A. The variable frequency drives (VFD's) shall be solid state, with a Pulse Width Modulated (PWM) output waveform (VVI, six-step, and current source drives are not acceptable). The VFD package as specified herein shall be enclosed in a NEMA 1 enclosure, completely assembled and tested by the manufacturer. The VFD shall employ a full wave rectifier (to prevent input line notching), DC Line Reactor, capacitors, and Insulated Gate Bipolar Transistors (IGBT's) as the output switching device (SCR's, GTO's and Darlington transistors are not acceptable). The drive efficiency shall be 97 percent or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.
- B. Specifications at 208 volts:
1. Input VAC +/-10 percent, 3 phase, 48-63Hz. Output 0 - Input Voltage, 3 phase, 0 to 500 Hz for drives up to 75 HP; 0 to 120 Hz for drives over 75 HP. Operation above 60 Hz. shall require programming changes to prevent inadvertent high speed operation. Environmental operating conditions: 0 to 40 C @ 3 kHz switching frequency, 0 to 3300 ft. above sea level, less than 95 percent humidity, non-condensing. Units shall be UL, CUL and CA approved.
- C. All VFD's shall have the following standard features:
1. All VFD's shall have the same customer interface, including digital display, keypad and customer connections; regardless of horsepower rating. The keypad is to be used for local control, for stepping through the displays and menus.
 2. The VFD shall give the user the option of either (1) displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last reference revised, or (4) cause a Warning to be issued, if the input reference (4-20mA or 2-10V) is lost; as selected by the user. The VFD shall provide a programmable relay output for customer use to indicate the loss of reference condition.
 3. The VFD's shall utilize plain English digital display (code numbers and letters are not acceptable). The digital display shall be a 40-character (2 line X 20 characters/line) LCD display. The LCD shall be backlit to provide easy viewing in any angle. All set-up parameters, indications, faults, warnings and other information must be displayed in words to allow the user to understand what is being displayed without the use of a manual or cross-reference table.
 4. The VFD's shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time.
 5. The VFD shall have the ability to automatically restart after an overcurrent, overvoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable. If the time between reset attempts is greater than zero, the time remaining until reset occurs shall count down on the display to warn an operator that a restart will occur.
 6. The VFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
 7. The VFD shall be equipped with an automatic extended power loss ride-through circuit which will utilize the inertia of the load to keep the drive powered. Minimum power loss ride-through shall be one-cycle, based on full load and not inertia. Removing power from the motor is not an acceptable method of increasing power loss ride-through.
 8. The customer terminal strip shall be isolated from the line ground.

9. Prewired three-position Hand-Off-Auto switch and speed potentiometer. When in "Hand", the VFD will be started, and the speed will be controlled from the speed potentiometer. When in "Off", the VFD will be stopped. When in "Auto", the VFD will start via an external contact closure, and its speed will be controlled via an external speed reference.
 10. The drive shall employ three current limit circuits to provide trip free operation:
 11. The Slow Current Regulation limit circuit shall be adjustable to 125 percent (minimum) of the VFD's variable torque current rating. This adjustment shall be made via the keypad, and shall be displayed in actual amps, and not as percent of full load. The Rapid Current Regulation limit shall be adjustable to 170 percent (minimum) of the VFD's variable torque current rating. The Current Switch-off limit shall be fixed at 255 percent (minimum, instantaneous) of the VFD's variable torque current rating. The overload rating of the drive shall be 110 percent of its variable torque current rating for one minute every ten minutes, and 140 percent of its variable torque current rating for two seconds every 15 seconds, input line fuses standard in the drive enclosure. VFD shall have a DC Line Reactor to reduce the harmonics to the power line and to increase the fundamental power factor.
 12. The VFD shall be optimized for a three kHz carrier frequency to reduce motor noise and provide high system efficiency. The carrier frequency shall be adjustable by the start-up engineer in ACH 501 units. The VFD shall have a manual speed potentiometer in addition to using the keypad as a means of controlling speed manually.
- D. All VFD's to have the following adjustments:
1. Five programmable critical frequency lockout ranges to prevent the VFD from continuously operating at an unstable speed.
 2. PI Setpoint controller shall be standard in the drive, allowing a pressure or flow signal to be connected to the VFD, using the microprocessor in the VFD for the closed loop control.
 3. Two programmable analog inputs shall accept a current or voltage signal for speed reference or for reference and actual (feedback) signals for PI controller. Analog inputs shall include a filter; programmable from 0.01 to 10 seconds to remove any oscillation in the input signal. The minimum and maximum values (gain and offset) shall be adjustable within the range of 0-20 MA and 0-10 Volts. Additionally, the reference must be able to be scaled so that maximum reference can represent a frequency less than 60 Hz, without lowering the drive maximum frequency below 60 Hz.
 4. Six programmable digital inputs for maximum flexibility in interfacing with external devices. One digital input is to be utilized as a customer safety connection point for fire, freeze, and smoke interlocks (Enable). Upon remote, customer reset (reclosure of interlock) drive is to resume normal operation.
- E. The following operating information displays shall be standard on the VFD digital display. The display shall be in complete English words (alpha-numeric codes are not acceptable):
- Output Frequency
 - Motor Speed (RPM, Percent, or Engineering units)
 - Motor Current
 - Calculated Motor Torque
 - Calculated Motor Power
 - DC Bus Voltage
 - Output Voltage
 - Heatsink Temperature
 - Analog Input Values
 - Keypad Reference Values
 - Elapsed Time Meter
 - kWh meter

- F. Speed Command Input shall be via:
1. Keypad.
 2. Two Analog inputs, each capable of accepting a 0-20mA, 4-20mA, 0-10V, 2-10V signal. Input shall be isolated from ground, and programmable via the keypad for different uses.
 3. Floating point input shall accept a three-wire input from a Dwyer photohelic (or equivalent type) instrument.
- G. Accessories to be furnished and mounted by the drive manufacturer.
1. Customer Interlock Terminal Strip-provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external interlocks and start/stop contacts shall remain fully functional whether the drive is in hand, Auto or Bypass.
 2. All wires to be individually numbered at both ends for ease of troubleshooting.
 3. Door interlocked thermal magnetic circuit breaker which will disconnect all input power from the drive and all internally mounted options. The disconnect handle shall be thru-the-door type, and be padlockable in the "Off" position.
 4. Manual transfer to line power via contactors. Include motor thermal overload and fuse or circuit breaker protection while in bypass operation. A three position selector switch to control the bypass contactor and the drive output contactor is to be mounted on the enclosure door. When in the "Normal" mode, the bypass contactor is open and the drive output contactor is closed. In the "Test" position both contactors are open, and in the "Bypass" position, the drive output contactor is open, and the bypass contactor is closed. The drive output contactor shall also open when a stop command is given, isolating the motor from the drive. Start/stop signals and safety interlocks will work in drive and bypass modes.
 5. Pilot lights shall be provided for indication of "Normal" operation, "Bypass" operation, and "External Fault". All pilot lights shall be push-to-test type.
 6. Service contactor (drive input contactor) which provides the ability to service the drive (electrically isolate the drive while in bypass operation without having to remove power from the motor). The service contactor shall open when the drive is switched to bypass, and also be controlled by a switch which is mounted inside the drive enclosure so that its access is limited to service personnel only.
 7. A class 20 bimetallic thermal motor overload relay shall be provided to protect the motor in bypass.
- H. Compliance to IEEE - 519
1. The VFD manufacturer shall provide calculations specified to this installation showing that the Total harmonic Distortion for the VFD's, reflected into the electrical distribution system is limited to the level defined by IEEE - 519 (latest edition) for general systems. Harmonic analysis shall be included with VFD submittal for approval by the engineer.
 2. The VFD manufacturer shall conduct on site harmonic measurements before and after start up of the VFD's. Results of the measurements, showing harmonic contribution of the VFD's, shall be provided to the engineer one month after start up.
 3. Three phase A. C. input line reactors shall be provided as a minimum, with all VFD's. The line reactors are to provide attenuation of line side voltage transients, thus preventing overload trips or other unnecessary V.F.D. shutdown, and provide a reduction in harmonic distortion.
 4. Line reactors shall have the following requirement:
 - a. Minimum of two or three percent line impedance.
 - b. 150 percent continuous current rating for one minute.
 - c. Saturation rating no less than 2.5 times the continuous current rating.

- d. U.L. recognized.
- I. General: Install variable frequency drives where indicated, in accordance with manufacturer's published installation instructions, complying with recognized practices to ensure that variable frequency drives comply with requirements and serve intended purposes.
- J. Access: Provide access space around control panels for service as indicated, but in no case less than that recommended by manufacturer.
- K. Support: Install drive control panels on walls where indicated on drawings. Provide necessary Unistrut and structural steel to provide adequate support .
- L. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- M. Start-Up
 - 1. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.
- N. Adjusting and Cleaning:
 - 1. Alignment: Check compatibility of control panel to motor and where necessary, adjust frequency and provide necessary filters to assure noise free operation of motors. Verify response from control panel to motor to assure turn down ratio specified and that static pressure signals are being received and that drives are controlling as specified and within recommended tolerances by manufacturer. Provide start-up report prepared by manufacturer's representative to assure operation is as specified.
 - 2. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- O. Acceptable Manufacturers:
 - Square D
 - Allen – Bradley
 - ABB
 - Siemens
 - Or Equal

2.20 AUTOMATED LIGHTING CONTROL SYSTEM

- A. General: Summary
 - 1. Section Includes:
 - a. Addressable Networked Light Management System.
- B. References
 - 1. National Fire Protection Association (NFPA)
 - 2. cULus Listing/Certification
 - a. Certified as Energy Management Equipment (UL 916)
 - b. Certified as Emergency Lighting Equipment (UL 924)
 - c. Meet Heat and Smoke Release for Air-Handling Spaces (UL 2043)
 - 3. Federal Communications Commission (FCC) / Industry Canada (IC)

4. California Energy Commission (CEC)
 5. Local Building Codes
- C. System Description
1. Lighting Control System includes computer-based software that provides control, configuration, monitoring and reports. System includes the following components:
 - a. Central Control Unit
 - b. System Server
 - c. 0-10V Dimming, Fixed Output Ballasts or 0-10V LED Drivers
 - d. System Field Devices (Input and Output Modules)
 - e. Lighting Control System Software
 - f. Lighting Controllers
 - g. Communication Wire
 - h. Occupancy sensors
 - i. Photo sensors
 - j. Power packs
 - k. Lighting control panels
 - l. Interface to audio visual equipment
 - m. Interface to BACnet
 - n. Interface to Tridium Niagara
 - o. Incandescent low-voltage dimming modules
- D. Submittals
1. General: Provide submittals per 1.4 (B – J) below:
 2. Bill of Materials: Complete list of all parts needed to fully install selected system components.
 3. Product Data: For each type of product indicated.
 4. Shop and Wiring Drawings: Submit shop drawings detailing control system, as supplied, including one-line diagrams, wire counts, coverage patterns, interconnection diagrams showing field-installed wiring and physical dimensions of each item.
 5. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 - a. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
 - b. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.
 6. Software Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On compact disc or DVD, complete with data files.
 - c. Printout of software application and graphic screens, or upon request, a live demonstration of Control, Configure and Analyze functionality or a video demonstrating above stated system capabilities.
 7. Installation Instructions: Manufacturer's installation instructions.
 8. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
 9. Warranty: Copy of applicable warranty.
- E. Quality Assurance
1. Installer Qualifications: Installer shall be one who is experienced in performing the work of this section, and who has specialized in installation of work similar to that required for this project.

2. Manufacturer Requirements: The manufacturer shall have a minimum of 10 years experience manufacturing networked lighting control systems and shall provide 24/7 telephone support by qualified technicians.
3. Contractor shall ensure that lighting system control devices and assemblies are fully compatible and can be integrated into a system that operates as described in the lighting control notes on drawings and as described within this specification. Any incompatibilities between devices, assemblies, and system controllers shall be resolved between the contractor and the system provider to ensure proper system operation and maintainability.
4. Performance Requirements: provide all system components that have been manufactured, assembled, and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.
5. Performance Testing Requirements
 - a. Manufacturer shall 100 percent test all equipment prior to shipment. Sample testing is not acceptable.
6. Code Requirements
 - a. System Control Unit and System Field Devices shall be cULus listed and certified.
 - b. All system components shall be FCC /IC compliant.
 - c. All system components shall be installed in compliance with National Electrical Codes and Canadian Electrical Code.
 - d. Building Codes: All units shall be installed in compliance with applicable, local building codes.
7. ISO Certification: System components shall be manufactured at ISO-9000 certified plants.

F. COORDINATION

1. Coordinate lighting control components to form an integrated interconnection of compatible components.
 - a. Match components and interconnections for optimum performance of lighting control functions.
 - b. Display graphics showing building areas controlled; include the status of lighting controls in each area.

G. Delivery, Storage & Handling

1. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
2. Delivery: Deliver materials in manufacturer's original, unopened, undamaged packaging with intact identification labels.
3. Storage and Protection: Store materials away from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

H. Warranty

1. On-going system expansion, service and support shall be available from multiple factory certified vendors. Recommended service agreements shall be submitted at the time of bid complete with manufacturers suggested inventory and pricing for system parts and technical support labor.
2. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within specified warranty period.

3. Manufacturer's Warranty: All equipment shall be warranted free of defects in materials and workmanship.
 - a. Warranty Period: All system hardware components shall have full warranty (non-prorated) for at least four years and all software components shall carry a warranty of 90 days from date of installation.
 - b. Owner Rights: Manufacturer's warranty is in addition to, not a limitation of, other rights the Owner may have under contract documents, or warranties of third party component manufacturers.

- I. Basis of Design Products
 1. Controls: ENCELIUM Energy Management System by OSRAM SYLVANIA
 2. Sensors: ENCELIUM Sensors by OSRAM SYLVANIA & Hubbell Building Automation, Inc.

- J. Acceptable Alternate Manufacturers
 1. Controls: Lutron, Sensor Switch, Crestron, Philips, Cooper, or equal.
 2. Sensors: Lutron, Sensor Switch, Watt Stopper, Leviton, Cooper or equal.

- K. System Performance Requirements
 1. This specification is intended to fully describe all of the design, engineering, programming, hardware, software, ancillary devices and associated technical services required to provide a building-wide networked lighting control system. This system is specified to perform scheduled and automated lighting control sequences.
 2. The lighting control "system" shall include a fully distributed WAN/LAN network of global controller/routers, individually addressable System Field Devices, sensors, switches, relays and other ancillary devices required for a complete and operable system. The system WAN/LAN shall be commissioned by ENCELIUM personnel or other ENCELIUM certified commissioning contractors.
 3. The basis of system design shall utilize non-propriety industry standard 0-10V dimming or fixed output ballasts and/or 0-10V LED drivers, occupancy sensors, and daylight sensors.
 4. On-going system expansion, service and support shall be available from multiple factory certified vendors. Recommended service agreements may be submitted at the time of bid complete with manufacturers suggested inventory and pricing for system parts and technical support labor.
 5. Lighting Control Software: The system shall offer two separate levels of lighting control: one personal lighting control for the average building occupant to control and adjust basic lighting functions in their workspace, and two central lighting control for the facility lighting administrator to perform energy management, configuration maintenance, monitoring operations, and providing support to building occupants.
 - a. Native central control software shall be utilized for energy reporting status and complete programming without the need for any third party hardware or software. Systems that require any third party linked software or graphics shall be unacceptable.
 - b. Software shall provide information on general system settings via mouse click on a floor plan. Left clicking over a device on the graphical software interface shall show a description of the selected device/function attribute.

6. Central Lighting Control:
 - a. Shall provide an Interactive, Web-based graphical user interface (GUI) showing floor plans and lighting layouts that are native to the lighting control software. The only means required to program and operate the lighting control system shall be programmed and operated from a user interface that is based on a plan view graphical screen on the user's computer or the lighting control system's main computer. Shall include the navigational features listed below to allow for user's orientation within the controlled space, geographic heading and/or landmarks:
 1. Interactive
 2. Vector based
 3. Zoom
 4. Rotate
 5. Pan
 6. Tilt
 - b. Shall allow building operator to navigate through an entire facility both in two-dimensional and three-dimensional multi-floor view, allowing for fast and easy navigation.
 - c. Three-dimensional view shall exclude walls and other structural features to avoid shadowing and cluttering of the plan view.
 - d. All programming, assignments of lighting loads to control strategies, lighting status and lighting energy reporting shall be native to the software and executed from this GUI. Editing shall be available from this GUI in a drag and drop format or from drop down menus without the need for any third party software. Systems that utilize or require third party linked graphics are unacceptable. The GUI shall continuously indicate the status of each connected device on the system and a warning indicator on the software if a device goes offline. Systems requiring spreadsheet editing for programming and that don't offer real time feedback are not acceptable.
 - e. Software settings and properties shall be selectable per individual device, room based, floor based or global building based.
 1. Lighting Control Software interface shall provide current status and enable configuration of all system zones including selected individual fixture availability, current light level, maximum light level, on/off status, occupancy status, and emergency mode (response to an emergency signal) status.
 - f. Shall have the ability to display various lighting system parameters such as Lighting status (ON/OFF); Lighting levels, Load shedding status, or Lighting energy consumption, Occupancy status in a colorized gradient ("weather" map) type of graphical representation.
 - g. Energy Analysis data shall be exportable in a CSV or similar format.
 - h. Shall allow import of native AutoCAD files.
7. Reports: Reporting feature shall be native to the lighting control software and capable of reporting the following parameters for each device and zone individually without requiring any third party hardware and software:
 - a. Energy consumption broken down by energy management strategy.
 - b. Energy demand broken down by energy management strategy.
 - c. Occupancy data by zone.
 - d. Building wide occupancy status
 - e. Lighting energy consumption in a color gradient ("weather map" type) view
 - f. Energy performance reports shall be printable in a printer friendly format and downloadable for use in spreadsheet applications.

8. Personal Lighting Controls: The Personal Control Software interface shall provide current status and enable each user with the ability to dim and brighten lights, and turn them on and off by individual fixture or zone. The Software shall offer user configurable light scenes, which may be programmed and then selected via the Software. Personal lighting control shall be available in open/private office environments.
9. Daylight Harvesting (Light Regulation Averaging): In a photo sensor-equipped system, the Central Controller Unit shall rationalize changes to light levels when ambient (natural) light is available and shall maintain a steady light level when subjected to fluctuating ambient conditions where dimming ballasts and/or drivers exist. Areas equipped with fixed output ballasts and/or drivers shall energize when natural light falls below foot-candle levels specified. System shall utilize light level inputs from common and/or remote sensor locations to minimize the number of photo sensors required. The System shall operate with multiple users in harmony and not react adversely to manual override inputs.
10. Time Clock Scheduling: The system shall be programmable for scheduling lights on or off via the Lighting Control Software interface.
 - a. Support for BACnet Time Schedule Object: This allows the export of Lighting Control time schedules to BACnet devices and vice versa in the event of Lighting Control System's integration with BACnet.
 - b. Override: Manual adjustments via lighting controllers or personal control software shall temporarily override off status imposed by time clock schedule.
 - c. Response to Power Failure: In the event of a power failure, the time clock shall execute schedules that would still be in progress had they begun during the power outage.
 - d. Flick Warning: Prior to a scheduled lights-off event or expiry of a temporary override, the system shall provide two short light level drops as a warning to the affected occupants. Flick warning time shall have the ability to be programmed via software between one and five minutes.
11. Load Shed Mode: An automatic load shedding mode shall be available where, when activated through the system, the control unit will reduce its output to a programmable maximum electrical demand load. The system shall not shed more load than required and load shedding priority shall be centrally configurable by control zone or by common uses (i.e., all hallways can be treated as one load shed group), with subsequent load shed priority groupings being utilized until the required defined load has been shed, for either a defined period, or until the demand response input has been removed. Systems that simply select a "load shed scene" whereby there is no guarantee that the defined required load will actually be shed are not acceptable.
12. Emergency Mode: There shall be a mode, when activated through the system, that will immediately adjust lights to full light output and retain that level until the mode is deactivated in the event of an emergency. This setting shall override all other inputs. The system shall interface with the building of life safety transfer switch, fire alarm control panel, and security system control panel.
 - a. Addressing: All ballasts and/or drivers shall be centrally addressable, on a per fixture or multiple fixtures/zone basis, through the Central Control Software. The basis of design shall utilize industry standard 0-10V Dimming, Fixed Output Ballasts and/or 0-10V LED Drivers connected to an Output Module. To simplify ongoing maintenance, the system shall not require manual recording of addresses for the purpose of commissioning or reconfiguration.
13. Programmable Task Tuning: Maximum light level programmability shall be available by individual fixture.
14. Unoccupied State: The system shall provide two states when occupancy status is vacant as per an occupancy sensor: lights turn off or lights adjust to configurable (dimmed) light level.

15. Occupied State: The system shall be capable of creating "comfort" or "support" zones to ensure that occupants are not isolated by turning off lights in adjacent areas for occupant comfort and safety, such as a hallway path to exit the premises.
16. The Automated Lighting Control System (ALCS) BACnet Interface shall share the following information with the BACnet enabled Building Automation System and other systems listed below:

Property	BACnet Type	Description
Lighting Load	Analog Value*	Reports the total lighting load of the ALS, defined in Watts
Light Zone State		Binary Value* State of the defined lighting zone - ON or OFF
Light Zone Dimming	Analog Value*	Light output level of the defined lighting zone, from 100 percent (maximum light output) to 0 percent (minimum light output)
Emergency System State	Binary Input	State of the emergency alarm system: alarm activated or alarm not activated
Fire Alarm State		Binary Input State of the fire alarm system: alarm activated or alarm not activated
Security System State	Binary Input	State of security alarm system: alarm activated or alarm not activated
Occupancy State		Binary Output State of the defined occupancy sensor – occupancy detected or not detected
Sheddable Load	Analog Output	Reports the total lighting load available for load reduction according to ALS, defined in Watts
Shed Status	Analog Output	Reports the total current load reduction achieved according to ALS defined prioritization, defined in Watts

Shed Request	Analog Input	Requested total amount of load reduction, defined in Watts or as a percentage of sheddable load
Sheddable Load (Group)	Analog Output	(As above, unprioritized for the selected group)
Shed Status (Group)	Analog Output	(As above, unprioritized for the selected group)
Shed Request (Group)	Analog Input	(As above, unprioritized for the selected group)

17. LAN Operations: System shall be capable of operating independent of building's existing network infrastructure if desired and shall not rely on tenant supplied PCs for operation. Network infrastructure shall only be utilized for Personal Control Software.
18. Firewall Security: Firewall technology shall be utilized to separate tenants from the lighting control network.
19. Lamp Burn In: The system software shall not permit dimming of new lamps prior to completion of lamp manufacturer 100 hour recommended accumulated operation at full brightness.
20. Re-configurability: The assignment of individual fixtures to zones shall be centrally configurable by Central Control Software such that physical rewiring will not be necessary when workspace reconfiguration or re-zoning is performed. Removal of covers, faceplates, and ceiling tiles. shall not be required.
21. Automatic Control Parameters: Occupancy sensor time delays shall be configurable through software. Light level sensor parameters shall be configurable through software.
22. Automatic Time Adjustment: System shall automatically adjust for leap year and daylight savings time and shall provide weekly routine and annual holiday scheduling.
23. Contact closure input: System shall be capable of receiving a momentary and sustained contact closure input from third party sources to control lighting zones.
24. The light management system shall interface digitally with the building automation system via BACnet/IP and Tridium Niagara AX interface. The lighting control system shall communicate the status of output devices (lighting loads) as well as input devices (dry contacts, switches, occupancy sensors, vacancy sensors, and photocells) over this connection allowing the building automation system to utilize lighting control system input devices such as occupancy sensors to determine if mechanical control zones are occupied for climate adjustments.
25. The system software shall provide a web based energy dashboard to show real time energy savings data and carbon footprint reductions.
26. Migration Plan to Control LED Fixtures
 - a. System shall be capable of migrating from the control of 0-10V Ballasts to 0-10V LED Drivers utilizing the same Output Modules without the need to change control hardware.

L. Lighting Controllers

1. Description: The system shall include separate lighting controllers for each of the listed functionalities and at minimum meet listed electromagnetic, mechanical, electrical and data specifications:
 - a. Software configurable lighting controller that provides on/off switching and dimming control for up to three lighting zones/scenes per controller or more with allowable multi-gang configurations. Status is indicated by an LED display to indicate function, scene or zone. Allows manual override of the time schedule.
 - b. Manual dimming and/or switching lighting controller that provides local on/off and dimming control over at least three lighting zones. Allows manual dimming of light levels and override of the time schedule.
 - c. Scenes in the central control software shall be synchronized with the buttons on the lighting controller.
 - d. Lighting controllers shall fit in a standard Decorator style wall plate and may be ganged together.
2. General
 - a. Addressing: All controllers shall be individually addressable & reconfigurable via Central Control Software.
 - b. Shall provide local on/off or dimming control over lighting zones
 - c. Shall utilize a standard single-gang or multi-gang form factor
 - d. Shall have a terminal block that connects to lighting system with 18 AWG, polarity independent, CMP rated and low voltage wire
 - e. Shall be manufactured with push-in wire receptacles
 - f. LED's: All controllers shall feature LED's to indicate light on and light off status.
 - g. Color: All controllers shall meet NEMA WD1 color specifications.
 - h. Style: All controllers shall feature Decorator styling wall plates.
 - i. Lighting scenes reconfigure automatically based on scene changes from personal control software.
 - j. Industrial lighting controllers shall also be available for damp location applications.
 - k. Shall comply or exceed the following electromagnetic requirements:
 1. EN 61000-4-2
 2. EN 61000-4-4
 3. EN 61000-4-5
 4. FCC Part 15/ICES-003
3. Mechanical Specifications:
 - a. Dimensions: Shall meet NEMA WD-6 spec.
 - b. Maximum Operating Ambient Temperature: 60 deg C.
 - c. Mounts in standard size wall box suitable for multi gang installation or alternative of Low Voltage mounting bracket.
 - d. Suitable for use with Decorator style wall plates.
4. Electrical Specifications:
 - a. Class 2 Low Voltage device.
 - b. Power through interconnected 18 AWG cable with 2-pin header
5. Data Specifications:
 - a. Class 2 communication bus that uses prefabricated 18 AWG cable.

M. System Field Devices (Input and Output Modules)

1. General: Input Modules provide a common interface to low voltage occupancy sensors and photo sensors while Output Modules provide a common interface to 0-10V Dimming, Fixed Output Ballasts and/or 0-10V LED Drivers and analog dimming devices such as incandescent low-voltage dimming modules. These modules automatically self-address and detect the type of devices they are connected to (i.e., photo sensor, occupancy sensor, 0-10V ballast, 0-10V LED drivers or incandescent dimming module) and establish two-way communication between the system Control Unit (CU) and themselves. These individually addressable modules enable each lighting component to be independently controlled and configured to best meet the needs of the facility.
 - a. Addressing: System Field Devices shall be individually addressable via Central Control Software.
 - b. System shall automatically address individual nodes during system commissioning thus eliminating the need to pre-address devices or record serial numbers during installation.
 - c. Modules shall at minimum meet the listed general, mechanical and environmental specifications set at below.
2. Air Gap Off
 - a. Definition: Air Gap Off shall refer to the physical disconnection of AC power to the ballast or driver when "OFF" is selected either automatically or manually, thus ensuring maximum energy savings by eliminating off-state phantom power losses as well as ensuring that no potentially lethal high-voltage is present at the ballast or driver when the lights appear to be off (for life-safety reasons).
 - b. Provisions: Provide an air-gap off relay for each control zone in the system. Where each fixture is to be controlled (dimmed and/or switched) independently, provide one relay per fixture. Where multiple fixtures are to be controlled (dimmed and/or switched), provide one relay per control zone, sized to handle both the inrush current as well as the maximum connected load, at the specified voltage.
 - c. General Specifications:
 - d. Shall supply 12VDC (up to 24VDC) to sensors.
 - e. Shall have 2 ports that accept 18 AWG, pre-fabricated, polarity independent quick connecting Class 2 communication bus that supplies 24 VDC.
 - f. Two models, one rated for regular indoor use and other for use in damp locations such as basements, cold storage areas. shall be available.
 - g. Memory: Retains all system settings in non-volatile memory.
3. Mechanical Specifications:
 - a. Wiring: The System Field Device shall not require wiring connections to the System apart from pre-terminated, quick connecting 18 AWG, polarity independent quick connecting Class 2 communication bus.
4. Environmental Specifications:
 - a. Operating Temperature Range: -40 deg C to +55 deg C.
 - b. Humidity: 0 percent to 100 percent RH condensing rated for damp locations.
 - c. 0 percent to 95 percent RH non-condensing rated for indoor locations.

N. Energy Control Unit

1. General: The Energy Control Unit (ECU) is a rack or wall mounted lighting control device that collects, processes and distributes lighting control information to System Field Devices and lighting controllers over a Class 2 communication bus. Each ECU has multiple Class 2 communication channels and can control a large quantity of nodes (sensors, lighting controllers, 0-10V Dimming, Fixed Output Ballasts and 0-10V LED Drivers.) per channel, per the manufacturers recommended maximum. The ECU is the central intelligence point for the area that it controls, collecting signal information from sensors, lighting controllers and personal control software and determining appropriate brightness levels or on/off status for each fixture or zone. Each ECU has an Ethernet connection for communication with a facility's or tenant's Local Area Network (LAN) to enable desktop personal control.
 - a. Shall interconnect with other ECUs and System Server Unit (SSU) using standard Ethernet connection that employs TCP/IP protocol.
 - b. Control units shall at minimum meet the mechanical, electrical, data, electromagnetic and environmental specifications listed below.
2. Mechanical Specifications:
 - a. Shall mount in a standard 1 inch rack (1U width), or alternatively where no rack is shown, via an individual wall mount.
3. Electrical Specifications:
 - a. Power Supply: 120V/60Hz/200W. Provide dedicated 120V receptacle fed from a dedicated normal power circuit; do not connect to a UPS or normal/emergency power source.
4. Data Specifications:
 - a. Shall have 8 ports that accept 18 AWG, pre-fabricated, polarity independent quick connecting Class 2 communication bus that supplies 24 VDC
 - b. Each ECU channel shall support up to 100 nodes or 800 nodes in total.
 - c. Each ECU shall have two Ethernet 10/100Base - Tx Cat 5 RJ45 ports that employs TCP/IP protocol:
 1. Lighting Control Network
 2. Tenant LAN Access Point
 - d. Shall have a status LED on front of unit.
 - e. Shall have configuration stored in non-volatile flash memory.
5. Shall comply or exceed the following electromagnetic requirements:
 - a. EN 61000-4-2
 - b. EN 61000-4-4
 - c. EN 61000-4-5
 - d. FCC Part 15/ICES-003
6. Environmental Specifications:
 - a. Operating Temperature Range: -20 deg C to +40 deg C.
 - b. Humidity: 0 percent to 95 percent RH non-condensing.

O. System Server Unit

1. General: System Server Unit (SSU) shall host the lighting control system database for all the lighting control devices. Server shall have the ability to:
 - a. Remotely access a system in order to change system settings or configuration;
 - b. Analyze system performance or energy data or generate system report;
 - c. Record energy consumption with average sampling every 5 minutes for unlimited duration;
 - d. Host the web interface required for the web enabled Personal Control Software or web based Central Control Software;
 - e. Optionally can reside on a client server (virtual server) thus eliminating the need for dedicated physical hardware if desired;
 - f. Interconnect with ECUs over standard Ethernet connection that employs TCP/IP protocol;

2. Hardware based servers shall at minimum meet the specifications listed below:
 - a. Specifications:
 1. Mechanical Specifications:
 - a. Shall mount in a standard 19 inch rack (1U width), or alternatively where no rack is shown, via an individual wall mount.
 - b. Electrical Specifications:
 1. Power Supply: 120V/60Hz/200W. Provide dedicated 120V receptacle fed from a dedicated normal power circuit.
 - c. Regulatory:
 1. FCC (US only) Class A.
 2. DOC (Canada) Class A.
 3. UL 60950.
 4. CAN/CSA-C22.2 No. 60950.
- P. Communication Wire
 1. Wiring: 18 AWG, pre-fabricated, polarity independent quick connecting wiring. The system shall have the capability to use both Class 1 and Class 2 wiring. The maximum connected length of wiring shall be 2500 ft. per channel.
 2. Field Bus: Integrates peripheral devices such as 0-10V ballasts and/or 0-10V LED drivers, occupancy sensors, photo sensors, relay-based controls, power packs and low voltage wall controls into a complete, networked programmable lighting control system. Provides power to photo sensors, PIR occupancy sensors and dual-technology occupancy sensors. Devices may be connected randomly on the network and special termination of each network channel is not required.
 3. Field bus shall at minimum meet the specifications listed below:
 - a. Specifications:
 1. Class 2 communication bus.
 2. Prefabricated one ft., five ft., ten ft., 15 ft., 20 ft., 25 ft. and 50 ft. lengths.
 3. Daisy chain topology
 4. Prefabricated with 2-wire connectors.
 5. Flame rated jacket for plenum use NFPA 262 (UL: FT6, CSA: CMP).
 6. Power Supply: 12 VDC (up to 24 VDC) to sensors.
- Q. Conductors and Cables
 1. Class 2 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG.
- R. Lighting Control Panels
 1. General
 - a. Addressing: All lighting control panels shall be individually addressable via Central Control Software.
 - b. Communication: All lighting control panels shall communicate via the same prefabricated, quick connecting low voltage wiring as all other devices.
 - c. Wiring: Relay control panels shall be interconnected on the same field bus as all other system components.
- S. Lighting Control System Software
 1. Personal Control Software: Enables individuals in a building to control lighting levels in their workspace from their own desktop PC. User can control the light level of each fixture in their workspace or can control all of the fixtures together as a group. Preset lighting scenes may be stored, recalled and modified. This software shall have the capability of acting as a "virtual occupancy sensor" for the system by detecting keyboard or mouse activity on each PC for incremental occupancy status data.
 - a. Technical Information:
 1. TCP/IP network traffic < 2kb/s.

2. Web based Personal Control Software: This feature allows individuals to control lighting levels in their workspace without the requirement for installation of software on client PCs. Individuals can access the interface through the web browser and perform individual fixture dimming control, on/off switching, modify and save preset lighting scenes.
3. Technical Information: Adobe Flash ® based user interface.
 - a. System Requirements:
 1. Internet web browser with Flash® Player 8 or later.
 2. Internet/Intranet connection.
 3. SSU enabled and configured to host dynamic website.
 4. Network connection with access to a network-enabled CU.
4. Web based Central Control Software: Central control software application is used to commission, configure and manage the system. Every system parameter in a building (or campus of buildings) is configured for each individual user or space and baseline settings are established for each of the following (depending on the basis of design) system features:
 - a. Daylight harvesting.
 - b. Occupancy control.
 - c. Smart time scheduling.
 - d. Task tuning.
 - e. Personal control.
 - f. Load shedding.
 1. Software utilizes a web based interface that permits a user to easily navigate between zones, floors or different buildings and allows a user to zoom in or zoom out of specific areas of a building. Both 3-dimensional and 2-dimensional multi-floor views shall be available. System features such as creation of zone hierarchies, overlapping and support zone definitions, user access rights, timeout settings for occupancy sensors, calibration of light levels for daylight harvesting and the configuration of multiple time schedule profiles shall be available. A web based Graphical User Interface (GUI) application integral to the system will be used to develop a dynamic, real-time, point-and-click graphic of each floor plan with representation of all light fixtures, lighting controllers, sensors, and switches. A central system server will be provided to support system data base and enterprise control management.
5. System Requirements:
 - a. Software must be able to run on a Windows Operating systems (Windows XP or newer) and also on Apple Mac Intel PCs (Mac OS 10.4 or newer).
 - b. Must support all common browsers, i.e.,
 1. Internet Explorer 6.0 or later
 2. Mozilla Firefox 3.0 or later
 3. Safari
 4. Google Chrome
 - c. Network connection with access to network-enabled CUs.
 - d. Color gradient ("weather map" type) data view (see below for an example) shall be available to display the following criteria:
 1. Current energy consumption
 2. Current energy savings
 3. Current fixture brightness
 4. Current fixture status
 5. Current occupancy data
 6. Current load shedding status
 7. Other custom modes that may be specified elsewhere

T. Photo Sensor:

Photo sensors shall at minimum meet the specifications listed below:

1. General Specifications:
 - a. Shall be Class 2, low voltage.
 - b. Ambient light sensor designed to interface directly with the analog input of the Lighting Control System.
 - c. Sensor shall supply an analog signal to the ALCS proportional to the light measured.
 - d. Sensor output shall provide for zero or offset based signal.
 - e. Sensor shall be capable of a fully adjustable response in the range between 0 and 10,000 foot candles with a +/- 1 percent accuracy at 70 deg F.
 - f. Input: 10VDC.
 - g. Minimum Output: 0 VDC.
 - h. Maximum Output: 10 VDC.
 - i. Sensor housing shall be flame retardant and meet UL 94 HB standards.
 - j. Operating Temp: -10 deg C to 60 deg C.
 - k. The sensitivity adjustments shall be at sensor body, and outside of the sensor's viewing angle.
 - l. The sensor housing shall be flame retardant and meet UL 94HB standards
2. Interior:
 - a. Indoor sensors shall have a Fresnel lens, with a 60 degree cone of response. The indoor sensor range shall be between 0 and 750 FC.
3. Exterior:
 - a. Outdoor models shall have a hood over the aperture to shield the sensor from direct sunlight. The outdoor sensor circuitry shall be completely encased in an optically clear epoxy resin. Outdoor sensors shall mount to a standard threaded 1/2 in. conduit or fit a 1/2 in. knockout. The Outdoor sensor range shall be between 0 and 750 FC.
4. Atrium:
 - a. The Atrium sensors shall have a translucent dome with a 180 degree field of view. Atrium sensor shall mount to a standard treaded 1/2 in. conduit or fit a 1/2 in. knockout. Atrium sensor range shall be from 2 to 2,500 FC.
5. Skylight:
 - a. The Skylight sensors shall have a translucent dome with a 180 degree field of view. Skylight sensor shall mount to a standard treaded 1/2 in. conduit or fit a 1/2 in. Skylight sensor range shall e between 10 and 7,500 FC.

U. Occupancy Sensors

1. Environmental:

Operating Temperature Range: 0°C to 40°C

 - a. Relative Humidity: 0 percent to 95 percent non-condensing
 - b. Ceiling Mount Occupancy/Vacancy Sensors
 1. Sensing mechanism:
 2. Dual technology (ultrasonic / passive infrared):
 3. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 4. Utilize an operating frequency of 32kHz or 40kHz that shall be crystal controlled to operate within plus or minus 0.005 percent tolerance.
 5. Electrical: Rating: 12 VDC input voltage, up to 40 mA current draw.
 6. Sensors shall turn off or reduce lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space
 7. Sensor shall accommodate all conditions of space utilization and all irregular work hours and habits.
 8. Sensors shall be UL listed.

9. Sensors shall be fully adaptive and adjust their sensitivity and timing to ensure optimal lighting control for any use of the space
10. Sensors shall have field adjustable controls for time delay and sensitivity to override any adaptive features. Sensor timeouts shall be configurable by System software.
11. Power failure memory:
12. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and learned parameters saved in protected memory shall not be lost.
13. Provide all necessary mounting hardware and instructions.
14. Sensors shall be Class 2 devices.
15. Indicate viewing directions on mounting bracket for all Ceiling mount sensors.
16. Provide customizable mask to block off unwanted viewing areas for all ceiling mounted sensors using infrared technology. Field prepare proper maskings for each space to eliminate unnecessary sensing beyond the space in which the sensor is located.
17. Provide an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options.

V. Power Packs

1. General:
 - a. Power pack shall be a self-contained transformer and relay module.
 - b. The internal relay shall control up to 20A for 120, 230, 277VAC or 347VAC ballast loads and 120VAC incandescent loads.
 - c. Power packs shall provide a 24 VDC, 150 mA output.
 - d. Power packs shall be capable of parallel wiring without regard to AC phases on primary.
 - e. Power pack can be used as a standalone, low voltage switch, or can be wired to sensor for auto control.
 - f. Construction shall be high impact, UL rated plastic case
 - g. Power pack shall be UL/CUL Listed, FCC Certified, UL 2043 plenum rated and meets ASHRAE 90.1 requirements
 - h. To ensure quality and reliability, power and auxiliary relay packs shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1 percent.
 - i. Shall at minimum meet the following environmental specifications:
 1. Operating Temperature Range: 0 deg. C to 40 deg. C
 2. Relative Humidity: 0 percent to 95 percent non-condensing

W. Examination

1. Site Verification: Verify that wiring conditions, which have been previously installed under other sections or at a previous time, are acceptable for product installation in accordance with manufacturer's instructions.
2. Inspection: Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

X. Installation

1. The Electrical Sub-contractor, as part of the work of this section, shall coordinate, receive, mount, connect, and place into operation all equipment. The Electrical Sub-contractor shall furnish all conduit, wire, connectors, hardware, and other incidental items necessary for properly functioning lighting control as described herein and shown on the plans (including but not limited to System Field Devices, 0-10V dimming ballasts, fixed output ballasts, 0-10V LED drivers and communication wire). The Electrical Sub-contractor shall maintain performance criteria stated by manufacturer without defects, damage, or failure.

2. Power: The contractor shall test that all branch load circuits are operational before connecting loads to sensor system load terminals, and then de-energize all circuits before installation.
 3. Related Product Installation: Refer to other sections listed in Related Sections for related products' installation.
- Y. Sensor Installation
1. Adjust sensitivity to cover area installed
 2. Set time delay on occupancy sensors that are connected to the lighting control system to the minimum. Time delays shall be controlled via Central Control Software.
 3. Sensor shall be powered through Input Module. No external power packs shall be used for powering sensors.
 4. Install occupancy sensors on vibration free stable surface.
 5. Install atrium and skylight light sensor facing toward window or skylight.
 6. Install interior light sensor in ceiling facing the floor.
- Z. Wiring Installation
1. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.
 2. Wiring within Enclosures: Comply with NEC & CEC. Separate power-limited and non power-limited conductors according to conductor manufacturer's written instructions.
 3. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
 4. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- AA. Software Installation
1. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current site licenses for software.
- BB. Field Quality Control
1. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 2. Perform the following field tests and inspections with the assistance of a factory-authorized service representative:
 - a. Operational Test: After installing lighting controllers and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Lighting control devices will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.
- CC. Testing
1. Upon completion of all line, load and interconnection wiring, and after all fixtures are installed and lamped, a qualified factory representative shall completely configure and test the system.
 2. At the time of checkout and testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.

DD. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel and building supervisors to adjust, operate, utilize, troubleshoot, conduct software installation, and maintain lighting controls and software training for PC-based control systems. Provide up to eight hours of on-site training with audio and video recorded. Provide a hard copy of manuals, instructional videos, and recorded training session(s) on CD or DVD.

2.21 FIRESTOP SYSTEMS

- A. General: Provide firestopping at all fire-rated construction where penetrated by the Work of this Section.
- B. Refer to Section 07 84 00 – Firestopping, for all product requirements for maintaining integrity of fire-rated construction at penetrations.

2.22 FLOOR OUTLETS (FLUSH TYPE)

- A. Section includes flush floor boxes equal to Wiremold RFB Series. Provide appropriate floor box model that meets the intent of what is shown on the drawings.
- B. Quality Assurance
 1. Electrical Raceways and Components: Comply with requirements of applicable local codes, NEC, UL, and NEMA Standards pertaining to raceways and components. Listed and labeled in accordance with NFPA 70, Article 100.
- C. Floor Boxes
 1. RFB4 and RFB4-4DB Series Floor Boxes: Manufactured from stamped steel and approved for use on above grade floors. The box shall be 12-3/4" L x 10" W x 3-7/16" H [324mm x 254mm x 87mm]. Provide the box with four (4) independent wiring compartments that allow capacity for up to four (4) duplex receptacles, communication and/or audio/video services. The RFB4 Series Box shall permit tunneling from end power compartment to end power compartment. The RFB4-4DB Series Box shall permit tunneling from adjacent or opposite compartments. Two (2) of the four (4) compartments shall have a minimum wiring capacity of 16.4 cu in [269cu cm], one (1) compartment shall have a minimum capacity of 32.3 cu in [529cu cm], and one (1) compartment shall have a minimum capacity of 50 cu in [820cu cm]. Four (4) compartments shall have a minimum of two (2) inches of space behind the device plates. The box shall include the following number of conduit knockouts: one (1) 1/2-inch [12.7mm], three (3) 1-inch [25mm], six (6) 3/4-inch [19.1mm], and six (6) 1-1/4-inch [32mm]. The box shall be fully adjustable, providing a maximum of 1-7/8-inch [47.7mm] pre-pour adjustment, and a maximum of 3/4-inch [19.1mm] after-pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics® workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.

2. RFB4-CI-1 and RFB4-CI-NA Series Floor Boxes: Manufactured from cast-iron and approved for use on grade and above grade floors. The box shall be 14-1/2" L x 11-7/8" W x 3-7/16" H [368mm x 302mm x 87mm]. Provide the box with four (4) independent wiring compartments that allow capacity for up to four (4) duplex receptacles and/or communication services. The box shall permit tunneling from adjacent or opposite compartments. Two (2) of the four (4) compartments shall have a minimum wiring capacity of 27 cu in [443cu cm], and two (2) compartments shall have a minimum wiring capacity of 36 cu in [590cu cm]. Four (4) compartments shall have a minimum of two (2) inches of space behind the device plates. The box shall include the following number of conduit hubs: four (4) 1-inch [25mm] and four (4) 1-1/4-inch [32mm]. The box shall be fully adjustable, providing a maximum of 1-7/8-inch [48mm] pre-pour adjustment, and a maximum of 3/4-inch [19.1mm] after-pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics® workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.
3. RFB4-SS Series Floor Boxes: Manufactured from stamped-steel and approved for use on above grade floors. The box shall be 13-5/8" L x 10" W x 2-7/16" H [346mm x 254mm x 62mm]. Provide the box with four (4) independent wiring compartments that allow capacity for up to four (4) duplex receptacles, communication and/or audio/video services. The box shall permit feed through tunneling from adjacent compartments. Two (2) of the four (4) compartments shall have a minimum wiring capacity of 15.7 cu in [257cu cm] and two (2) compartments shall have a minimum wiring capacity of 31.2 cu in [511cu cm]. Four (4) compartments shall have a minimum of two (2) inches of space behind the device plates. The box shall contain the following number of conduit knockouts: two (2) 1/2-inch [12.7mm], six (6) 3/4-inch [19.1mm], and eight (8) 1-inch [25mm]. The box shall be fully adjustable, providing a maximum of 1-7/8-inch [48mm] pre-pour adjustment, and a maximum of 3/4-inch [19.1mm] after-pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics® workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.
4. RFB4E Series Floor Boxes: Manufactured from stamped steel and approved for use on above grade floors. The box shall be 13-1/8" L x 13-1/8" W x 4-1/16" H [333mm x 333mm x 103mm]. Provide the box with four (4) independent wiring compartments that allow capacity for up to four (4) duplex receptacles, communication and/or audio/video services. The box shall permit feed through removable barriers from adjacent compartments. Four (4) compartments shall have a minimum wiring capacity of 75 cu in [1230cu cm]. Four (4) compartments shall have a minimum of 3-1/2 inches of space behind the device plates. The box shall contain the following number of conduit knockouts: six 3/4-inch [19.1mm], ten (10) 1-inch [25mm], and eight (8) 1-1/4-inch [32mm]. The box shall have two removable knockout plates that can be replaced with a 2-inch trade size conduit hub (2HUB). The box shall be fully adjustable, providing a maximum of 2-inch [35mm] pre-pour adjustment, and a maximum of 3/4-inch [19.1mm] after-pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.

5. RFB4E-OG Series Floor Boxes: Manufactured from stamped steel and painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and approved for use on grade and above grade floors. The box shall be 13-1/8" L x 13-1/8" W x 4-1/16" H [333mm x 333mm x 103mm]. Provide the box with four (4) independent wiring compartments that allow capacity for up to four (4) duplex receptacles, communication and/or audio/video services. The box shall permit feed through removable barriers from adjacent compartments. Four (4) compartments shall have a minimum wiring capacity of 75 cu in [1230cu cm]. Four (4) compartments shall have a minimum of 3-1/2 inches of space behind the device plates. The box shall contain the following number of conduit knockouts: six 3/4-inch [19.1mm], ten (10) 1-inch [25mm], and eight (8) 1-1/4-inch [32mm]. The box shall have two removable knockout plates that can be replaced with a 2-inch trade size conduit hub (2HUB). The box shall be fully adjustable, providing a maximum of 2-inch [35mm] pre-pour adjustment, and a maximum of 3/4-inch [19.1mm] after-pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.
6. RFB6 Series Floor Boxes: Manufactured from stamped steel and approved for use on above grade floors. The box shall be 13-1/8" L x 12-1/2" W x 3-1/4" H [333mm x 317mm x 83mm]. Provide the box with six (6) independent wiring compartments that allow capacity for up to six (6) duplex receptacles, communication and/or audio/video services. The box shall permit feed through tunneling from adjacent compartments. Two (2) of the six (6) compartments shall have a minimum wiring capacity of 23 cu in [376cu cm] and four (4) compartments shall have a minimum wiring capacity of 52cu in [850cu cm]. Four (4) of the six (6) compartments shall have a minimum of 3-1/4 inches of space behind the device plates and two (2) of the six (6) compartments shall have a minimum of 2-3/8 inches of space behind the device plates. The box shall contain the following number of conduit knockouts: twelve 3/4-inch [19.1mm], four (4) 1-inch [25mm], and twelve 1-1/4-inch [32mm]. The box shall be fully adjustable, providing a maximum of 1-3/8-inch [35mm] pre-pour adjustment, and a maximum of 3/4-inch [19.1mm] after-pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.
7. RFB6-OG Series Floor Boxes: Manufactured from stamped steel and painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and approved for use on grade and above grade floors. The box shall be 13-1/8" L x 12-1/2" W x 3-1/4" H [333mm x 317mm x 83mm]. Provide the box with six (6) independent wiring compartments that allow capacity for up to six (6) duplex receptacles, communication and/or audio/video services. The box shall permit feed through tunneling from adjacent compartments. Two (2) of the six (6) compartments shall have a minimum wiring capacity of 23 cu in [376cu cm] and four (4) compartments shall have a minimum wiring capacity of 52cu in [850cu cm]. Four (4) of the six (6) compartments shall have a minimum of 3-1/4 inches of space behind the device plates and two (2) of the six (6) compartments shall have a minimum of 2-3/8 inches of space behind the device plates. The box shall contain the following number of conduit knockouts: twelve 3/4-inch [19.1mm], four (4) 1-inch [25mm], and twelve 1-1/4-inch [32mm]. The box shall be fully adjustable, providing a maximum of 1-3/8-inch [35mm] pre-pour adjustment, and a maximum of 3/4-inch [19.1mm] after-pour adjustment.
The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.

8. RFB6E Series Floor Boxes: Manufactured from stamped steel and approved for use on above grade floors. The box shall be 13-1/8" L x 12-1/2" W x 4" H [333mm x 317mm x 102mm]. Provide the box with six (6) independent wiring compartments that allow capacity for up to six (6) duplex receptacles, communication and/or audio/video services. The box shall permit feed through tunneling from adjacent compartments through 1-1/4-inch grommet openings. Two (2) of the six (6) compartments shall have a minimum wiring capacity of 23 cu in [376cu cm] and four (4) compartments shall have a minimum wiring capacity of 52cu in [850cu cm]. Four (4) of the six (6) compartments shall have a minimum of 3-1/4 inches of space behind the device plates and two (2) of the six (6) compartments shall have a minimum of 2-3/8 inches of space behind the device plates. The box shall contain the following number of conduit knockouts: twelve 3/4-inch [19.1mm], four (4) 1-inch [25mm], and twelve 1-1/4-inch [32mm]. The box shall be fully adjustable, providing a maximum of 1-3/8-inch [35mm] pre-pour adjustment, and a maximum of 3/4-inch [19.1mm] after-pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.
9. RFB6E-OG Series Floor Boxes: Manufactured from stamped steel and painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and approved for use on grade and above grade floors. The box shall be 13-1/8" L x 12-1/2" W x 4" H [333mm x 317mm x 102mm]. Provide the box with six (6) independent wiring compartments that allow capacity for up to six (6) duplex receptacles, communication and/or audio/video services. The box shall permit feed through tunneling from adjacent compartments. Two (2) of the six (6) compartments shall have a minimum wiring capacity of 23 cu in [376cu cm] and four (4) compartments shall have a minimum wiring capacity of 52cu in [850cu cm]. Four (4) of the six (6) compartments shall have a minimum of 3-1/4 inches of space behind the device plates, and two (2) of the six (6) compartments shall have a minimum of 2-3/8 inches of space behind the device plates. The box shall contain the following number of conduit knockouts: twelve 3/4-inch [19.1mm], four (4) 1-inch [25mm], and twelve 1-1/4-inch [32mm]. The box shall be fully adjustable, providing a maximum of 1-3/8-inch [35mm] pre-pour adjustment, and a maximum of 3/4-inch [19.1mm] after-pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.

D. Activation Covers

1. FloorPort FPCT, FPBT, and FPFFT Series Covers: Manufactured of die-cast aluminum or die-cast zinc, and available in brushed aluminum finish and powder-coated paint finishes (black, gray, bronze, nickel and brass). Activation covers shall be available in flanged and flangeless versions. Covers shall be available with options for tile or carpet inserts, or flush covers. The cover's hinge shall allow for the cover to open 180 degrees. The furniture feed covers shall come equipped with one (1) 1-inch trade size screw plug opening and one (1) combination 1-1/4-inch and 2-inch trade size screw plug.
 - a. Flanged covers shall be 7-3/4" L x 6-9/16" W [197mm x 167mm].
 - b. Flangeless covers shall be 6-3/4" L x 5-9/16" W [171mm x 142mm].

2. 6CT, 6CTC, 6CFFTC, 8CTC, and 8CT Series Covers: Manufactured of die-cast aluminum alloy and available in powder-coated gray, black, brass, nickel or bronze finish. The covers shall be available in carpet and tile versions. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub water tightness. The activation cover for the 8CTC and 8CT series shall be 9-1/4-inch [235mm] in diameter. The activation cover for the 6CT and 6CTC series shall be 7-1/4-inch [184mm] in diameter and the activation cover for the 6CFFTC series shall be 7-3/4-inch [197mm] in diameter. The carpet covers shall be surface mounted and the tile covers shall be flush with the finished floor covering. The covers shall have spring loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible.
 3. The covers shall have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.
- E. Communication Modules Mounting Accessories
1. The floor box manufacturer shall provide a complete line of faceplates and bezels to facilitate mounting of UTP, STP (150 ohm), fiber optic, coaxial, and communication devices. The box shall provide a series of device mounting plates that will accommodate Ortronics workstation connectivity outlets and modular adapters, and other open system devices.
- F. Installation
1. Strictly comply with manufacturer's installation instructions and recommendations and approved shop drawings. Coordinate installation with adjacent work to ensure proper clearances and to prevent electrical hazards.
 2. Mechanical Security: Raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, in accordance with manufacturer's installation sheets.
 3. Accessories: Provide accessories as required for a complete installation, including insulated bushings and inserts where required by manufacturer.
 4. Unused Openings: Close unused box openings using manufacturer's recommended accessories.
 5. Provide a minimum concrete pour depth of 3-7/16-inch [87mm] plus 1/16-inch [1.6mm] above the top of the box for the RFB4, RFB4-4DB, RFB2, and the RFB2-OG Series Boxes; 2-7/16-inch [62mm] plus 1/16-inch [1.6mm] for the RFB4-SS and RFB2-SS Series Boxes; and 3-7/16-inch [87mm] plus 13/16-inch [21mm] above the top of the box for the RFB4-CI-1, RFB6, and RFB6-OG Series Boxes; and 4-1/16-inch [103mm] above the top of the RFB4E and RFB4E-OG Series Boxes; and 4-inch [102mm] above the top of the RFB6E and RFB6E-OG Series Boxes. Provide the box with four (4) locations to accommodate leveling for pre-concrete pour adjustment and include four (4) leveling screws for the pre-pour adjustment.
- G. Cleaning and Protection
1. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.
 2. Protect boxes and fittings until acceptance.

PART 3 - EXECUTION

3.01 WORK COORDINATION AND JOB OPERATIONS

- A. Equipment shall not be installed in congested and possible problem areas without first coordinating installation of same with other trades. Relocate electrical equipment installed in congested or problem areas should it interfere with the proper installation of equipment to be installed by other trades.
- B. Particular attention shall be directed to coordination of lighting fixtures and other electrically operated equipment requiring access which is to be installed in ceiling areas. Coordinate with other trades, the elevations of equipment in hung ceiling areas to insure adequate space for installation of recessed fixtures before said equipment is installed. Conflicts in mounting heights and clearances above hung ceilings for installation of recessed lighting fixtures or other electrically operated equipment requiring access shall be brought to the attention of Architect for a decision prior to equipment installation.
- C. Furnish to General Contractor and other subcontractors information relative to portions of electrical installation that will affect other trades sufficiently in advance so that they may plan their work and installation.
- D. Obtain from other trades information relative to electrical work which he, the Electrical Subcontractor, is to execute in conjunction with installation of other trades' equipment.
- E. Lighting fixtures in mechanical spaces or utility/storage rooms shall only be installed after all mechanical equipment is in place.

3.02 PLANS AND SPECIFICATIONS

- A. Plans:
 - 1. Drawings showing layout of electrical systems indicate approximate location of raceways, outlets, and apparatus. Runs of feeders and branch circuits are schematic and are not intended to show exact routing. Final determination as to routing shall be governed by structural conditions and as indicated on the approved coordination drawings.
- B. Specifications:
 - 1. Specifications supplement drawings and provide specifics pertaining to methods and material to be used.

3.03 IDENTIFICATION

- A. Equipment shall be marked for ease of identification as follows.
 - 1. Provide screw-on nameplates on panelboards, F.A. terminal cabinets, starters, and disconnect switches. Nameplates to be of black phenolic with white engraving. For starters and disconnect switches lettering shall be minimum of 1/4 in. high. Nameplates on panelboards shall have the following information.
 - a. Line 1 - Panel designation in 1/2 in. high letters.
 - b. Line 2 - Utilization voltage in 3/8 in. high letters.
 - c. Line 3 - Distribution source "Fed from " in 1/4 in. high letters.
 - 2. Neatly typed directory cards listing circuit designations shall be fastened inside the cover of panelboards. Spare circuits shall be penciled.

3. Color coding schedules. If there is more than a single system voltage, different voltages shall have separate color codes, as previously specified. A copy of the color code schedule shall be affixed to each secondary switchboard and distribution panel and shall be of the phenolic nameplate type as previously specified. A typewritten color code schedule shall also be affixed, under plastic, inside each panelboard door.
4. Outlet boxes both concealed and exposed shall be identified as to panel origination and circuit number by means of fibre pen on the inside of coverplate.
5. Special system outlet boxes concealed above hung ceilings shall be identified as to system by spray painting during roughing. The following systems shall be identified.
 - a. Fire Alarm - red.
 - b. Normal/Emergency - yellow.
 - c. Security - blue.
 - d. Sound - green.
6. Wiring device plates on devices connected to normal-emergency circuits shall be red in color.
7. All conductors in boxes larger than standard outlet boxes, in all wireways, trench headers shall be grouped logically and be identified.
8. Grounding conductors and neutrals shall be labeled in panels, wireways as to circuits associated with.

3.04 PROTECTION AND CLEANUP

A. Protection:

1. Materials and equipment shall be suitably stored and protected from weather.
2. During progress of work, pipe and equipment openings shall be temporarily closed so as to prevent obstruction and damage.
3. Be responsible for maintenance and protection of material and equipment until final acceptance.

B. Cleanup:

1. Keep job site free from accumulation of waste material and rubbish. Remove all rubbish, construction equipment, and surplus materials from site and leave premises in a clean condition.
2. At completion, equipment with factory finished surfaces shall be cleaned and damaged spots touched up with the same type paint applied at factory.
3. Particular attention is called to Section 110-12(c) of the NEC, which requires that internal parts of electrical equipment not be contaminated by construction operations.

3.05 PORTABLE OR DETACHABLE PARTS

- A. Retain possession of and be responsible for spare parts, portable and detachable parts, and other removable portions of installation including fuses, keys, locks, blocking clips, inserts, lamps, instructions, drawings, and other devices or materials that are relative to and necessary for proper operation and maintenance of the system until final acceptance, at which time such parts shall be installed or turned over to the Owner, as the case may be.

3.06 SAFETY PRECAUTIONS

- A. Provide proper guards, signage, and other necessary construction required for prevention of accidents and to insure safety of life and property. Remove any temporary safety precautions at completion.

3.07 MOUNTING HEIGHTS

- A. All electrical equipment shall be mounted at the following heights unless noted or detailed otherwise on drawings. Notes on architectural drawings shall supersede those noted below or detailed on the electrical drawings. If mounting height of an electrical component is questionable, obtain clarification from Architect before installation.
1. Duplex convenience outlets, microphone outlets, and telephone outlets - 18 inches.
 2. Light switches, pushbutton stations, HOA switches, and all other toggle or control switches for the operation of heating, ventilating, and air conditioning, plumbing, and general service - 48 inches.
 3. Clock outlets - 84 inches.
 4. Fire alarm pull stations - 48 inches.
 5. Fire alarm audio visual signals - 80 inches or 6 inches below ceiling, whichever is lower.
 6. Panelboards for lighting, power, telephone, and other auxiliary systems - 78 in. to top.
 7. Equipment located in lobbies shall be located as detailed on architectural drawings or as directed by Architect.
 8. All receptacles, light switches, fire alarm signals, and clocks sharing a common location shall be symmetrically arranged.
 9. Exterior and interior wall brackets shall be as detailed on architectural drawings.
- B. Mounting heights given are from finished floor to centerline. In the case of a raised floor, surface of raised floor is the finished floor.

3.08 WORKMANSHIP AND INSTALLATION METHODS

- A. Work shall be installed in first-class manner consistent with best current trade practices. Equipment shall be securely installed plumb and/or level. Flush-mounted outlet boxes shall have front edge flush with finished wall surface. No electrical equipment shall be supported by work of other trades. Cable systems shall be supported and not draped over ducts and piping or laid on ceiling suspension members. Lighting fixtures shall be installed to agree with Architects reflected ceiling plans.
- B. Supports:
1. Support work in accordance with best industry practice and by use of standard fittings.
 2. In general, walls and partitions will not be suitable for supporting weight of panelboards, dry type transformers and the like. Provide supporting frames or racks extending from floor slab to structure above.
 3. Provide supporting frames or racks for equipment, intended for vertical surface mounting in free standing position where no walls exist.
 4. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of equipment.
 5. Provide 3/4 in. thick painted plywood mounting surfaces in all electric and telephone areas and for all equipment on free standing racks. All plywood shall be fire retardant and painted both sides and edges with two coats of white paint.
 6. No work for exposed installations in damp locations shall be mounted directly on any building surface. In such locations, flat bar members or spacers shall be used to create a minimum of 1/4 in. air space between building surfaces and work.

7. Nothing (including outlet, pull and junction boxes and fittings) shall depend on electric raceways or cables for support. All outlet, pull, and junction boxes shall be independently supported.
 8. Nothing shall rest on, or depend for support on, suspended ceiling or its mounting members.
 9. Support surface or pendant mounted lighting fixtures:
 - a. From outlet box by means of an interposed metal strap, where weight is less than five pounds.
 - b. From outlet box by means of a hickey or other direct threaded connection, where weight is from five to fifty pounds.
 - c. Directly from structural slab, deck or framing member, where weight exceeds fifty pounds.
 - d. Pendant lighting fixtures shall be supported by threaded rods in non-public areas and by manufacturer's standard tube hangers with swivel aligner and canopy in public areas. Provide non-standard pendant lengths where required to mount fixtures at elevations either called for on drawings or as shown in architectural elevations.
 10. Support recessed lighting fixtures directly from structural slabs, decks or framing members, by means of jack chain or air craft cable, one at each end of fixture at opposite corners.
 11. Where support members must of necessity penetrate air ducts, provide airtight sealing provisions which allow for a relative movement between the support members and the duct walls.
 12. Provide channel sills or skids for leveling and support of all floor mounted electrical equipment.
 13. Where permitted loading is exceeded by direct application of electrical equipment to a slab or deck, provide proper dunnage to distribute the weight in a safe manner.
 14. Support metallic raceways by either running within steel frame or hung from the building frame. Anything hung from building frame shall be attached with metallic fasteners.
- C. Fastenings:
1. Fasten electric work to building structure in accordance with the best industry practice.
 2. Where weight applied to attachment points is 100 pounds or less, fasten to building elements of:
 - a. Wood -- with wood screws.
 - b. Concrete and solid masonry -- with bolts and expansion shields.
 - c. Hollow construction -- with toggle bolts.
 - d. Solid metal -- with machine screws in tapped holes or with welded studs.
 3. Where weight applied to attachment points exceeds 100 pounds, fasten as follows:
 - a. At field poured concrete slabs, provide inserts with 18 in. minimum length slip-through steel rods, set transverse to reinforcing steel.
 - b. Where building is steel framed, utilize suitable auxiliary channel or angle iron bridging between structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
 4. Floor mounted equipment shall not be held in place solely by its own dead weight. Provide floor anchor fastenings. Floor mounted equipment over 72 inches in height shall also be braced to nearest wall or overhead structural elements.
 5. For items which are shown as being mounted at locations where fastenings to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging to building structural elements.

6. Fastenings for metallic raceways using the fastening as support shall be of the metallic type. Fastenings to hold raceways or cables in place may be via tywraps.

D. General Raceway Installation:

1. Install the various types of raceways in permitted locations as previously specified. All raceways shall be run concealed. Consult Architect for instruction for raceways which must be exposed in public spaces.
2. Raceways for normal-emergency or emergency only wiring cannot contain other conductors.
3. Raceways shall be properly aligned, grouped, and supported in accordance with code. Exposed raceways shall be installed at right angles to or parallel with structural members. Concealed raceways may take most direct route between outlets.
4. Raceways run on trapeze hangers shall be secured to the trapeze.
5. Raceways shall be continuous and shall enter and be secured to all boxes in such a manner that each system shall be electrically continuous from service to all outlets. Provide grounding bushings and bonding jumpers where raceways attach to painted enclosures or terminate below equipment.
6. Where raceways enter boxes, cabinets, tap boxes, other than those having threaded hubs, a standard locknut shall be used on the outside and locknut and bushing on the inside.
7. Where raceways terminate below equipment and there is no direct metal to metal continuity, provide grounding bushings on raceways and interconnect with equipment grounding conductor.
8. All empty raceways shall be provided with a pull wire.
9. All raceway sleeves, stub-ups, or stub-outs, where not connected to a box or cabinet, shall be terminated with a bushing.
10. All raceway joints shall be made up tight and no running threads will be permitted.
11. Where raceways are cut, the inside edge shall be reamed smooth to prevent injury to conductors.
12. All vertical raceways passing through floor slabs shall be supported.
13. Raceways shall not be installed in concrete slabs above grade or below waterproofed slabs.
14. Electric raceways and/or sleeves passing through floors or walls shall be of such size and in such location as not to impair strength of construction. Where raceways alter structural strength or the installation is questionable, the structural engineer shall be contacted for approval.
15. Raceways shall not run directly above or below heat producing apparatus such as boilers, nor shall raceways run parallel within 6 inches of heated pipes. Raceways crossing heated pipes shall maintain at least a 1 inch space from them.
16. Raceways shall be installed in such a manner as to prevent collection of trapped condensates, and all runs shall be arranged to drain.
17. Raceways passing between refrigerated and non-refrigerated spaces and those penetrating enclosures with air movement shall be provided with seals.
18. Raceways feeding fire and jockey pumps shall be rigid metal conduit either run below slab or inside two hour rated enclosure. Final connections to motors shall be liquidtight flexible conduit.
19. Where two alternate wiring methods interconnect such as EMT to flexible metal conduit, an outlet box shall be provided.
20. All empty raceways entering building and all sleeves or core drilled openings through floors shall be sealed.

21. Each exterior raceway or assembly in a ductbank shall be provided with continuous warning tape installed 12 inches above raceway or ductbank.
22. Underground rigid non-metallic raceways where allowed and run as a ductbank encased in concrete shall be installed with plastic spacers to ensure a separation of 3 inches between raceways. Top of ductbanks shall be 30 inches below grade, unless otherwise detailed.
23. Elbows and extensions of rigid non-metallic raceway systems which penetrate slabs shall be rigid or intermediate metal conduit.
24. Raceways used for transformer connections shall be flexible type and shall contain a grounding conductor.
25. Raceways entering building through foundation wall into a basement area shall be provided with wall entrance seals or with other acceptable waterproofing method.

E. General Outlet Box Installation:

1. Boxes shall be set flush with finish surface and provided with proper type extension rings or plaster covers. Thru the wall boxes are not permitted. Check device or fixture to be mounted to box to ensure box orientation is proper.
2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operation.
3. Remove knockouts as needed and plug unused openings.
4. Where required for horizontal and vertical alignment of boxes in stud partitions, bar hangers spanning two studs shall be used. Device boxes for insertion type receptacles shall be provided with far side box supports where there are less than two entering nonflexible raceways and where bar hangers are not provided.
5. Boxes flush mounted in fire rated partitions and on opposite sides of the partition shall be separated by a distance of 24 inches in accordance with UL listing for the box.
6. Locations of outlets indicated on drawings are approximate. For items exposed to view, refer to architectural drawings and coordinate locations with masonry joints, panel joints, ceiling grids, structural members.
7. In case of conflict with standard mounting heights and device alignment, consult Architect prior to roughing.
8. Check all door swings on architectural drawings to ensure lighting switches are installed on strike side of door.
9. The right to make any reasonable change in location of outlets prior to roughing is reserved by Architect. Reasonable change shall be interpreted as movement within 10 ft. of location shown.
10. Obtain dimensioned plan from Architect for floor outlets.
11. Outlet boxes for use where surface metal raceways are allowed shall be of a type specifically designed to be used with such surface metal raceway systems.

F. Conductor Installation:

1. No conductors shall be pulled into individual raceways until such raceway system is complete and free of debris. No harmful lubricants shall be used to ease pulling.
2. All conductors shall be wired so that grounded conductor is unbroken; switches in all cases being connected in ungrounded conductor.
3. Connections throughout the entire job shall be made with solderless type devices of approved design satisfactory to Inspector of Wires.
4. All taps and splices shall be insulated equal to that of conductor insulation.
5. All conductors of each feeder in pull boxes shall be grouped, tied together, supported, and identified.

6. All conductors in panelboards and other wiring enclosures shall be neatly formed and grouped.
 7. All conductors of emergency only and/or normal/emergency shall be run in separate raceway systems to final outlet box.
 8. Provide support for conductors in vertical raceways in accordance with Article 300-19.
 9. Strip insulation from conductors with approved tools and only of sufficient length for proper termination. Cutting of conductor stranding is unacceptable.
 10. Taps from paralleled conductors shall be of a type which tap each conductor, such as ILSCO PTA series.
 11. Grounding conductors are to be identified as to associated power circuits.
- G. Type MC Cable Installation:
1. Where cable is permitted under the products section, the installation of same shall be done in accordance with code and the following:
 - a. Cable shall be supported in accordance with code. Tie wire is not an acceptable means of support. Horizontally run cable supports such as Caddy WMX-6, and clamps on vertical runs such as Caddy CJ6 shall be used. Where cables are supported by the structure and only need securing in place, then ty-raps will also be acceptable. Ty-raps are not acceptable as a means of support. All fittings, hangers, and clamps for support and termination of cables shall be of types specifically designed for use with cable, i.e., romex connectors not acceptable.
 - b. Armor of cable shall be removed with rotary cutter device equal to roto-split by Seatek Co., not with hacksaw.
 - c. Use split insuliner sleeves at terminations.
 - d. Any cable system used in conjunction with isolated ground circuits shall have both an isolated ground conductor and an equipment ground conductor.
- H. Stranded Conductor Installation:
1. If Contractor selects stranded conductors for # 10 AWG and smaller, terminate such conductors as follows:
 - a. No stranded conductor may be terminated under a screwhead. Provide insulated terminal lugs for all screw connections equal to Thomas & Betts STA-KON type RC with forked tongue and turned up toes. Installation of lugs shall be done with compression tool such as T&B WT-145C which prevents opening of tool until full compression action is completed.
 - b. Backwired wiring devices shall be of clamp type; screw tightened. Force fit connections not allowed.
 2. Stranded conductors will not be allowed for fire alarm work.
- I. Accessibility:
1. Electrical equipment requiring service or manual operation shall be accessible.
 2. Work switches for equipment within accessible hung ceiling spaces, such as fan powered terminal boxes, shall be located at terminal box, and so located so as to be accessible.
- J. Vibration Elimination:
1. All equipment connections to rotating equipment or equipment capable of vibration shall be made up by flexible raceways.

K. Wiring Device Gaskets:

1. Provide wiring device gaskets at coverplates where device is mounted in wall separating conditioned and non-conditioned spaces.

3.09 FEEDER CIRCUITS

- A. Provide feeders as called for on the drawings.
- B. Feeders shall be defined as any circuit originating from the main building switchboard and/or distribution panels.
- C. All feeder conductors shall be continuous from origin to panel or equipment termination without splicing.
- D. All feeders shall be conductors pulled into raceways. Cable systems are not allowed for feeders unless specifically indicated.

3.10 BRANCH CIRCUITS

- A. Provide all branch circuit wiring and outlets for a complete and operating system. The system shall consist of insulated conductors connected to the panelboards and run in raceways or as cable systems if permitted under products section, to the final outlet and shall include outlet boxes, supports, fittings, receptacles, plates, fuses.
- B. Physical arrangement of branch circuit wiring shall correspond to circuit numbering on drawings. Combining of circuits and raceways will be allowed up to a 3 phase, 4 wire circuit in a single raceway, unless shared neutrals are not allowed by other sections of this Division, or are indicated as separate neutrals on the drawings. Any combination of homeruns such as this, however, shall be indicated on record drawings. When a common grounded conductor is used for more than one circuit, the arrangement shall be such that a receptacle, fixture, or other device may be removed or disconnected without disconnecting the grounded conductor for other circuits. Ground fault circuit breakers and isolated ground outlets shall be wired with separate neutrals and separate grounding conductors per circuit. A consistent phase orientation shall be adhered to throughout project at terminations.
- C. Circuits feeding three phase equipment shall not be combined into common raceways, unless specifically indicated.
- D. All wiring in panelboards and cabinets shall be neatly formed and grouped.

3.11 WATERPROOFING

- A. Waterproof all openings in slabs and walls.

3.12 CUTTING AND PATCHING

- A. All cutting of surfaces, including core drilling of walls and slabs up to 12 in., shall be done by Electrical contractor. Openings through new wall surfaces will be provided by General Conditions if Electrical contractor gives suitable notice as erection of surface proceeds. If suitable notice is not given, Electrical contractor shall then be responsible for cost of corrective work required.
- B. Patching will be provided by the trade responsible for the surface to be patched.

3.13 MECHANICAL SYSTEM COORDINATION

- A. The Mechanical System contractor will be providing various items of mechanical services equipment and control apparatus. In general, Electrical contractor shall connect up power wiring to this equipment.
- B. The Mechanical and Electrical contractor shall closely coordinate their respective portions of work.
- C. If, due to local regulations, electric heating equipment furnished by the mechanical systems subcontractor is required to be installed by licensed electricians in order to allow connection by Electrical contractor's licensed electricians, it will then be Mechanical contractor's responsibility to engage and pay for services of such licensed electricians.
- D. Power wiring to be provided by Electrical contractor is the line voltage power supply wiring. Control wiring is responsibility of Mechanical System contractor unless specifically indicated on electrical drawings, or in this Division of the specifications. Temperature Control contractor shall refer to electrical drawings for location of all magnetic starters.
- E. 120 volt control wiring source to temperature control panel is the responsibility of Electrical contractor.

3.14 DISTRIBUTION EQUIPMENT TESTING

- A. All individual motor starters, main distribution panels, motor controls, VFD's, feeder conductors, and emergency systems shall be tested in accordance with the following. In general, all tests shall be done in accordance with the 1995 Acceptance Testing Specifications of the International Electrical Testing Association.
- B. The Testing Subcontractor may be an independent contractor or a manufacturer of the equipment, which is to be tested.
- C. Test report forms, delineating tests to be made, and method of recording same shall be submitted prior to commencing work. Test reports when submitted shall include interpretation of results and recommendation for any corrective work required.
- D. Main Distribution Panels:
 - 1. Visual Inspection:
 - a. Check for foreign material within bus enclosure.
 - b. Check for missing hardware.
 - c. Inspect entire assemblies for transit damage or factory defects.
 - d. Check for all bus dimensions and bracing per specifications.
 - e. Check ratings of current transformers and potential transformers.
 - f. Check ratings of all protective relays per drawings.
 - g. Physical Inspection:
 - h. Torque all bus hardware to proper tension.
 - i. Circuit breaker interlocks all work properly.
 - j. All doors and hinged panels open and close properly.
 - k. Relay blocking removed from all control and protective relays.
 - l. All circuit breakers operate, close and trip mechanically.
 - m. Torque all feeder conductors to terminal manufacturers' recommendations.

2. Electrical Testing:
 - a. Breakers operated electrically trip and close from local and remote positions.
 - b. All circuit breakers calibrated to manufacturer's respective time current curves as specified.
 1. Long time pick-up amps.
 2. Long time delay tripping at 300 percent of current setting.
 3. Resets okay at 80 percent of pick-up value.
 4. Short time pick-up current.
 5. Short time delay trip time at 105 percent of setting.
 6. Instantaneous minimum pick-up current.
 - c. All protective relays calibrated to manufacturer's characteristic time curves for pick-up, drop-out, instantaneous and time delay.
 - d. All instruments calibrated for accuracy.
 - e. Protective relay schemes to be electrically tested by primary injection of current through current transformers and the tripping of associated circuit breakers.
 - f. Insulation resistance tests made on all circuit breakers, line to load breaker open, line to ground breaker closed, 3 poses tested individually. Switchgear bus to be tested phase to phase and phase to ground with Megohmmeter type instrument. Relays also to be insulation resistance tested.
- E. Magnetic Starters:
 1. Visual inspection to determine:
 - a. Shipping damage.
 - b. Proper bussing and contactor sizes.
 - c. Correct overload relay heater ratings. Any incorrectly sized overloads shall be replaced by the contractor who originally provided same.
 2. Electrical Testing:
 - a. Electrical operation of control relays, timing relay, and contactor coils.
 - b. Insulation resistance test on all current carrying bus to ground and between phases.
 - c. Calibration check of overload heater to ascertain tripping point and time delay at 300 percent of heater rating.
- F. Conductors:
 1. All secondary service conductors and all feeder conductors from switchboards and distribution panels shall be tested.
 - a. Visual and mechanical inspection
 1. Conductors to be inspected for physical damage and proper connection and sizing in accordance with single line diagram.
 2. Conductor connections shall be torque tested to manufacturer's recommended values.
 - b. Electrical Tests:
 1. Perform insulation resistance test on each conductor with respect to ground and adjacent conductor.
 2. Perform continuity test to insure proper conductor connection.
- G. Emergency Systems:
 1. Engine Generator - Prior to the emergency generator test specified under the emergency generator specification, the testing contractor shall perform the following:
 - a. Visual and Mechanical Inspection:
 1. Inspect for physical damage.
 2. Compare nameplate rating and connection with specifications and single line diagram.

3. Inspect for proper anchorage and grounding. Verify engine cooling and fuel system integrity.
- b. Electrical and Mechanical Tests:
 1. Perform a dielectric absorption test on generator winding with respect to ground. Determine polarization index.
 2. Perform phase rotation test to determine compatibility with load requirements.
 3. Test protective relay devices in accordance with applicable sections of these specifications.
 4. Perform dc over potential test between winding and ground.
2. Automatic Transfer Switches:
 - a. Visual and Mechanical Inspection:
 1. Inspect for physical damage.
 2. Verify that the short circuit withstand rating exceeds the available short circuit duty.
 3. Compare equipment nameplate information and connections with single line diagram and report any discrepancies.
 4. Check switch to ensure positive interlock between normal and alternate sources. (Mechanical and Electrical).
 5. Check tightness of all control and power connections.
 6. Perform manual transfer operation.
 7. Ensure manual transfer warnings are attached and visible to operator.
 - b. Electrical Tests:
 1. Perform insulation resistance tests phase-to-phase and phase-to-ground with switch in both source positions.
 2. Measure contact resistance in normal and alternate source position.
 3. Set and calibrate in accordance with the project electrical engineer's specifications.
 - a. Voltage and frequency sensing relays.
 - b. All time delay relays.
 - c. Engine start and shutdown relay.
 4. Perform automatic transfer by tests.
 - a. Simulating loss of normal power.
 - b. Return to normal power.
 - c. Simulating loss of emergency power on return to normal.
 - d. Simulate all forms of single phase conditions.
 5. Monitor and verify correct operation and timing.
 - a. Normal voltage sensing relays.
 - b. Engine start sequence.
 - c. Time delay upon transfer.
 - d. Alternate voltage sensing relays.
 - e. Automatic transfer operation.
 - f. Interlocks and limit switch function.
 - g. Timing delay and retransfer upon normal power restoration.
 - h. Engine cool down and shutdown feature.
 - c. NEC 700.10 ATS Engine Start Control and Monitoring
 1. The Engine Start Control and Monitoring Modules shall be ASCO 5101 Engine Start Modules or approved equal. The solution must cover and provide complete compliance to the 2017 NEC 700.10 code.
 2. The ATS shall provide continuous monitoring of the entire remote start circuit. Visual and audible annunciation of generator malfunction shall be initiated if the integrity of the start circuit is compromised.

3. There shall be minimum time delay (less than 5 seconds) in annunciation of any compromised condition such as an open or short circuit. A system which annunciates compromised conditions only after a generator start signal is initiated via a redundant path does not meet the intent of this specification.
4. The detection of a compromised start circuit shall initiate and latch the generator start circuit.
5. Each Generator Engine Start Module shall be din-rail mounted and accept up to (8) ATS Engine Start. Each channel must have its own dedicated tri-colored status LED.
6. Each Engine Start channel must have its own dedicated switch with ability to enable or disable monitoring function.
7. Engine-start circuit shall be a single pair of typical hardwire used in legacy applications. Additional wiring and components beyond specified herein does not meet the intent of this specification.
8. Coordinate placement of required components within the generator controls with the specified manufacturers.
- 9.
10. Grounding Grids or Electrodes: Measurement of resistance from ground grids or electrodes to earth to determine adequacy of grounding system in building and compliance with specifications and/or electrical code.
11. Settings of Adjustable Devices: Using the result of the fault current and coordination study specified hereinafter, the Testing Contractor shall set all adjustable devices.

3.15 FAULT CURRENT, ARC FLASH AND COORDINATION STUDY

- A. Employ the manufacturer of the secondary distribution equipment or an independent organization to perform a fault current, arc flash and coordination study to ensure a selectively coordinated system from the incoming mains to the branch circuit panelboards.
- B. The report shall be submitted in a standard format and shall include the fault current availability at various points in the distribution system, breaker coordination curves and recommended settings of all adjustable devices in the system.
- C. The study shall be submitted prior or concurrent with switchgear submittal.

3.16 INSTALLATION OF FIRESTOP SYSTEMS

- A. General: Install firestop systems at all fire-rated construction where penetrated by the Work of this Section.
- B. Refer to Section 07 84 00 – Firestopping, for all installation requirements for maintaining integrity of fire-rated construction at penetrations.

3.17 STORAGE AND INSTALLATION OF EQUIPMENT

- A. The electrical subcontractor shall store and install electrical equipment and wiring listed for dry locations only after the building is watertight.

END OF SECTION 260000

SECTION 27 0000

TECHNOLOGY
 (Sub-Sub Bid Required)

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SECTION 27 0000

TECHNOLOGY
(Sub-Sub Bid Required)

PART 1- GENERAL

1.01 FILED SUB-SUB BID REQUIREMENTS

- A. Filed Sub-Sub-Bid Requiring a Paragraph "E" Listing on the FORM FOR SUB-BID required per M.G.L. Chapter 149 Section 44A to 44L, as amended to date. The Electrical Subcontractor will be responsible for all related building preparation and coordination, see specification for additional Paragraph "E" Listing requirements of the Listed Systems Contractor, and coordination of responsibilities.
- B. Section 270000 TECHNOLOGY, shall be a Filed Sub-Sub Bid of Section 260000 ELECTRICAL, requiring a Paragraph "E" Listing on the FORM FOR SUB-BID

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.03 QUALITY ASSURANCE

- A. Sustainable Goals: The Architect has designed the project to meet the Owner's sustainable goals. Products and systems have been specified which meet certain third-party evaluations or have particular VOC and source requirements. Evaluation of products proposed for substitution will be evaluated based on the Owner's sustainable goals and other criteria included in Division 1. The Contractor is encouraged to use sustainable construction practices means and methods. Unless specifically stated in a specification section, no sustainable design documentation is required of the Contractor.

1.04 COOPERATION AND COORDINATION WITH OTHER TRADES

- A. The work shall be so performed that the progress of the entire building construction, including all other trades, shall not be delayed and not interfered with. Materials and apparatus shall be installed as fast as conditions of the building will permit and must be installed promptly when and as directed.

- B. This Section shall be furnish/installed as follows by a single firm/company that is a qualified systems contractor. The Electrical Subcontractor shall be responsible for properly preparing the project for installation by systems contractor, as specified.
1. Electrical Subcontractor responsibilities shall include: The Electrical Subcontractor shall be responsible for furnishing and installing all related building preparation including, but not limited to: outlet boxes with plaster rings, floor boxes, poke through devices, pathways, power, cableways, cable tray, cable protection, wiremold, surface raceways, cable supports, conduits with bushings, conduit stubs with bushings, sleeves with bushings (all conduits, stubs, sleeves, etc. shall be brought to an accessible ceiling or accessible area below floor), pull strings, bonding, grounding, core drilling, cutting, patching, fireproofing of penetration & openings, environmental seals, smoke and fire stopping seals including all conduits, raceways, sleeves, slots etc. where cables pass from one location to another, seismic supports, supplementary steel and channels, etc., for a completely operational system, as specified. The Electrical Subcontractor shall also accept delivery and properly store & secure all equipment and materials required by the systems contractor. The Electrical Subcontractor shall install all specialized backboxes (microphone, amplifier, etc.) and any exterior antennas furnished by Systems Contractor.
 - a. The Electrical Subcontractor shall provide cable tray over each rack and cabinet as required to facilitate a neat and orderly installation of cables and to secure the top of the racks to the structure. Cables shall drop straight down to equipment racks. Cable trays shall be secured at both ends to the structure and connected together as required for a complete contiguous installation. Utilize proper supports to support the cable tray to the building structure as well as the equipment rack and cabinet. Submit mounting supports for approval before installation.
 - b. This entire Section: The Electrical Subcontractor shall read this section in its entirety and shall provide all requirements of the Electrical Subcontractor as detailed in this Section.
 2. Systems Contractor responsibilities for this section shall be: Systems contractor shall be responsible for providing, installing, programming, troubleshooting, training and warranty service of all cabling, terminal equipment, headend equipment specified in this section for a completely operational system. The systems contractor shall furnish all specialized backboxes (speaker, microphone, amplifier, etc.) and all exterior antennas to the Electrical Subcontractor for their installation.
 - a. Keep fully informed as to the shape, size and position of all openings required for all apparatus and give information in advance to build openings into the work. The electrical subcontractor shall furnish and set in place all sleeves, pockets, supports and incidentals.
 - b. All distribution systems which require pitch or slope such as plumbing drains, steam and condensate piping shall have the right of way over those which do not. Confer with other trades as to the location of pipes, ducts, lights and apparatus and install work to avoid interferences.
 - c. Coordinate exact locations and roughing in dimensions of all work before installation and make all final connections as required. Any changes required to avoid interferences or to provide adequate clearances for Code and maintenance requirements shall be made at no additional costs.
 - d. Structural elements of the project shall not be relocated, altered or changed to accommodate the work without written authorization from the Architect.
 - e. Work that is installed before coordination with other trades or that causes interference with the work of other trades shall be changed to correct condition.
 - f. Obtain a complete set of Project Drawings and Specifications for coordination and to determine the full scope of work.
 - g. Attend project coordination meetings to coordinate work of this Section, work of other trades and project and phasing requirements.

1.05 SUBMITTALS

- A. Product Data for all materials specified and shown on drawings to be installed.
- B. Equipment List: Provide a detailed Equipment List showing quantities by manufacturer and model number of all major items of equipment and installation material to be used in the system as specified herein.
- C. Submit supporting hardware for this system as part of the work for approval prior to installation.
- D. Product Data: Include complete sets of indexed cut sheets, in quantity as dictated by the project, of all major pieces of equipment and materials being supplied. Arrange these sheets in the order the equipment appears in the Specification. Clearly highlight information showing compliance with this and/or all applicable Specifications. In the event that the manufacturer or representatives' cut sheet contains more than one item, clearly indicate which items of the cut sheet are intended for installation.
- E. Shop Drawings: Submit a set of complete Shop Drawings, by system, showing equipment to be installed. Include system configuration block diagrams of all equipment, indicating equipment type and model numbers. Show each and every component, system and subsystem, as well as all proposed connections between system components, and proposed layouts of equipment racks for the entire system.
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. Cabling administration drawings and printouts.
 - 3. Wiring diagrams to show typical wiring schematics including the cross-connects.
 - 4. Cross-connects. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
 - 5. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.
 - 6. Cable tray layout showing cable tray route to scale with relationship between the tray and adjacent structural, electrical and mechanical elements.
- F. Quality Assurance Submittals:
 - 1. Provide manufacturer's certification that Installer is qualified to install systems specified. Include a written statement signed by the Installer attesting that they have been in business for at least five years in the installation and servicing of systems specified. Include the names of at least five clients for whom similar Work as specified has been performed in the past three years; list the individual responsible for the day-to-day operation of the system along with their current telephone number and address.
 - 2. Provide names, qualifications, and certifications of installation personnel including Communication Systems Installer's site Supervisor/Foreman who shall be in charge of, and responsible for, all activities at the job site for the duration of the Project. The job Supervisor/Foreman shall not be changed during the project without notification and approval from the Owner.
 - 3. Complete warranty information including sample Registration Certificate.
 - 4. Technical Diagrams and Drawings:
 - a. Simplified single line block diagrams showing the interconnection of all equipment and functional relationships. Show all equipment, patch panels, cables and jacks, whether connected or not. The intent of these diagrams is to provide sufficient clear and complete information that a technician of average skill may efficiently troubleshoot and service the system, even if unfamiliar with the installation.

- b. Provide "As Built" architectural quality plan Drawings at 1/8" = 1'-0" scale. Provide an electronic copy of the "As Built" drawings on CD(s).
- c. All technical diagrams and drawings shall be mounted on the wall behind a clear plastic cover for protection. There shall be 1 set of the above drawings and diagrams provided per equipment room, this includes both the MDF Room and all IDFs.

1.06 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 260000 – Electrical General Provisions
- B. Section 260000 – Basic Materials and Methods

1.07 TELEPHONE/DATA SYSTEM

A. General:

1. All telecommunication and data system interconnecting wiring, terminal blocks, connections, terminations, shall be furnished and installed by a licensed and certified installer.
2. The Electrical Subcontractor (E.C.) shall furnish and install all raceways, and outlet boxes as indicated on the drawings, including pull wires for all empty raceways and all access panels. General contractor will furnish and install all backboards (3/4" thick by 78" high) which shall be mounted at the MDF room and each IDF room.
3. General Requirements:
 - a. Applicable Standards:

Materials and equipment shall be installed in accordance with the most current versions of the National Electrical Code, local codes, safety codes, ANSI, ASTM, EIA, TIA, BISCO, IEEE, UL, NFPA.

The following industry standards are the basis for the structured cabling system described in this document.

 - 1) ANSI/TIA/EIA
 - TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard
 - TIA/EIA-568-B.1 General Requirements
 - TIA/EIA-568-B.2 Balanced Twisted Pair Cabling Components Standard
 - TIA/EIA-568-B.3 Optical Fiber Cabling Components Standard
 - TIA/EIA - 942 Telecommunications Infrastructure for Data Centers
 - TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathway and Spaces
 - TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - J-STD-607-A Commercial Building Grounding/Bonding Requirements NFPA
 - NFPA 70 National Electric Code (NEC) ISO/IEC
 - ISO 11801 Generic Cabling for Customer Premises
 - EIA/TIA-TSB 67. Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair Cabling Systems"
 - EIA/TIA-455-61. "FOTP-61, Measurement of Fiber or Cable Attenuation Using An OTDR".
 - IEEE 802.3 "Carrier Sense Multiple Access With Collision Detection".
 - ATM Forum Standard for 155 Mb/s ATM over Category 6 (AF-PHY-

- BISC1: 0015.000, 9/94) Telecommunications Distribution Methods and LAN Design Manual
 - IEEE-802: Standards for Local Area Networking
 - UL Performance Levels Certification Program
 - ANSI-IEEE-C2: National Electrical Safety Code (NESC)
 - ANSI/NFPA-101: Life Safety Code
 - Massachusetts Electric Code CMR527
- b. Exposed wiring is not acceptable in any occupied space.
- c. Contractor is responsible for strict adherence to Massachusetts electrical codes, and all other applicable codes.
- d. The contractor is responsible for obtaining municipal permits and inspections as mandated by law.
- e. All exposed cabling shall be run in raceway or conduit.
- f. All penetrations in station raceway shall have rubber or equivalent grommets to prevent cable cuts on trough edges.
- g. Raceway shall be of sufficient size to accommodate all wiring. Fill density not to exceed 40%, unless otherwise noted. It is the responsibility of the bidder to determine the size needed based upon the floor plans provided. A minimum size of ¾" conduit shall be adhered to.
- h. All raceways shall be attached to the building structure using screws and anchors.
- i. The I.T. sub contractor is responsible for all aspects of MDF construction. Refer to drawings for configuration of MDF.
- j. All cabling at the MDF shall be neatly bundled and dressed to the termination blocks. All appropriate cable management materials (slotted duct, D rings, etc.) should be utilized for this purpose.
- k. All labeling of cables shall be 6" back from the termination with machine generated labels, hand written labels are not permitted.
- l. All cable pulls in conduit, raceway, innerduct, etc. shall have pull string left in place for future use.
- m. Color code identification of cables must be maintained throughout all splices.
- n. All station cabling shall be clearly and legibly labeled at both the faceplate end and the MDF termination blocks. In addition to labeling both the inside of the faceplates and MDF termination blocks, the cable jacket shall be labeled six inches back from the terminations on both ends. Labeling shall be machine generated.
- o. Labeling of the outside of the jack with identification numbers shall be made using a Panduit LS8 handheld label machine or equal. Samples shall be provided to Engineer for approval prior to installation.
- p. In order to qualify for installation of the data communications system, Contractor must possess the required license classification, a performance history, experience in the installation and termination of optical fiber cable systems, and proof of time in business. Contractor must be trained and certified for the communications cable and hardware which it installs, and must furnish proof of certification.
- q. License Classification: Contractor must possess a valid state Contractor's License.
- B. Unless otherwise indicated, the following work is not included as part of the systems integrator's responsibilities in this SECTION, except for coordination, and is to be performed by others as indicated:
1. Raceway shall be provided by the electrical contractor.
 2. Empty conduits to accessible point above ceiling or below floor shall be provided by the electrical contractor.
 3. Floor boxes and poke through devices shall be provided by the electrical contractor.

4. Standard device boxes with plaster rings for data and Integrated Instructional Technology Network System shall be provided by the electrical contractor.
5. Structural blocking to support wall and ceiling mounted televisions/monitors shall be provided by the General Contractor.
6. Interface with public utilities telephone service shall be arranged by the owner, and coordinated with this systems integrator.
7. Telephone equipment and handsets will be provided under a separate contract.

1.08 DEFINITIONS

- A. Main Cross Connect (MC): The MC is the location, within a building or complex of buildings, where the entire telecommunications system originates. It may include: the physical location, enclosure, wire and cable management hardware, termination hardware, distribution hardware, and patching and equipment racks.
- B. Horizontal Cross Connect (HC): The HC is the location in a building where a transition between the backbone or vertical riser system and the horizontal distribution system occurs.

1.09 SYSTEM DESCRIPTION

- A. The data communications system shall consist of four components, active switch equipment, an optical fiber backbone, a copper twisted-pair backbone, and twisted pair copper work station cabling.
- B. The audio-visual systems shall consist of wiring, jacks, amplification equipment, control equipment, and head end video equipment.

1.10 SCOPE OF WORK

- A. Contractor shall provide materials for and install a complete, functional voice data communications and A/V system in accordance with this specification and all drawings. Contractor shall be responsible for providing a complete, functional system including all necessary components, whether included in this specification or not.
- B. The installation shall include cable, innerduct, interconnect/patching equipment, connectors, jumpers, wiring blocks, and telecommunications outlets, and any other equipment. In addition to material and equipment, Contractor shall provide labor and any incidental material required for installation. All copper station cables shall be terminated on patch panels and data communications outlets. Upon completion of installation, Contractor shall test all fiber and copper pathways and record the test results, as specified in the following.
- C. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "good quality" means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.11 FUNCTION AND OPERATION

- A. The intended function of the data communications cable system is to transmit data signals from a central location to several individual data outlet locations. Upon completion of the work outlined in this specification, the system shall be capable of transmitting data signals at a rate of 1000 Mbps.
 - 1. Work station cable, from the HC to the work area, shall be installed in accordance with EIA/TIA-568-A specified installation practices, EIA/TIA TSB 67 recommended installation practices, manufacturer specified installation practices, and shall be capable of transmitting a signal at 155 Mbps with acceptable attenuation and cross-talk measurements. The entire work station cable system, including wiring blocks, cable, and telecommunications outlets shall be tested for Category 6 compliance. Category 6A shall be used for wireless access points.

1.12 ALTERNATES:

- A. Refer to Section 012300 for Alternates affecting this section.
- B. Include in your bid a separate price for amounts to be added or deducted from base bid amount for the following areas of Technology work:
 - 1. None

1.13 PROTECTION OF WORK AND PROPERTY

- A. Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.
- B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be replaced with equal material or equipment at the option of the Architect and Owner.
- C. Materials and equipment stored for this project shall be protected and maintained according to the manufacturer's recommendations and requirements and according to the applicable requirements of NFPA 70B.
- D. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen and make good any damage caused.
- E. Use caution to avoid damage to existing work, and to prevent harm to personnel working in all areas.
- F. Observe all safety precautions and requirements for the construction.
- G. When open-flame or spark producing tools such as blower torches, welding equipment, etc., are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where the work is to be performed. Provide, where necessary, fire protective covering and maintain a constant non-working fire watch where work is being performed and until it is completed.
- H. The General Contractor and the Installer are responsible for initiating, maintaining, and supervising all safety precautions and requirements during construction.

1.14 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interface work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Continuity of all services shall be maintained in all areas which will be occupied or temporarily relocated during the construction period. If an interruption of service becomes necessary, such shall be scheduled in advance, made only upon consent of the Owner and at a time outside normal working hours as the Owner shall designate.
- C. Refer to the overall scheduling of the work of the project. Schedule work, process Submittal and order materials and equipment to conform to this schedule and install work to not delay nor interfere with the progress of the project.
- D. Inform Architect immediately of any delays or potential delays. Furnish manufacturer's letter to verify order date, equipment delays, expected shipment date, order number, and potential remedies to speed up delivery. Any costs to speed up delivery shall be implemented at no cost to the project if the equipment or material was not ordered as soon as possible after Contract award or within the time frames indicated with the Submittal.
- E. Include premium time required to comply with the project scheduling and phasing.
- F. Be aware of, and plan for, project scheduling and phasing. Provide for complete continuous operation of all systems. Coordinate scheduling and phasing with the Architect, Owner, other Trades, and the General Contractor.

1.15 WARRANTY

- A. Voice and Data Cabling Warranty: The products that shall best support the needs of the project, and provide the highest level of system performance over the life of the facility, shall be a voice and data cabling system that is made up of system components designed, manufactured and installed as a total system solution. This requirement also applies to data patch cords specified in this Section; e.g. Ortronics patch cords shall be used with Ortronics jacks and patch panels.
- B. Provide a Manufacturer's Extended Product Warranty that covers product defects for all passive components of the Voice and Data Cabling System. Passive components are defined as those exhibiting no gain or contributing no energy to the Data Cabling System and include but are not limited to cabling, connectors, outlets, patch panels, patch cords, racks as outlined in PART 2 of this Specification.
- C. The following shall be covered by the Manufacturer's Extended Product Warranty:
 - 1. All passive components that comprise the Voice and Data Cabling System will be free from manufacturing defects in material of workmanship under normal and proper use.
 - 2. All passive components that comprise the Voice and Data Cabling System shall exceed the specifications of ANSI/TIA/EIA 568B series, and exceed ISO/IEC 11801 standards, including all subsequent changes to these standards that are in effect at the time of bidding, and shall meet or exceed the performance specifications as outlined in PART 2 of this Specification.
 - 3. The installation shall exceed the insertion and return loss, attenuation and near end crosstalk (NEXT) requirements of ANSI/TIA/EIA 568B series and the ISO/IEC 11801 standards for cabling links/channel configurations specified in these standards including all subsequent changes to these standards that are in effect at the time of bidding.

4. Each Voice and Data Channel shall be capable of delivering data at 1.2 Gbps between active network electronics. A Data Channel is comprised of all passive components including cabling, connectors, patch panel port, and patch cords, with up to a total of 4 connections between Owner's network electronics (not in the contract).
5. Upon successful completion of the Voice and Data Cabling System installation by the Communication Systems Installer, and subsequent inspection by an authorized representative of the Manufacturer of the passive components, the Owner shall be provided with Registration Certificate, from the Manufacturer, registering the Installation.
6. Duration of Warranty: The warranty shall run for 20 years from the Date of Substantial Completion of the Project, unless the Registration Certificate is issued by the Manufacturer at a later date, in which case the warranty shall run for 20 years from the date that the Registration Certificate is issued.
7. The Extended Product Warranty is applicable to the Voice and Data Cabling System passive components at the original site of installation. Under the Extended Product Warranty, the Manufacturer of the passive components shall either repair or replace the defective product(s) at the Manufacturer's cost. This includes the replacement or repair cost of defective materials and the cost of labor to repair or replace any and all defective products.
8. The Communication Systems Installer shall be able to provide a Manufacturer's warranty that the Voice and Data Cabling System shall be free from failures which prevent operation of the specific applications for which the original Voice and Data Cabling System was designed to support, including but not limited to: 1000Base-T Gigabit Ethernet.

1.16 SEISMIC REQUIREMENTS

- A. Equipment and work shall meet the restraint requirements per Massachusetts Building Code.

PART 2- PRODUCTS

2.01 GENERAL

- A. Throughout Part 2, material quantities are given. These quantities are given for reference purposes only. It is the responsibility of the Contractor to provide appropriate quantities of materials to provide a complete, functional system.
- B. Equipment shall be installed in accordance with Technology drawings. General installation provisions are as follows:
 1. Equipment Racks: Equipment racks shall be assembled and mounted in locations shown in the Drawings and as described herein. Each rack shall be assembled in accordance with the manufacturer's instructions and recommendations. Each rack shall be mounted such that the side rails are plumb. Each rack shall be affixed to the building structure at each of the mounting holes provided. Attachment shall be by 1/2" X 1-1/4" lag bolts. A 3/8" pilot hole shall be drilled for each lag bolt. Each bolt shall be tightened to the extent that it holds the mounting hardware firmly, but not so tight as to distort the hardware or strip the threads. Equipment racks are to be co-located with the quadplex power outlets to allow for easy connection of racked equipment to the power system of the school.

2. Wiring Blocks and Wire Management Components: Where required, wiring blocks and wire management components shall be mounted to the plywood backboard. Wiring blocks and wire management shall be mounted in accordance with the attached drawings. Each device shall be mounted such that its horizontal dimension is level. In cases where more than one device is mounted, they shall be aligned vertically. Each device shall be affixed to the plywood backboard by means of screws suitable for fastening to plywood. A minimum of four (4) of the mounting holes provided shall be utilized for fastening. Screws shall be tightened to the extent that they hold the device snug to the backboard, but not so tight as to distort or damage the device. Wiring blocks shall be terminated in accordance with the manufacturer's instructions and recommendations. Installation of accessories shall also be conducted in accordance with the manufacturer's instructions and recommendations.

2.02 COMMUNICATION EQUIPMENT ROOM FITTINGS

A. Summary:

Section Includes:

1. Telecommunications mounting elements.
2. Pathways
3. Telecommunications equipment racks and cabinets
4. Grounding.

B. Coordination: Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
5. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

C. Pathways:

1. General Requirements: Comply with TIA/EIA-569-A.
2. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - a. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
 - b. Support brackets with cable tie slots for fastening cable ties to brackets.
 - c. Lacing bars, spools, J-hooks, and D-rings.
 - d. Straps and other devices.

D. Equipment Frames (Racks):

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APC
 - b. Cooper B-Line, Inc.
 - c. Hubbell Premise Wiring.
 - d. Panduit
 - e. Or equal
2. General Frame Requirements:
 - a. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
 - b. Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.
 - c. Finish: Manufacturer's standard, baked-polyester powder coat.
3. Floor-Mounted Racks: Modular-type, two-post quick rail, aluminum construction.
 - a. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
 - b. Baked-polyester powder coat finish.
4. Equipment Cabinets:
 - a. 42RU, 24" W
 - b. Steel construction.
 - c. Treated to resist corrosion.
 - d. Cable access provisions top and bottom.
 - e. Grounding lug.
 - f. 19" Dual slide rack mount monitor keyboard drawer (provide 2)
 - g. Power strip (2).
 - h. Regulatory approvals: EIA-310-D
 - i. Warranty: 5-years
 - j. Standards: UL 60950
5. Cable Management for Equipment Frames:
 - a. Metal, with integral wire retaining fingers.
 - b. Baked-polyester powder coat finish.
 - c. Vertical cable management panels shall have front and rear channels, with covers.
 - d. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.
6. Power Strips: Comply with UL 1363.
 - a. Rack mounting.
 - b. Receptacles: Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles for each power strip. Provide two in each rack.
 - c. LED indicator lights for power and protection status.
 - d. LED indicator lights for reverse polarity and open outlet ground.
 - e. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
 - f. Cord connected with 15-foot line cord.
 - g. Rocker-type on-off switch, illuminated when in on position.
 - h. Peak Single-Impulse Surge Current Rating: 33 kA per phase.

- i. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

E. Grounding:

1. Comply with requirements in 260000 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.
2. Telecommunications Main Bus Bar:
 - a. Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - b. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
 - c. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
3. Comply with ANSI-J-STD-607-A.

F. Labeling:

1. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.03 UTP CABLE (BACKBONE)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Inc.; Electronics Division.
2. CommScope
3. Mohawk; a division of Belden CDT.
4. Molex
5. Superior Essex Inc.
6. Or equal

- B. Description: Multi-pair Backbone Cable: Category 5e, 100-ohm, 25-pair UTP binder groups covered with a gray thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications: Type CMP, complying with NFPA 262.

- C. Multi-pair backbone cables: Provide copper backbone cable that meets or exceeds the following specifications:

1. Electrical Specifications:

Maximum DC Resistance	28.6 Ω /1,000 ft (9.4 Ω /100m)
Maximum DC Resistance Unbalanced	5%
Maximum Capacitance Unbalanced (pair to ground)	1,000 pF/1000 ft. (328 pF/m)
Mutual Capacitance @ 1kHz	18 nF/1000 ft (5.9 nF/100 m), max.

2. Attenuation (dB/100 m [328 ft.]):

Frequency	Attenuation (Max.)
1.00 MHz	2.3 dB
4.00 MHz	4.9 dB
10.00 MHz	8.5 dB
16.00 MHz	12 dB

3. Worst Pair Near-End Crosstalk (NEXT) dB/100 m [328 ft.]:

Frequency	Pair-To-Pair NEXT (Max.)
1.0 MHz	13.8 dB
4.0 MHz	11.2 dB
10.0 MHz	10.2 dB
16.0 MHz	9.2 dB

2.04 WORK STATION CABLE

- A. Description: From each MDF or IDF, 4-pair enhanced Category 6 cables shall be routed to each work station (data outlets). Provide Category 6A for wireless access points.

1. Product:

- a. Copper 4-pair UTP:
UTP cables shall:
Be manufactured by one of the following:

Belden
Berk-Tek
Commscope
General Cable
Mohawk
Helix
Panduit
Or equal

Be 100 Ω 4-pair, category 6 cable.

Shall be appropriate for the environment in which it is installed.

2. Required Accessories and Quantities (Hard Wall Locations):

- a. Work Station: Panduit CFPLS** stainless steel Single Gang, Single Port Face plate. Using Panduit CMB**-X blank modules to fill unused ports. Refer to drawings for two, three, and four gang configurations. Modules shall be CJ688TP** – color to be selected by engineer.

3. Work Area Equipment Cords: The Work Area Equipment Cords shall meet or exceed the following criteria:

Modular Equipment Cords: Category 6 (Category 6A for wireless access point outlets)

4. Category 6 (Category 6A for wireless access point outlets) modular equipment cords shall:

Be round, and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four color-coded twisted-pairs within a flame-retardant jacket.

Be equipped with modular 8-position (RJ45 style) plugs on both ends, wired straight-through with standards compliant wiring.

5. Use modular plugs which exceed FCC CFR 47 part 68 subpart F and IEC 60603-7 specifications, and have 50 micro inches minimum of gold plating over nickel contacts.

- 6. Be resistant to corrosion from humidity, extreme temperatures, and airborne contaminants.
- 7. Utilize cable that exhibit power sum NEXT performance.
 - Be available in several colors with or without color strain relief boots featuring a snagless design.
 - Provide (1) 10 foot cord per data jack shown on drawings.
 - Be made by an ISO 9001 and 14001 Certified Manufacturer.
 - Electrical Specifications:
 - DC resistance per lead: 9.38 Ω / 100 m maximum.
 - Input impedance without averaging: 100 Ω + 15% from 1 to 100 MHz.
 - 100% transmission tested with laboratory grade network analyzers for proper performance up to 1000 MHz. Vendor shall guarantee cords are compatible with category 6 links.
- 8. UL VERIFIED (or equivalent) for TIA/EIA proposed category 6 electrical performance.
- 9. UL LISTED 1863.
- 10. All information outlets for 100 Ω 22-26 AWG copper cable shall:
 - Be available in black, white, gray, ivory and light ivory.
 - Accommodate a minimum of two 8-position / 8-conductor modular jacks.
 - Utilize compliant pin technology 110 style insulation displacement connectors which allows the use of a 4-pair impact tool.
 - Allow for a minimum of 200 re-terminations without signal degradation below standards compliance limit.
 - Be constructed of high impact, flame-retardant thermoplastic.
 - Be available in a screened version for 100 Ω ScTP cable.
 - Be made by an ISO 9001 and 14001 Certified Manufacturer.
 - Electrical Specifications:
 - ANSI/TIA/EIA-568-B1, B2, B3 and ISO/IEC 11801 proposed category 6 compliant.
 - The following requirements shall also be met (NEXT Loss and FEXT tested in both Differential and Common Mode):

Parameters	Performance	Performance @ 100 MHz *
NEXT Loss	+ 3.0 dB	43.0 dB
FEXT	+ 3.0 dB	43.0 dB **
Insertion Loss (Attenuation)	+ 40%	.24 dB
Return Loss	+ 6 dB	20 dB
LCL	40 dB (1-100 MHz)	**

- B. INSTALLATION: Installation shall be conducted in accordance with guidelines established the manufacturer and industry standards. Wall Plates shall be mounted such that their vertical dimension is plumb. Each wall plate shall be labeled with its respective work station number. Each modular mounting frame shall be labeled with its respective work station number.
- C. Technical Requirements: Horizontal cabling: the horizontal subsystem is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the Telecommunications room/closet. It consists of the telecommunications outlet/connector, the horizontal cables, optional consolidation point, and that portion of the cross-connect in the telecommunications room/closet serving the horizontal cable.
 - 1. Cable Types: All UTP and fiber optic cables shall conform to the following standards:

ANSI/TIA-568C.0 Generic Telecommunications Cabling for Customer Premises
 ANSI/TIA-568C.1 Commercial Building Telecommunications Cabling
 ANSI/TIA-568C.2 Balance Twisted Pair Telecommunications Cabling

ANSI/TIA-568C.3 Optical Fiber Cabling and Components Standard

Including all applicable addenda) and ISO/IEC 11801 (International) Generic Cabling for Customer Premises standard (latest amendment and including all applicable addenda).

Input Impedance	Bonded-Pair	Non-bonded Pair
100 + 12	1-20 MHz	-----
100 + 15	20-250 MHz	1-100 MHz
100 + 20	250-350 MHz	-----
100 + 22	350-625 MHz	100-200 MHz
100 + 32	-----	200-625 MHz

- a. Copper: The following cable specifications shall also be met by the cable manufacturer for 4-pair UTP, premium category 6 cables:

Attenuation: Qualified Cables shall exhibit worst case attenuation less than the values derived using the equations shown in the chart below from 1 MHz to the highest referenced frequency value. Worst case qualified cable attenuation performance for selected frequency points of interest is also provided.

Attenuation Limits Table			
		System 6SM	
Frequency Range		1-350 MHz	
Worst Case		$\leq 1.82\sqrt{f} + .017 \cdot f + \frac{0.20}{\sqrt{f}}$	
Frequency Points of Interest	MHz		
	100	19.8 dB	
	200	29 dB	
	300	35.3 dB	

Near End Crosstalk (NEXT) Loss:

Qualified Cables shall exhibit worst case NEXT Loss greater than the values derived using the equations shown in the chart below from 1 MHz to the highest referenced frequency value. Worst case qualified cable NEXT Loss performance for selected frequency points of interest is also provided.

NEXT Loss Limits Table			
		System 6SM	
Frequency Range		1-350 MHz	
Worst Case Cable NEXT Loss		$\geq 76 - 15\log(\frac{f}{0.772})$	
Frequency Points of Interest	MHz		
	100	44.3 dB	
	200	39.8 dB	
	300	37.1 dB	

Power Sum Near-End Crosstalk (PSNEXT) Loss:

Qualified Cables shall exhibit worst case PSNEXT Loss greater than the values derived using the equations shown in the chart below from 1 MHz to the highest referenced frequency value. Worst case qualified cable PSNEXT Loss performance for selected frequency points of interest is also provided.

PSNEXT Loss Limits Table			
		System 6SM	

Frequency Range		1-350 MHz
Worst Case PSNEXT Loss		$\geq 74 - 15\log\left(\frac{f}{0.772}\right)$
Frequency Points of Interest	MHz	
	100	42.3 dB
	200	37.8 dB
	300	35.1 dB

Equal Level Far-End Crosstalk (ELFEXT):

Qualified Cables shall exhibit worst case ELFEXT greater than the values derived using the equations shown in the chart below from 1 MHz to the highest referenced frequency value. Worst case qualified cable ELFEXT performance for selected frequency points of interest is also provided.

ELFEXT Limits Table			
		System 6SM	
Frequency Range		1-350 MHz	
Worst Case ELFEXT		$\geq 70 - 20\log\left(\frac{f}{0.772}\right)$	
Frequency Points of Interest	MHz		
	100		27.8 dB
	200		22.7 dB
	300		18.2 dB

Power Sum Equal Level Far-End Crosstalk (PSELFEXT):

Qualified Cables shall exhibit worst case PSELFEXT Loss greater than the values derived using the equations shown in the chart below from 1 MHz to the highest referenced frequency value. Worst case qualified cable PSELFEXT performance for selected frequency points of interest is also provided.

PSELFEXT Loss Limits Table			
		System 6SM	
Frequency Range		1-350 MHz	
Worst Case PSELFEXT		$\geq 67 - 20\log\left(\frac{f}{0.772}\right)$	
Frequency Points of Interest	MHz		
	100		24.8 dB
	200		18.7 dB
	300		15.2 dB

Return Loss:

Qualified Cables shall exhibit worst case Return Loss greater than the values derived using the equations shown in the chart below from 1 MHz to the highest referenced frequency value. Worst case qualified cable Return Loss performance for selected frequency points of interest is also provided.

Return Loss Limits Table					
				System 6SM	
Frequency Range				1-350 MHz	
Worst Case Return Loss				Frequency (MHz)	Return Loss (dB)
				$\leq f < 10$	$21 + 4 \cdot \log(f)$ dB
				$10 \leq f < 20$	25 dB
				$20 \leq f \leq 300$	$25 - 7 \cdot \log(f/20)$
Frequency Points of Interest	MHz	-		20.1 dB 18 dB 16.8 dB	
	100				
	200 300				

Propagation Delay (ANSI/TIA/EIA-568-A-1):

Qualified Cables shall exhibit worst case Propagation Delay less than the values derived using the equations shown in the chart below from 1 MHz to the highest referenced frequency value. Worst case qualified cable Propagation Delay performance for selected frequency points of interest is also provided.

Propagation Delay Limits Table					
				System 6SM	
Frequency Range				1-350 MHz	
Worst Case Propagation Delay				$< 476 + \frac{36}{\sqrt{f_{MHz}}}$	
Frequency Points of Interest	MHz			480 ns 479 ns 478 ns	
	100				
	200 300				

Delay Skew (ANSI/TIA/EIA-568-A-1):

Qualified Cables shall exhibit worst case Delay Skew less than the values specified in the chart below per 100 m from 1 MHz to the highest referenced frequency value.

Delay Skew Limits Table					
				System 6SM	
Frequency Range				1-350 MHz	
Worst Case Delay Skew	MHz			25 ns 25 ns 25 ns	
	100				
	200 300				

Longitudinal Conversion Loss (LCL):

For all categories of 100 Ω unshielded and screened cables, the worst case calculated LCL for any pair in a 100 m cable shall not be less than 35 dB, from 1 MHz to the highest referenced frequency for each performance category. LCL measurements shall be performed in accordance with ITU-T Recommendation O.9 (November, 1988) or equivalent. Calculated LCL performance shall be determined by subtracting the test balun loss correction factor (as specified by the balun manufacturer) from the measured value at all frequencies.

LCL Limits Table			
		System 6SM	
Frequency Range		1-350 MHz	
Worst Case Delay Skew	MHz		35 dB 35 dB* 35 dB
	100		
	200		
	300		

Longitudinal Transfer Conversion Loss (LCTL):

For all categories of 100 Ω unshielded and screened cables, the worst case calculated LCTL for any pair in a 100 m cable shall not be less than 35 dB, from 1 MHz to the highest referenced frequency for each performance category. LCTL measurements shall be performed in accordance with ITU-T Recommendation O.9 (November, 1988) or equivalent. Calculated LCL performance shall be determined by subtracting the test balun loss correction factor (as specified by the balun manufacturer) from the measured value at all frequencies.

LCTL Limits Table			
		System 6SM	
Frequency Range		1-350 MHz	
Worst Case Delay Skew	MHz		35 dB 35 dB* 35 dB*
	100		
	200		
	300		

Attenuation to Crosstalk Ratio (ACR):

Using "pair-to-pair NEXT Loss", all Qualified Cables shall exhibit worst case ACR performance for the specified frequency range shown in the following table.

ACR Limits Table			
		System 6SM	
Frequency Range		1-350 MHz	
Worst Case ACR	MHz		24.1 dB 24.1 dB 24.1 dB .5 dB
	1-80		
	80-100		
	1-100		
	100-300		

PSACR Limits Table			
		System 6SM	
Frequency Range		1-350 MHz	
Worst Case PSACR	MHz		22.1 dB 22.1 dB 22.1 dB -1.5 dB
	1-80		
	80-100		
	1-100		
	100-300		

Transfer Impedance:

Surface Transfer Impedance is specified for ScTP cables and is determined by the formula below in mΩ/m where f = frequency. All qualified ScTP cables shall have a margin greater than or equal to the values specified in the following table.

$$T_{cable} = 37 + 4f + 4\sqrt{f} + 5\sqrt[3]{f}$$

Transfer Impedance Limits Table			
Margin 1-100 MHz		System 6SM	
Transfer Impedance		10 %	

2.05 MAIN DISTRIBUTION FACILITY (MDF)

A. Description: The equipment shall be installed in accordance with Drawings.

1. Products and Quantities:
 - a. Equipment Rack: - As specified.
 - b. Fiber Interconnect: Panduit FRME24 rack mount fiber optic enclosure or equal. Supply and install as many as necessary to service all fiber strands entering the MC.
 - c. Modular Patch Panels: Panduit CPPLA48WBLY or equal: 48-port patch panel wired Category 6 Patch Panel. One (1) Port for each workstation served from the MDF with a minimum of 12 spare ports are required. If the number of workstation cables, plus required spare count (12) is greater than 48, then a second 48-port patch panel is required. Supply and install as many patch panels in the MDF as necessary to service all workstation cables plus the required spare count.
 - d. Patch Cables: Panduit UTPSPXX-** or equal where XX is the length in feet and ** is the color. The length shall vary between 3' and 6' and shall be determined by Owner.
2. Required Accessories and Quantities:
 - a. Adapter Panels: Panduit FAP6WEIDSC – 6 Port Duplex Multimode SC Adapter Panels.
 - b. Fiber Jumpers: Panduit F6D3-3M3Y, 3 meter, Duplex, 62.5, SC to LC Fiber and ST to LC Fiber Jumper or equal.
 - c. Cable Management: Panduit WMPH2E Front/Rear cable manager or Panduit WMPPLS Low Profile Cable Manager or equal.
 - d. Cable Management Rings and Strain Relief: Panduit WMBV1 21"x5" Vertical Manager Ring, Panduit WMBV2 2"x5" Vertical Manager Ring and/or Panduit WMSRC1 or WMSRC2 strain relief clips. Provide and install sufficient quantities to conform to attached Drawings.

B. Smart UPS

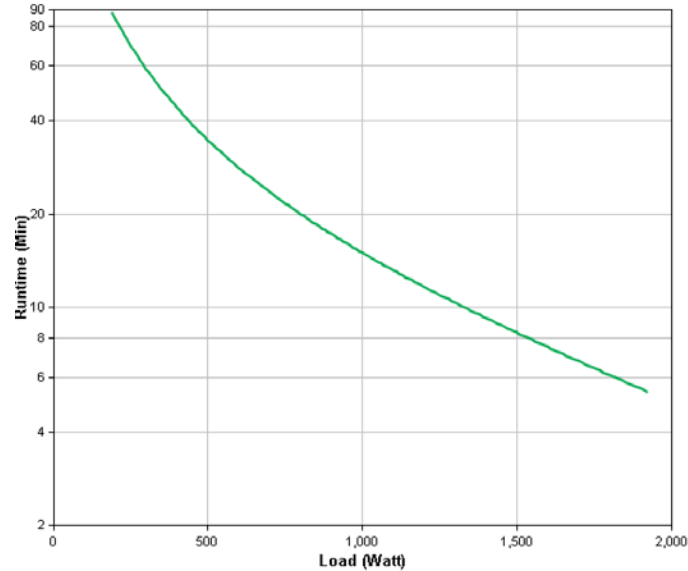
1. Output
 - a. Output power capacity: 1.92 KWatts / 1.92 kVA
 - b. Max Configurable Power (Watts): 1.98 KWatts / 2.2 kVA
 - c. Nominal Output Voltage: 120V
 - d. Output Voltage Distortion: Less than 5%
 - e. Output Frequency (sync to mains): 50/60Hz +/- 3 Hz
 - f. Topology: Line Interactive
 - g. Waveform type: Sine wave
 - h. Output Connections
 1. (6) NEMA 5-15R (Battery Backup)
 2. (2) NEMA 5-20R (Battery Backup)
 - i. Transfer Time: 4ms typical: 8ms maximum

2. Input

- a. Nominal Input Voltage: 120V
- b. Input frequency: 50/60 Hz +/- 3 Hz (auto sensing)
- c. Input Connections: NEMA 5-20P
- d. Cord Length: 8ft (2.44meters)
- e. Input voltage range for main operations: 82 - 143V
- f. Input voltage adjustable range for mains operation: 75 - 154V
- g. Number of Power Cords: 1

3. Batteries & Runtime

- a. Battery type: Maintenance-free sealed Lead-Acid battery with suspended electrolyte : leakproof
- b. Typical recharge time: 3hour(s)
- c. Replacement Battery: SMT3000RM2UNC
- d. Expected Battery Life (years): 3 - 5
- e. RBC Quantity: 1
- f. Runtime



g. Efficiency

1.	Load	Efficiency
2.	25%	97.3%
3.	50%	97.9%
4.	75%	97.8%
5.	100%	97.6%

4. Communications & Management

- a. Interface Port(s): Smart-Slot , USB
- b. Control panel: LED status display with On Line : On Battery : Replace Battery and Overload indicators, Multi-function LCD status and control console
- c. Audible Alarm: Alarm when on battery : distinctive low battery alarm : overload continuous tone alarm
- d. Emergency Power Off (EPO): Yes
- e. Available SmartSlot™ Interface Quantity: 1

5. Surge Protection and Filtering

- a. Surge energy rating: 530Joules

6. Physical
 - a. Maximum Height: 3.39inches (86mm , 8.6CM)
 - b. Maximum Width: 18.9inches (480mm , 48.0CM)
 - c. Maximum Depth: 26.89inches (683mm , 68.3CM)
 - d. Rack Height: 2U
 - e. Net Weight: 93.08lbs. (42.31KG)
 - f. Shipping weight: 109.41lbs. (49.73KG)
 - g. Shipping Height: 10.0inches (254mm , 25.4CM)
 - h. Shipping Width: 23.62inches (600mm , 60.0CM)
 - i. Shipping Depth: 38.6inches (980mm , 98.0CM)
 - j. Color: Black
 - k. Units per Pallet: 8.0

7. Environmental
 - a. Operating Temperature: 32 - 104 °F (0 - 40 °C)
 - b. Operating Relative Humidity: 0 - 95 %
 - c. Operating Elevation: 0-10000ft (0-3000meters)
 - d. Storage Temperature: -15 - 45 °C
 - e. Storage Relative Humidity: 0 - 95 %
 - f. Storage Elevation: 0-50000ft (0-15000meters)
 - g. Audible noise at 1 meter from surface of unit: 55.0dBA
 - h. Online thermal dissipation: 215.0BTU/hr

8. Conformance
 - a. Approvals: CSA, ENERGY STAR V1.0 (USA), FCC Part 15 Class A, UL 1778
 - b. Equipment protection policy: Lifetime : \$150000
 - c. Standard warranty: 3 years repair or replace (excluding battery) and 2 year for battery

C. Installation: Installation shall be conducted in accordance with manufacturer's recommendations, industry standards, and this specification. Installation includes complete assembly and mounting of the fiber interconnect equipment, dressing the fiber and copper cables, complete assembly and mounting of the equipment rack, and mounting of the wiring blocks. Equipment shall be mounted in accordance with attached Drawings.

2.06 TESTING AND DOCUMENTATION

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Visually inspect UTP jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 2. Visually confirm Category 5e marking of outlets, cover plates, outlet/connectors, and patch panels.
 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Provide test instruments that meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. Multi-pair Voice Riser Tests:
 - a. Test each pair of multi-pair voice riser cables for proper polarity; no reversals; no transpositions; continuity; no shorts; no AC voltages; no DC voltages; no opens; and proper numbering at each termination.
 - b. Bring cables and/or pairs not meeting the requirements of the standard into full compliance, at no additional cost to the Owner.
 - c. Document cable testing in accordance with Submittals Article. Provide a table of test results in a 3-ring binder submitted with the as-built Drawings.
6. Category 6 Data, and Voice UTP Cable Testing:
 - a. Test voice and data jack in each Outlet for Category 6 ANSI/TIA/EIA 568B series compliance, using a Certified Level III testing instrument. Tests shall verify both the integrity of all conductors and correctness of the termination sequence. Tests shall also include length, mutual capacitance, characteristic impedance, attenuation and near-end and far-end crosstalk. Testing shall be performed between modular jacks at the Outlets and the modular jacks at the patch panel field.
 - b. The Communication Systems Installer shall bring cables and/or pairs not meeting the requirements of the standard into full compliance, at no additional cost to the Owner.
 - c. Document cable testing in accordance with Submittals Article. Provide a table of test results in a 3-ring binder submitted with the as-built Drawings.
7. Fiber Optic Cable Testing:
 - a. Test all fibers in the completed end-to-end system. Testing shall consist of a bi-directional end to end OTDR trace, or a bi-directional end to end power meter test performed per ANSI/TIA/EIA 455 53A. The system loss measurement shall be provided at 850 and 1310 nanometers.
 - b. Pre-installation cable testing: Test all fiber optic cable prior to the installation of the cable. Assume all liability for the replacement of the cable should it be found defective after the installation.
 - c. Loss Budget: Fiber links shall have a Maximum Loss of:
$$\text{Maximum Loss} = (\text{allowable loss per km}) (\text{km of fiber in link}) + (.4\text{dB}) (\text{number of connectors})$$
Note: A mated connector-to-connector interface is defined as a Single connector.
 - d. Loss numbers for the installed link shall be calculated by taking the sum of the bi-directional measurements and dividing that sum by two. Any link not meeting the requirements of the Maximum Loss shall be brought into compliance at no additional charge to the Owner.
 - e. Prepare a certification report listing the test results and both the calculated and measure loss for each fiber. Submit this report with the test results as called for in the Submittals Article.
 - f. Bring cables and/or strands not meeting the requirements of the standard into full compliance.

- D. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
 - 1. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
- E. Document data for each measurement. Print data for submittals in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- F. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- G. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- H. Prepare test and inspection reports.

2.07 LOCAL SOUND SYSTEM

- A. General
 - 1. Provide necessary equipment and relays to mute local sound system during a paging system announcement, and during a fire alarm condition.
 - 2. Provide for a complete and satisfactory operating stand alone video and sound reinforcement system for the following: Multi-purpose Room requirements of system.
 - a. Audio reinforcement system consisting of wireless microphone systems wired microphone systems permanently installed ceiling speakers.
 - b. Headend equipment rack located in a locked area.
 - c. Integration with building intercom/paging system for paging override.
 - d. Integration with building fire alarm system for muting during a fire alarm condition.
 - e. Assistive listening system equal to 4 percent of the listed occupancy or as required by the most current ADA code.
 - f. Reproduction of DVD sound tracks and computer audio to listeners through speakers located in the room.
 - g. Automatic mixing of audio inputs.
 - h. Bluetooth
 - 3. All equipment, except portable equipment, shall be held firmly in place. This shall include all loudspeakers and amplifiers. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three.
 - 4. All switches, amplifier equipment and microphone outlets shall be clearly, logically, and permanently marked using proper size engraved laminated plastic name tags fastened with screws for a permanent type of adhesive. In order to protect the owner and to insure the availability of warranty service and parts, the installing supplier shall be a factory authorized representative for the products they are supplying. A letter authorizing representation shall be supplied and included in the submittals. Any substitutions shall be requested in writing to the architect and the owner ten days prior to bid.
 - 5. Any request for substitution shall include detailed manufacturers data to substantiate that the proposed product is equal to that specified.
 - 6. Low-voltage AV cable pulls with coiled ends as shown on the drawings. These cables shall be installed within an existing infrastructure of electrical conduits, boxes, wall, floors, and ceiling, and as shown on the drawings installed by the electrical contractor

7. Provision and installation of video display wall mounts, video display ceiling mounts, projector ceiling mounts, projector wall mounts, projector threaded iron mounting pipes and associated flanges, brackets, trim, and supports. Ceiling mount pipes shall be painted flat white in rooms with white ceilings, unless otherwise directed by the Architect. Additionally, provide and install speaker back boxes in hard plaster ceiling locations, and provide and install any other special permanently installed audiovisual items that require access to the building's infrastructure during the open-wall and open-ceiling phase(s) of the construction.
8. Furnish and install audiovisual equipment, control systems, custom plates, plates, projectors, speakers, touch control panels, pushbutton control panels, custom engraved pushbuttons, custom machined and engraved aluminum plates, cameras, microphones, audio sources, video sources, switchers, scalers, interfaces, displays, racks, workstations, custom furniture and lecterns, teleconferencing, power supplies, amplifiers, connectors, adapters, and related systems as shown on associated drawings. Systems are to include all patch cables, in-rack jumpers, user interface cables, accessories and miscellaneous items to ensure a complete and operational turnkey installation
9. connectivity to LAN where necessary.
10. Program the control system and adjust settings on devices for proper operation.
11. The AV systems electrical trade subcontractor shall furnish and install all grounding and bonding material. The grounding and bonding shall meet the National Electrical Code (NEC) as well as local codes, which specify additional grounding and/or bonding requirements.

B. Quality Assurance

1. Project management: Maintain the same person in charge of work throughout installation.
2. Contract Documents: Maintain a complete set of system drawings and specifications at the site at all times during installation.
3. Fabrication and Installation: Fabricate all equipment racks and subassemblies. Make field connections of all audio, video and control wiring including microphone, line level, loudspeaker, video, and control system circuits to equipment, equipment racks and connection panels. Continuously supervise the installation and connections of cable and equipment.
4. Contractor Qualifications: To be considered qualified for this work, the contracting firm must be experienced in the provisions of audio visual systems similar in complexity to those required for this project, and meet the following:
 - a. The Contractor's primary business is the provision, fabrication and installation of professional audiovisual and related systems.
 - b. The Contractor is an authorized dealer for the specified Audiovisual Control System and factory trained in the installation, maintenance and programming of such systems.
 - c. The Contractor is, at a minimum, CAVSP Basic level certified solution provider, with at least (1) CTS-I and (1) CTS (or C-EST) certified employee on-site for the duration of the installation.

C. Assistive Listening System:

1. Provide one assistive listening systems per local sound system specified, assistive listening systems including all components for a complete and operational system for the six individual sound systems. Provide receivers for 8 occupants and 4 hearing aid compatible neck loops per sound system.
 - a. Provide transmitter and universal rack mounting kit
 - b. Provide wall-mounted rack
 - c. Provide RF receiver
 - d. Provide bar speaker
 - e. Provide neck loop

- f. Provide all required batteries
 - g. Provide assistive listening notification signage
 - h. Provide remote antennae kit
2. Manufacturer/Model/Or equal
- a. Listen LT-800 stationary RF transmitter (72 or 216 MHZ)
 - b. (1) Listen LA-122 universal antenna kit
 - c. (1) Listen LA-326 universal rack mounting kit
 - d. (8) Listen LR-400 portable display receiver (72 or 216 MHZ)
 - e. (8) Listen LA-164 ear speaker
 - f. (4) Listen LA-166 neck loop
 - g. Listen LA-361 high capacity AA alkaline batteries for all components requiring batteries.
 - h. (1) Listen LA-304 assistive listening notification signage kit
3. Quantity: one per local sound system.

2.08 LOCAL SOUND SYSTEM – Multi Purpose Room

A. Media commons room Local Sound System Equipment

1. Loud Speakers (drop in type):
 - a. Provide drop in mounted speaker with mounting hardware. Color to be selected by the Architect.
 - b. Manufacturer/Model
 1. JBL 81 C/T: recessed drop in speaker - color to be selected by architect.
 2. Or equal
 - c. Quantity: 12
2. Amplifier:
 - a. Provide power amplifier to serve pendant mounted load speakers.
 - b. Manufacturer/Model
 1. Crown Amp GCDI2X600-U-US CDi Drivecore install analog series DCi 2/600 2 channel power amplifier
 2. Or equal
 - c. Quantity: 1
3. Digital Signal Processor (DSP):
 - a. Provide 8X8 DSP
 - b. Manufacturer/Model
 1. Symetrix DSP Prism 8X8
 2. Or equal
 - c. Quantity: 1
4. Wireless Microphone System:
 - a. Manufacturer/Model
 1. Shure MXW series wireless handheld mics MXW2/SM58 - QTY: 2
 2. Shure 2-Channel Access Point transceiver MXWAPT2 – QTY: 2
 3. Shure 4 channel networked charging station MXWNCS4 – QTY: 1
 4. Shure 4 channel network interface for DSP MXWANI4 – QTY: 1
5. Network switch for control system:
 - a. Manufacturer/Model
 1. Cisco SG350-10PK9-NA
 2. Or equal
 - b. Quantity: 1

6. Media Input Plate:
 - a. Provide media input plate as indicated on the drawings with the following specifications. Color to be selected by Architect.
 1. One gang wall plate passive mixing device, combining a microphone with a stereo line level audio source into a single mic level matching and mixing between the music source and the mic. Works with both dynamic and condenser microphones and passes phantom power from the sound system to the mic input. Line signals are input via a 3.5mm stereo or RCA jacks. The mic input is a balanced female XLR. A ground lift switch breaks the ground connection between the inputs and the output screw terminal.
 - b. Manufacturer/Model
 1. Whirlwind M1P3xx
 2. Or equal
 - c. Quantity: 2
7. Wall controller:
 - a. Manufacturer/Model
 1. Symetrix ARC3E wall controller volume control
 - b. Quantity: 2
8. CD Player:
 - a. Manufacturer/Model
 1. TASCAM CD-200BT
 2. Or equal
 - b. Quantity: 2
 - c. Provide line level input for future AV- video screens
9. Equipment Rack:
 - a. Provide wall mounted enclosed and lockable swing-out rack
 - b. Manufacturer/Model
 1. Middle Atlantic EWR 10-22SD
 2. Or equal
 - c. Provide power strip that complies with UL1363, it shall be rack mounted equal to Furman Merit X-8 series. Provide quantity of two.
 - d. Provide all required cabling and mounting hardware for a fully functional local sound system.

2.09 MISCELLANEOUS CABLING SYSTEM

- A. Provide and terminate all speaker, clock, microphone, antenna, cabling per manufacturer's recommendations for a completely operational system as specified.
- B. Sound/Speaker cabling shall be home run and looped directly to applicable headend termination board, as specified. All cable runs shall be free from in-line splices. Insulate all cable shields (at field device end) from field grounds by cutting and taping shields.
 1. Classroom speakers, office speakers, conference room speakers, work room speakers, exterior horn speakers and others areas that have only one (1) public address speaker shall each be individually home run, without splices, back to their respective sound or master clock headend. Provide 22 AWG solid shielded speaker cables.
 2. Hallways and other areas that have multiple speakers, may have a maximum of eight (8) speakers per speaker loop home run, without splices, back to their respective sound headend. Provide 18 AWG stranded speaker cables.
 3. Horn Speakers areas that have multiple speakers, may have a maximum of four (4) speakers per speaker loop home run, without splices, back to their respective sound headend. Provide 18 AWG stranded speaker cables.

- C. Roof mounted Antenna, provide a RG-6U coax cable between the roof mounted antenna location and the AM/FM tuner location.
 - 1. Cables shall be left coiled in backbox with minimum of 48 in. slack.

2.10 CABLE TELEVISION SYSTEM

- A. Furnish and install cable and all outlets. Cabling shall be provided as indicated on the drawings.
- B. Television outlet locations shall have wall boxes mounted both at 18" above finished floor unless otherwise indicated. The boxes shall be 4" square with double gang plaster ring, and cover for cable outlet and duplex receptacle where shown on Plan. At other locations, provide single gang plaster ring and cover.
- C. Provide (2) RG-6 cable per CATV outlet run above ceiling to MDF room. Provide broadband distribution amp at MDF room CATV service entrance equal to BIDA 100 A-30.

PART 3 - EXECUTION

3.01 GENERAL

- A. Do not install equipment and materials which have not been reviewed by the Architect. Equipment and materials which are installed without the Architect's review or without complying to comments issued with the review shall be removed from the project when so instructed by the Architect. No payment will be made for unapproved or removal if it is ordered removed. The Installer shall be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.
- B. Obtain detailed information on installation requirements from the manufacturers of all equipment to be furnished, installed or provided. At the start of construction, check all Contract Documents, including all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing.
- C. Equipment and systems shall not be installed without first coordinating the location and installation of equipment and systems with the General Contractor and all other Trades.
- D. Any and all material installed or work performed in violation of above requirements shall be re-adjusted and corrected by the Installer without charge.
- E. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the electrical outlets, conduit and equipment, to determine the exact location of all outlets.
- F. After installation, equipment shall be protected to prevent damage during the construction period. Openings in conduits and boxes shall be closed to prevent the entrance of foreign materials.
- G. Home runs indicated are not to be combined or reduced without written consent from the Architect.
- H. All connections to equipment shall be made as required, and in accordance with the approved submittal and setting drawings.

I. Delivery, Storage and Handling:

1. Deliver, store, protect and handle products in accordance with recommended practices listed in Manufacturer's Installation and Maintenance Manuals.
2. Deliver equipment in individual shipping splits for ease of handling, mount on shipping skids and wrap for protection.
3. Inspect and report concealed damage to carrier within specified time.
4. Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation. Meet the requirements and recommendations of NFPA 70B and the Manufacturer. Location shall be protected to prevent moisture from entering enclosures and material.
5. Handle in accordance with NEMA and the Manufacturer's recommendations and instructions to avoid damaging equipment, installed devices and finish.
6. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer shall be required to brace the equipment suitably to insure that the tilting does not impair the functional integrity of the equipment.

J. Site Observation:

1. Site observation visits will be performed randomly during the project by the Architect. Reports will be generated noting observations. Deficiencies noted on the site visit reports shall be corrected. All work shall comply with the Contract Documents, applicable Codes, regulations and local Authorities whether or not a particular deficiency has been noted in a site visit report.
2. Be responsible to notify the Architect ten working days prior to closing in work behind walls, raised access floors, ceilings, etc., so that installed work can be observed prior to being concealed.
3. Areas shall stay accessible until deficiencies are corrected and accepted. Notify the Architect when all deficiencies are corrected. Return reports with items indicated as corrected prior to re-observation by the Architect.

K. Project Open House:

1. If the Owner elects to have an open house at the end of the project, provide assistance to the Owner. Cooperate and provide manpower to operate and demonstrate systems during the open house as requested by the Owner.

3.02 EQUIPMENT RACKS, CABINETS AND BRACKETS

- A. Securely mount equipment racks, cabinets and wall mounted relay brackets to the building structure. Proper supports such as 3/8" lag screws and expansion anchors shall be used. Proper quantity of supports shall be utilized. Dry wall screws and other types of supports not specifically approved to support equipment are specifically prohibited. Submit mounting supports for approval before installation.
- B. Position racks, cabinets, and wall mounted relay brackets in order to have minimum 3 foot clearance for easy access. Equipment racks, cabinets and relay brackets mounted on or against walls shall have 3 foot clearance in front of deepest component. Free standing equipment racks and cabinets shall have 3 foot clearance in front and rear of deepest components. Provide 3 foot clearance between free standing equipment racks or cabinets and any other obstruction to allow access from front to rear of rack or cabinet for maintenance.

- C. The Electrical Contractor shall provide cable tray over each rack and cabinet as required to facilitate a neat and orderly installation of cables and to secure the top of the racks to the structure. Cables shall drop straight down to equipment racks. Cable trays shall be secured at both ends to the structure and connected together as required for a complete contiguous installation. Utilize proper supports to support the cable tray to the building structure as well as the equipment rack and cabinet. Submit mounting supports for approval before installation.
- D. Cable Management: All cables shall enter the wiring closet to within the equipment racks and/or brackets. Secure the bundle(s) to the rack strain relief and wire management behind the patch panels and cross connect block panels. Install horizontal and side-mounted vertical cable management panels and brackets for routing and management of patch cables. Maintain EIA/TIA and BICSI standards on bundling, supporting and bend radii.
- E. Once the cabling system has been installed and terminated, install all active components and surge protected power strips into the racks, cabinets and wall mounted relay brackets.
- F. Surge Protected Outlet Strips: Mount UPS and surge protected outlet strips per Manufacturer's directions. Refer to details on the Drawings for mounting location.

3.03 TERMINATIONS

- A. All copper conductors of every cable shall be completely terminated at both ends.

3.04 CABLE PATHWAYS

- A. Install cables in pathways provided by the Electrical Subcontractor or required under execution part of this Section.
- B. Provide all equipment and cabling for a complete installed operating system. In general, pathways, outlet boxes and grounding are provided by the Electrical Subcontractor.
- C. All pathways provided under this Section shall comply with fill capacities as per Code, EIA/TIA 569 and BICSI.
- D. Cable bending radius shall not be less than minimum required by EIA/TIA and BICSI.
- E. Cabling installed concealed shall be supported from the building structure (e.g. cable trays, J-Hooks, etc.).
- F. Cables shall be installed no closer than 12 inches (305mm) to electrical equipment and wiring. When cables are required to cross power wiring, they shall only do so perpendicular to the power wiring. Telecommunications cabling and power wiring shall only cross each other the minimal number of times as required due to building design limitations.
- G. Clearances: Clearances between cabling and other building systems as required by EIA/TIA 569 and BICSI shall be maintained throughout the building.
- H. All cables shall be installed in a neat and workman-like manner. Cables shall be installed parallel and perpendicular to building elements.
- I. Provide expansion fittings and adequate cable slack at all building expansion joints.
- J. Fire/smoke seal all conduits, raceways, sleeves, slots, etc. where cables pass from one location to another.

3.05 SEALING OF PENETRATIONS AND OPENINGS

A. Environmental Seals

1. Provide seals on raceways exposed to widely different temperatures, as in refrigerated or cold storage areas. Install seal to prevent circulation of air from warmer to colder sections through the raceway.
2. Provide seals under device plates for outlets on walls between conditioned and non-conditioned spaces.
3. Provide outlet plate gasket seals at all work area outlets on interior and exterior walls.

3.06 SEISMIC SUPPORTS, SUPPLEMENTARY STEEL AND CHANNELS

- A. Provide all supports, supplementary steel and channels required for the proper Seismic installation, mounting and support of all work installed under this Section.
- B. All supports, supplementary steel and channels shall be furnished, installed and secured with all fittings, support rods and appurtenances required for a complete support or mounting system.
- C. Supplementary steel and channels shall be firmly connected to the building construction in a manner approved by the Architect prior to the installation of same. Submit to the Architect, via the General Contractor, the locations proposed for using supplementary steel and channels for the support of equipment, fixtures and raceways. The submittal shall indicate the mounting methods, size and details of the supports, channels and steel; it shall indicate also that weight which the supports, channels and supplementary steel is to carry.
- D. The type and size of the supporting channels and supplementary steel shall be of sufficient strength and size for seismic restraint and to allow only a minimum deflection in conformance with the channel and supplementary steel manufacturer's requirements for loading.
- E. All supplementary steel and channels shall be installed in a neat and workmanlike manner parallel to the walls, floor and ceiling construction. All turns shall be made with 90 degrees and 45 degrees fittings, as required to suit the construction and installation conditions.
- F. All supplementary steel, channels, supports, and fittings, shall be Underwriters' Laboratories, Incorporated, approved, be galvanized steel and be manufactured by Steel City, Unistrut, Power-Strut, T. J. Cope, Chalfant or approved equal.
- G. Provide supports to meet the required Seismic rating as indicated under "Part One" of this Specification.
- H. Provide beam clamps with set screws (C-clamp type).
- I. Work under this Section shall be held in place by Seismic rated methods.
- J. Supporting from the roof decking will not be acceptable.
- K. Provide expansion anchors on masonry units or brick work. Power actuated supports will not be accepted.
- L. Provide stainless steel or corrosion resistant supports in corrosive areas on wet or damp areas.

- M. Support work from the building structure, independent of suspended ceilings, roof deck or other trades work. Where duct work, pipes, pipe racks, type of building construction materials or structural framing members provide obstruction or difficult support means, hanger rods shall be used in association with horizontal sections of steel support channels, in an approved manner.
- N. All work shall be installed in a rigid and satisfactory manner and shall be supported by bar hangers in frame construction or shall be fastened directly with wood screws on wood, bolts with expansion shields on concrete or brick toggle bolts on hollow masonry units, and machine screws or welded threaded studs on metal. Threaded studs of the proper type and holding capacity driven in by a power charge and provided with lock washers and nuts are acceptable for mounting of equipment on solid concrete walls or slabs.
- O. Obtain written permission from the General Contractor allowing use of power activated charges. Use only properly trained and licensed operators.
- P. Do not use power charge driven supports for any work that is to be hung from a horizontal surface without written permission from the Architect.
- Q. Preset inserts of the proper type and holding capacity shall be used in overhead slab construction wherever possible.
- R. Provide lateral supports for work to prevent excessive movement during a seismic event using rods, braces or galvanized or stainless steel cables.
- S. Pendants, supports or hanging rods longer than 12 inches (300mm) shall be laterally braced.
- T. Where installed in damp, wet and areas requiring wash down, all surface mounted panels, boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

3.07 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260000 "Identification for Electrical Systems."
 - 1. Confirm labeling scheme with the Owner prior to final labeling.
 - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
- C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- E. Cable and Wire Identification:
1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Provide preprinted or computer-printed type labels with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
1. Cable Labels: Use flexible vinyl or polyester that flexes as cables are bent.

3.08 CABLE SUPPORTS

- A. Provide strain relief hardware for backbone cables at each floor level as they pass from one floor to the next.
- B. Provide hook and loop (Velcro) cable wraps at all panels, equipment racks and cabinets. Cable ties are specifically prohibited.
- C. Cable ties for horizontal cables shall be secured with minimum required compression in order to secure the cables properly without impeding the signal transmission rating (geometry) of the cable. Hook and loop (Velcro) cable wraps may be used in lieu of cable ties for copper cables only. Cable-ties are specifically prohibited for fiber optic cables.
- D. When pathways are not provided or specified, provide J-Hook supports from the building structure as required for cable runs to the cable drop location. Maximum distance between supports shall be five feet (1 500mm) depending on the structural elements of the building. Maximum number of cables per support shall be thirty. Provide additional supports as required when cable quantities exceed thirty and to maintain required bending radius of cables. Cables installed exposed or in areas subject to abuse (below 10 feet (3m) above finished floor) or in accessible areas shall be installed in conduit.

- E. All cables shall be supported directly from building structure. Under no circumstance shall cable be installed using cross bracing, plumbing/sprinkler pipes, ceiling systems or any other system that is not a specifically approved method to independently support cables. Cables shall not be allowed to rest on ceiling tiles, duct work, piping, etc. Supports shall be provided as required in order for cables to avoid contact with any other building system. Bundle cables in groups by Room.

3.09 CABLE PROTECTION

- A. Provide bushings in all metal studs and the like where cables will pass through. Bushings shall be of two (2) piece construction with one piece inserted through the opening and the second piece locking it into place. Single piece bushings with locking tabs or friction fit are specifically prohibited.
- B. Cables to be installed in existing enclosed open bays or furred spaces where conduit stubs are not provided shall be protected from chafing or any damage. The Installer shall verify that the warranty shall not be violated before installing any cabling in these locations.
- C. Provide cutting, coring, sleeves and bushings and seal as required at all penetrations.
- D. Fiber optic backbone cables shall be installed in inner duct.
- E. Cables damaged during installation shall not be repaired. They shall be completely replaced with new cable.

3.10 INSTALLATION

- A. All cabling shall be installed in conduit where indicated on plans, or shall be installed open using other methods, approved by architect, such as J-Hooks.
 - 1. Install wiring, per manufacturers recommendations. Use UL listed plenum cable in environmental air spaces including plenum ceilings.
- B. All wiring shall be new and concealed in pipe where exposed.
- C. All conduits and raceways shall have pull strings remaining after cable is pulled.
- D. Impedance and Level Matching:
 - 1. Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- E. Control Circuit Wiring:
 - 1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
 - 2. Make installation in strict accordance with approved manufacturer's drawings and instructions.
 - 3. The Installer shall provide necessary transient protection on the AC power feed, all station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

F. Weatherproofing:

1. Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

G. Typical Layouts and requirements of the specified systems:

1. Typical layout:
 - a. Equipment racks and cabinets
 - b. Backbone cabling
 - c. Headend equipment
2. Typical layout of telecommunications equipment racks and cabinets.
 - a. Each equipment rack and cabinet shall contain the following equipment:
 1. Fiber optic patch panel
 2. Fiber optic cable management
 3. Surge protector power strip
 4. Patch panels - Horizontal distribution
 5. Horizontal distribution cable management
 6. Vertical cable management
 7. Patch cords
 - b. Provide space for the installation of network electronics equipment in the equipment racks.
 - c. Furnish and install horizontal cable management between each patch panel (fiber optics, Hub distribution, Horizontal distribution, and telephone distribution).
 - d. Furnish and install horizontal distribution patch panels in each wire center with sufficient ports to terminate all modular jacks shown on the drawings plus twenty percent spares. The exact number of modular jacks and horizontal distribution patch panels shall be obtained from the drawings.
 - e. Furnish and install all equipment racks and cabinets required to support the aforementioned equipment.
 - f. The MDF room shall contain fiber optic patch panel quantities which correspond to the total number of fiber optic patch panels located in the IDF rooms.
 - g. Grounding bars shall be installed under SECTION 260000. Furnish and install the required grounding to ensure that all of the aforementioned equipment is grounded and bonded.
3. Headend
 - a. The headend consists of connecting hardware for the following:
 1. CATV System
 2. Sound System
 3. Master Clock System
 - b. Final terminations from IDC cross connect block panels to telephone equipment and PBX by -Telephone Company and Equipment Installer. Coordinate with Telephone Company and Equipment Installer for final terminations.
 - c. Final terminations from the IDC cross connect block panels to the headend equipment shall be provided by the headend equipment installer.
 - d. Coordinate with the headend equipment installer and the electrical contractor for:
 1. The installation of all the IDC cross connect block panels at the headend equipment. Installation shall be neat in appearance.
 2. The final terminations at the headend.

3.11 TRAINING

- A. As a minimum, training sessions shall consist of the following:
1. General project information and review shall be by the General Foreman or Superintendent of the Trade.
 2. Specific system training shall be by a Factory Trained Representative.
 3. Provide a complete review of the project and systems including, but not limited to, the following:
 - a. In a classroom environment review each Record Drawing (use of typical is acceptable).
 - b. Note equipment layouts, locations and control points.
 - c. Review each system.
 - d. Review system design operation and philosophy.
 - e. Review alarms and necessary responses.
 - f. Review standard troubleshooting techniques for each system.
 - g. Review areas served by equipment.
 - h. Identify color codes used.
 - i. Review features and special functions.
 - j. Review maintenance requirements.
 - k. Review operation and maintenance manuals.
 - l. Respond to questions (record questions and answers).
 1. After classroom training, walk the entire project, review each equipment room and typical locations. Explain equipment and proper operation.
- B. During the instruction period the Owner and Maintenance Manual shall be used and explained.
- C. The Owner and Maintenance Manual material shall be bound in 3-ring binders and indexed. On the edge of the binder provide a clear see-through plastic holder with a typed card indicating the Project name, the Architect's name, the installer's name and the Volume number (e.g., Vol. No. 1 of 2).
- D. Provide name, address and telephone number of the manufacturer's representative and Service Company for all items supplied so that the source of replacement parts and service can be readily obtained.
1. Include copies of manufacturers and installer's warranties and maintenance contracts and performance bonds properly executed and signed by an authorized representative.
 2. Include copies of all test reports and certifications.

3.12 ACCEPTANCE DEMONSTRATIONS

- A. Systems installed under this Section shall be demonstrated to the Owner and Architect. Demonstrations are in addition to necessary testing and training sessions. Notify all parties at least 7 days prior to the scheduled demonstration. Schedule demonstrations, in cooperation with and at times convenient to all parties, so as to not disturb ongoing activities.
- B. Systems shall be tested prior to the demonstrations and each system shall be fully operational and tested prior to arranging the Acceptance Demonstration. Final payments will be withheld until a satisfactory demonstration is provided for all systems indicated or requested.

- C. If the demonstration is not totally complete, performing all functions, features and connections or interfaces with other systems, or if there is a failure during the demonstration, additional demonstrations shall be arranged. Provide and pay for all costs, labor and expenses incurred for all attendees for each additional demonstration required for acceptance and demonstration of complete system operation.
- D. Demonstrations shall be scheduled in ample time to complete all activities prior to final acceptance and Owner occupancy. Demonstrations shall take place at least 30 days prior to the scheduled project completion date and 30 days prior to owner's use and occupancy.
- E. As a minimum, provide demonstrations for systems indicated under "Work Included" under Part One of the Specifications. Provide demonstrations of additional systems as requested by the Owner, or Architect.

3.13 PROJECT OWNER COORDINATION

- A. Prior to Substantial Completion of the project and in ample time to address and resolve any coordination issues, request and arrange meetings between the Owner, Owner's Vendors and Consultants, Architect and General Contractor to discuss the Scope of Work for each system being provided and the interface required for a fully functional and operational system upon project completion. Initial meetings shall be scheduled three months prior to the scheduled Substantial Completion date or as soon as Submittals are submitted and reviewed for projects with shorter schedules.
- B. At these meetings the required interface with the Owner shall be reviewed, requests for information required to complete programming or for coordination shall be presented and system operation and philosophy shall be discussed.
- C. Additional meetings shall be held as requested by any party so that all issues are resolved and with the goal and intent being that all systems are fully operational and functional upon project Substantial Completion and that the responsibility for all components required is clearly established.

3.14 CLEANING UP

- A. Upon completion of all work, and testing, thoroughly inspect all exposed portions of the installation and completely remove all exposed labels, markings, and foreign material.
- B. The interior of all boxes and cabinets shall be left clean; exposed surfaces shall be cleaned and plated surfaces polished.
- C. Repair damage to finish surfaces resulting from work under this Section.
- D. Remove material and equipment from areas of work and storage areas.
- E. All equipment shall be clean from dirt, dust, and fingerprints prior to final acceptance.
- F. Touch up all damaged pre-finished equipment using materials and methods recommended by the Manufacturer.

3.15 PROJECT CLOSEOUT

- A. Provide close out submittals as required herein and in SECTION 017700 - PROJECT CLOSEOUT including the following close out submittals.
1. Operation and Maintenance Manuals
 2. Record Drawings.
 3. Test Reports.
 4. Extra Materials.
- B. Obtain written receipts of acceptance close out submittals submitted. Receipts shall specifically detail what is being delivered (description, quantity and specification section) and shall be dated and signed by firm delivering materials and by the Owner's Representative.
- C. Telecommunications:
1. Provide ten percent (10%) spare dust covers provided to the Owner at the completion of the project.
 2. Provide fifteen (15%) spare patch cables and line cord for each cable length provided.
 3. Provide record drawings indicating actual cable routing and cable terminations and all required identifiers. Provide copy mounted in each telecommunications closet and the main cross connect.
 4. All sketches, drawings, and charts herein are for the purpose of providing for specifications in a simplified format. Errors and omissions in such does not relieve the Contractor of the responsibility for providing a fully complete, secure and properly operating integrated instructional technology network system suitable for the intended use. Bidders must obtain a complete set of Project Drawings and Specifications to determine the full scope of work. In case of conflict the Project Drawings and Specifications shall prevail.

3.16 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with Division 1 requirements for construction waste management and recycling.

END OF SECTION

SECTION 28 0000

INTEGRATED ELECTRONIC SECURITY SYSTEM

(PART OF SECTION 260000 TRADE BID)

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SECTION 280000

INTEGRATED ELECTRONIC SECURITY SYSTEM

(PART OF SECTION 260000 TRADE BID)

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 FILED SUB SUB-BID REQUIREMENTS

- A. Sub bidder's attention is directed to Massachusetts M.G.L. Chapter 149 Section 44F, as amended, which provides in part as follows.
- B. Section 280000 INTEGRATED ELECTRONIC SECURITY SYSTEM shall be a Filed Sub- Sub Bid of Section 260000 ELECTRICAL, requiring a Paragraph "E" Listing on the FORM FOR SUB-BID.
- C. Each sub-bidder shall list in Paragraph E of the "Form for Sub-bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that sub trade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.
- D. This Section shall be provided by a qualified Systems Contractor.
 - 1. The Systems Contractor shall be DCAM Certified by the state of Massachusetts Division of Capital Asset Management, in the category of: ALARM SYSTEMS.

1.03 SUMMARY

- A. Work described herein shall be interpreted as work to be done by the Integrated Electronic Security System Contractor. Work to be performed by other trades will be referenced to a particular contractor.

- B. The work under this Section includes providing of all material, labor, equipment and supplies and the performance of all operations to provide a complete working Integrated Electronic Security System, as required by the Drawings and details as specified herein. Where the Drawings, Specifications, Codes, Regulations, Laws, or the requirements of the drawings/specifications conflict, provide the higher quality and higher quantity indicated or required and follow the strictest requirement. In general, the work includes, but is not limited to, the following:
1. Systems:
 2. Based Access Control/Security Management System.
 - a. Graphics Designer System.
 - b. IP Based Electronic Surveillance System (CCTV) and Digital Recording System
 - c. Intrusion Detection Systems.
 - d. Audio/Video Intercom System.
 - e. Remote Access
 - f. Integration and software upgrades to the existing AMAG access control system
 3. Equipment Racks and Cabinets.
 4. Terminations.
 5. Conduit Systems and sleeves will be provided by the Electrical Sub-Contractor.
 6. 120VAC Power Requirements will be provided by Electrical Subcontractor.
 7. Protection of new and existing work.
 8. Record Drawings and Documentation.
 9. Staging.
 10. Operation and Maintenance Instructions and Manuals for the Section's work.
 11. Nameplates, Labels and Tags.
 12. Testing and certification.
 13. Fireproofing of Penetrations and Openings will be provided by the Electrical Sub-Contractor.
 14. Access panels and doors.
 15. Coordination with manufacturers, other trades and Owner.
 16. Core drilling and cutting will be provided by Electrical Sub-Contractor.
 17. Patching will be provided by Construction Manager.
 18. The Integrated Electronic Safety and Security System shall include:
 - a. IP Based Access Control/Security Management System.
 - b. Graphics Designer System.
 - c. IP Based Electronic Surveillance System (CCTV) and Digital Recording System
 - d. Intrusion Detection Systems.
 - e. Audio/Video Intercom System.
 - f. Remote alarm
 19. Testing of all equipment installed.
- C. Provide and maintain in safe adequate condition all staging and scaffolding required for the proper execution of the work of this Section. All staging and scaffolding required for this work shall be provided by the security contractor for the first 8' in height. Staging and scaffolding which is beyond 8' in height shall be provided by the CM including the first 8'.
- D. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.
- E. Install client software at Devotion School for viewing of CCTV system.
- 1.04 RELATED SECTIONS
- A. Unless otherwise indicated, the following work is not included as part of the systems integrator's responsibilities in this SECTION, except for coordination, and is to be performed by others as indicated:
1. Surface mounted metal raceway will be provided by Electrical Sub-Contractor.

2. Empty conduits to accessible point above ceiling or below floor will be provided by Electrical Sub-Contractor.
3. Floor boxes and poke through devices will be provided by Electrical Sub-Contractor.
4. Standard device boxes with plaster rings for Integrated Electronic Security System will be provided by Electrical Sub-Contractor.
5. Interface with public utilities telephone service shall be arranged by the owner's service provider, and coordinated with this systems integrator.
6. Hardware: SECTION 087100 – DOOR HARDWARE
7. The installation, operating cost and maintenance of the controlled environmental conditions, for equipment located on site, as required by the manufacturer, NFPA 70B, or as specified in these specifications shall be the responsibility of the Construction Manager.
8. All required sleeves, J-Hooks, boxes and conduits for a complete and operational system shall be provided by the Electrical Sub-contractor.
9. Section 01 91 13 – General Commissioning Requirements.

1.05 DEFINITIONS

- A. Integrator: The "Integrator" is the IESS (Integrated Electronic Safety and Security) Systems Integrator who uses their own employees for performance of all construction activity related to their specified responsibilities, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform and the "Installers" must be certified, experienced and qualified to provide, install, program, troubleshoot, train, warrant and service all the systems in this section in their entirety.
- B. EIA - Electronics Industries Association
- C. TIA - Telecommunications Industry Association
- D. ANSI - American National Standards Institute
- E. TSB - Technical Systems Bulletin (EIA/TIA)
- F. SP - Standards Proposal (EIA/TIA)

1.06 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in their Section as most recently amended.
- B. EIA/TIA Building Telecommunications Wiring Standards:
 1. No. 568B Series - Telecommunications Wiring Standards
 2. No. 569A - Telecommunications Pathways and Spaces
 3. No. 606 - The Administration Standard for the Telecommunications Infrastructure
 4. No. 607 - Grounding/Bonding
- C. Materials and workmanship of the Integrated Security System shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following applicable.
 1. Commonwealth of Massachusetts Building Code
 2. Massachusetts Electric Code, 2017 Edition
 3. State Department of Public Safety
 4. NFPA 101 "Life Safety Code"
 5. NFPA 72 National Fire Alarm Code

6. NFPA Standards
7. Standards of the Underwriters Laboratories (UL)
8. Occupational Safety and Health Act (OSHA)
9. Americans with Disabilities Act (ADA)
10. Town of Harvard

1.07 SYSTEM DESCRIPTION

- A. Provide a complete working Integrated Electronic Safety and Security System as required by the Drawings and details and as specified herein. The complete system shall be provided and Integrated by security system and life safety service provider.

1.08 PERFORMANCE REQUIREMENTS

- A. Include GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS and applicable parts of Division 01 as part of this Section.
- B. Examine all Project Specifications and Drawings for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.

1.09 QUALIFICATIONS

- A. It is the sole intent of this section to ensure to the end-user, single source responsibility from a single qualified systems integrator.
- B. The Systems Integrator shall be experienced in the operations they are engaged to perform, trained, licensed, and factory certified.
- C. UL Compliance: The system supplied shall be listed by Underwriter's Laboratories. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.
- D. FCC Approval, the intrusion detection system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Provide the FCC registration number of the system being proposed as a part of the submittal process.

1.10 INTERPRETATION OF DRAWINGS

- A. All work indicated on the Drawings is intended to be correct to scale, but figures dimensions and detailed Drawings are to be followed in every case. The Drawings shall be taken in a sense as diagrammatic. Size of raceways and methods of running them are indicated, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered.
- B. Locations indicated on the Drawings are approximate and it is intended that all equipment shall be located in accordance with the general and detail Drawings of the construction proper. Coordinate the location, mounting heights and routing of cabling work with other trade's requirements and with field conditions, city electrician and engineer.
- C. All measurements shall be taken at the building before fabrication commences.
- D. Schematic diagrams shown on the Drawings indicate the required functions. Standard diagrams of the manufacturer may be used for the functions indicated without exact adherence to the Schematic Drawings shown. Work required for such deviations shall be provided.
- E. Items referred to in singular number in Contract Drawings shall be provided in quantities necessary to complete work.

- F. The right is reserved to make changes in locations of work prior to rough-in at no additional cost.
- G. Where Drawings or Specifications conflict or are unclear, advise the Architect, in writing, before Award of Contract. Otherwise, interpretations of Contract Documents by the Architect shall be final, and no additional compensation shall be permitted due to discrepancies or unclarities resolved according to the Architect's interpretation.
- H. It is the intent of these Contract Documents to have systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the Installer has failed to notify the Architect, in writing, of the situation prior to Contract Award, the Installer shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.

1.11 MATERIAL AND EQUIPMENT STANDARDS

- A. Materials shall be new, unused, of recent manufacture, not previously installed, full weight, standard, the best quality of its kind and acceptable to the Architect.
- B. Provide NRTL listed or labeled products whenever there are NRTL standards, listings or labeling available for that product category.
- C. The Specifications or notes and description following a catalog number is basically to identify the item, but may also call for accessories, options or modifications which are not indicated in the catalog number.
- D. Provide products of one manufacturer for each classification of equipment.

1.12 WARRANTY

- A. Provide three (3) year Warranty, warranty shall start at time of substantial completion. Any failure due to defective material, equipment, installation or workmanship which may develop, shall be corrected at no expense to the Owner including all materials, labor, travel, expenses, system diagnostics and damage to areas, materials and other systems resulting from such failures.
- B. Manufacturers shall provide replacement warranties for material and equipment furnished under this Section. Such warranties shall be in addition to and not in lieu of all liabilities which the Manufacturer and the Installer may have by law or by provisions of the Contract Documents.
- C. Include copies of all warranties, maintenance contracts and training contracts or performance bonds in the Operation and Maintenance Manuals.

1.13 MAINTENANCE

- A. Provide installers maintenance contract, for a period equal to warranty.

1.14 CERTIFICATES OF APPROVAL

- A. Upon completion of all work, and as a condition to receiving payment at Substantial Completion, furnish to the Architect the following original signed certificates and include copies of these certificates as part of the Operation and Maintenance manuals: (Provide 3 copies of O & M Manuals).
1. Certification from the manufacturers authorized representative stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be installed in accordance with the manufacturer's requirements, all requirements for manufacturer's warranties are complied with, and equipment are within factory tolerances. This certification shall be provided for each piece of major equipment and for all complete systems. Provide certificate for additional items requested by the Architect.
 2. Certificates of inspection, letters or notices from the appropriate governmental authorized inspection authorities stating that all portions of the work (indicate trade and responsibility) have been inspected and are installed in conformance with the applicable codes, laws, ordinances and referenced standards. If non-conformance notices are received, include the re-inspection certificate, letter of explanation, etc. as required to indicate complete conformance. Provide written evidence of all exceptions or variances given by the AHJ.
 3. Certificate from the installing firm responsible for the work (indicate trade and responsibility) signed by an authorized Officer of the firm and the Foreman or Project Manager in charge, indicating trade license numbers and stating that to the best of the signer's knowledge and belief that the project (indicate project name and address) has been installed in compliance with the Contract Drawings, Specifications and Addenda, and all applicable codes, laws, ordinances and referenced standards. Where sub-contractors perform a portion of the work of this Section include certificates from them.

1.15 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Give detailed instructions, prior to the Substantial Completion of the work, to the responsible personnel designated by the Owner in the operation and maintenance of all work installed under this Section. A letter with two copies containing the name of the person or persons to whom the instructions were given and the dates of the instruction period shall be submitted to the Architect at the completion of the project.
- B. Prepare three sets of Owner and Maintenance containing Manufacturer's catalogs, other similar data including the necessary photographic equipment cuts, wiring diagrams and final reviewed Shop Drawings and Product Data covering all equipment and devices furnished or installed under this Section. These manuals shall provide complete instructions for the proper operation and use of the equipment together with instructions for lubrication and periodic maintenance and for trouble shooting. Operating instructions shall be specific for each system and shall include copies of posted specific instructions. This manual shall contain only that information which specifically applies to this project and all unrelated material shall be deleted or clearly crossed out.
- C. Submit a valid certificate of completion of installation and service training on the latest up-to-date version of the manufacturer's equipment being provided from the security system (or systems) manufacturer (s) for at least two (2) present employees of the installer
- D. Include copies of all test reports and certifications.

1.16 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Diagrams for cable management system.
 - 2. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
 - 3. Wiring Diagrams. For power, signal, and control wiring. Show typical wiring schematics including the following:
 - a. Workstation outlets, jacks, and jack assemblies.
 - b. Patch cords.
 - c. Patch panels.
 - 4. Cable Administration Drawings: As specified in "Identification" Article.
 - 5. Battery and charger calculations for central station, workstations, and controllers.
- C. Samples: For workstation outlets, jacks, jack assemblies, and faceplates. For each exposed product and for each color and texture specified.
- D. Other Action Submittals:
 - 1. Project planning documents as specified in Part 3.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Microsoft Windows software documentation.
 - 2. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
 - 3. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
 - 4. System installation and setup guides with data forms to plan and record options and setup decisions.

1.17 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.
- B. Source Limitations: Obtain central station, workstations, controllers, Identifier readers, and all software through one source from single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Comply with NFPA 70, "National Electrical Code."
- E. Comply with SIA DC-01, SIA DC-03 and SIA DC-07.

1.18 HOISTING EQUIPMENT AND MACHINERY

- A. Unless otherwise specified, all hoisting and rigging equipment and machinery required for the proper and expeditious prosecution and progress of the Work of this Section shall be furnished, installed, operated and maintained in safe condition by the CM, as specified under Section 011000, GENERAL REQUIREMENTS.

1.19 STAGING AND SCAFFOLDING

- A. Unless otherwise specified, the CM shall provide all lifts and man-lifts, and furnish, erect and maintain in safe condition, all staging and scaffolding over 8 ft. in height, including the initial 8 ft. in height, as needed for proper execution of the work of this Section. Staging and scaffolding shall be of adequate design, erected and removed by experienced stage builders having all accident prevention devices required by Federal, state and local laws.
 - 1. The security contractor shall be responsible for his own scaffolding 8 ft. and under, as specified under Section 011000, GENERAL REQUIREMENTS.

1.20 COMMISSIONING

- A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 019113 – General Commissioning Requirements.
- B. Complete installation and startup checks and functional tests according to Section 019113 – General Commissioning Requirements and manufacturers written instructions.
- C. Operational Test: After electrical system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the startup procedure.
- D. Verify that equipment is installed and commissioned as per requirements of Section 019113 and manufacturers written instructions/requirements.

PART 2 - PRODUCTS

2.01 SYSTEM CABLING

- A. Provide and terminate all cabling per manufacturers recommendations for a completely operational system as specified.
- B. CCTV System Cabling, provide & terminate all cabling as required for a completely operational CCTV System as required by equipment manufacturer.
 - 1. CCTV Camera Cabling:
 - a. CAT 6A cabling shall be provided for each CCTV camera location.
 - b. Provide CAT 6A patch cabling as required between patch panels and POE switches at
 - c. each IDF/MDF location and at camera locations.
 - d. Power cabling for exterior devices shall be 12 gauge 2 conductor, provide applicable gauge per applicable distances.
 - e. Provide all line cords as required, field measured for proper length.

- f. Provide any additional cabling as required per manufacturer's specifications.
2. Telephone Line interface; provide and terminate a Cat 6A cable between security system headend and the MDF/Demarc.
- C. Intrusion Alarm System Cabling, provide & terminate all cabling as required for a completely operational Intrusion Alarm System as required by equipment manufacturer.
1. Key Pad: The control station shall be connected to the control/communicator with #18 AWG, unshielded, 4-wire cable and have a maximum of 1000 feet between the control/communicator and the control station.
 2. The Electrical Sub-Contractor shall provide 120VAC duplex outlet at the Intrusion Alarm System Controller location.
 3. Multiplex Loops: Provide #18 AWG four conductor cable for loops up to 2000 feet, provide #18 AWG four conductor cable for loops up to 5000 feet. Do not use twisted pair or shielded cable for multiplex bus wiring loops. Cable shall be as required by the equipment supplier.
 4. Audible Devices, provide a minimum #14 AWG four conductor cable.
 5. Telephone Line interface, provide and terminate a Cat 6A cable between the Intrusion Alarm System Controller and the MDF/Demarc.
- D. Cabling for Access Control System, provide & terminate all cabling as required for a completely operational Access Control System as required by equipment manufacturer.
1. EL = Door Lock Device; provide & terminate cabling between EL and associated Power Supply and between Power Supply and associated ACC. Electrical Sub- contractor shall confirm power supply location with installer. Electrical Sub-contractor shall provide 120VAC outlet and power supply backbox at power supply location. EL furnished and installed by door hardware, associated EL Power Supply furnished by door hardware provider, installed and wired by systems integrator. EL may be an Electronic Door Strike, Magnetic Door Lock, etc., see Architect for details.
 2. CR/KP = Door Reader Device; provide CR/KP, provide and terminate cabling to associated ACC. The cable requirements of the card reader shall be a minimum five.
 3. (5) conductor, 22 AWG, stranded cable with overall shield (for a Wiegand protocol interface). A six (6) conductor cable is required when controlling the red and green LED individually. A seven (7) conductor cable is required when both the red and green LED's are controlled by the Host. A 22 AWG twisted pair, shielded, stranded cable is required for use of the tamper switch. The card reader shall be provided with a 10 wire pigtail connector.
 4. ALM = Alarm Line Module; provide ALM, provide & terminate cabling to associated Door Contact, and ACC. ALM mounts within J-Box at door location.
 5. DC = Door Contacts (recessed in door/frame); DC furnished, installed and wired by systems integrator, provide & terminate cabling to associated ALM (Alarm Line Module).
 6. ACC = Access Control System Controller.
 7. ACS = PC & Monitor for Access Control System.
 8. Fire Alarm System interface.
 - a. Provide and terminate cabling between applicable electronic door lock power supplies and the fire alarm system headend. Terminations to fire alarm control panel by fire alarm contractor.
 - b. Provide and terminate cabling between access control system headend and the fire alarm system headend. Terminations to fire alarm control panel by fire alarm contractor.
 - c. Cat 6A cable between the Access Control System and the MDF/Demarc.

2.02 EQUIPMENT CABINETS

- A. Provide equipment cabinets to house all security equipment, communication equipment, telephone/data equipment, and audio visual equipment. Racks shall be located as shown on the drawings.
- B. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following Manufacturers or equal:
1. Chatsworth, Great Lakes.
 2. Winsted
 3. Lowell
 4. Or equal.
- C. Equipment Cabinets
1. Equipment Cabinets shall be seven feet (2134 mm) high, 24 inches (600 mm) wide, 31.5 inches (800 mm) deep, free standing cabinets as indicated on the drawings. These cabinets are also known as Primary Distribution cabinets, Remote Distribution cabinets, CCTV cabinets, AV cabinets, etc. Cabinet features shall include the following:
 2. Cabinets shall be welded construction, steel or aluminum, piano hinged doors with keyed locks and access handles on front and rear. Door locks shall be keyed alike. Color shall be approved by the Architect. Front door shall have integral shatter proof vision panels in a metal frame.
 - a. Integral EIA nineteen inch (518 mm) wide, open bay equipment rack. Rack shall be as described herein this specification. Rack shall be located within the cabinet in order to properly mount all passive and active electronic components.
 - b. Shelves for electronic equipment with load carrying capacity to support at least 125 percent of each piece of electronic equipment weight. Shelves shall have adequate openings within them to dissipate heat and allow for adequate electronic equipment ventilation.
 - c. Mounting brackets specifically designed to support the equipment installed within the cabinet.
 - d. Hook and loop (Velcro) cable strain relief system on rear of rack to support horizontal and backbone cables. Tie-wraps are specifically prohibited.
 - e. Hook and loop (Velcro) horizontal and vertical cable management on front of rack to support patch cable and cross connect wiring. Tie-wraps are specifically prohibited.
 - f. Hook and loop (Velcro) cable management system independent of telecommunications cabling management to properly dress the electronic equipment power cords through the cabinet maintaining as much clearances between the two as possible. Tie-wraps are specifically prohibited.
 - g. Cabinets are to be design for convection ventilation, no fans shall be used. The individual cabinet shall have adequate ventilation in order to have a temperature within the cabinet be no greater than 88 degrees F based on an ambient room temperature of 78 degrees F in the warmer months of the year and 68 degrees F in the colder months of the year.
 - h. Bonding and grounding cables for all equipment not directly bolted to equipment rack (i.e shelf mounted electronic equipment, etc.).
 - i. Bonding and grounding buss bar with individual set screw terminals for at least six #6 Cu. bonding cables.
 - j. Surge protected power strip as described in this specification.
 - k. Patch panels as described in this specification.
 - l. Blank/louvered panels where required to fill gaps between equipment within the rack.
 - m. All hardware, supplementary steel, channel and supports as required to properly assemble the cabinet and support it to the building structure.

2.03 SURGE PROTECTED POWER STRIP

- A. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following Manufacturers:
1. Wiremold Sentrex, TrippLite, S.L. Weber or equal.
- B. Surge protected power strip shall be rack mount type with 10 ft. cord.
- C. Surge protected power strip with six NEMA 5-15R outlets 15 amp capacity, 120 volts, UL 1449 listed, maximum surge current of 33,000 amps, clamping voltage of 260 volts, maximum 5 picosecond response time, resettable overload circuit breaker, surge suppression warning light, surge protection for line to neutral, line to ground, neutral to ground, EMI/RFI filters. One required for each load up to 1200 watts (total of individual equipment loads).

2.04 CABLE SUPPORTS

- A. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following manufacturer's:
- | | |
|--------------------------------------|--|
| J-Hooks: | Caddy, Chatsworth, Mono-System, or equal. |
| Hook and Loop Fasteners: | Chatsworth, Ortronics, Siemons, or equal. |
| Cable Ties: | DEK, Panduit, Amp, 3M, T&B, or equal. |
| Beam Clamps: | Burndy, Minerallac, Kindorff, Steel City, OZ/Gedney, or euqal. |
| Split Mesh Strain Reliefs (Kellums): | Hubbell, Woodhead, or equal. |
- B. J-Hooks shall be sized to correctly support the number of cables, which pass through them. Under no circumstances shall cable quantity exceed 50 in any given support. Fill capacity shall be as required by code for conduit. That is to say that every J-Hook shall have a maximum of 40 percent fill capacity. Install additional supports as required.
- C. Hook and loop fasteners shall be designed for their specific application. For example, if a hook and loop fastener is used to support cables to a rack, it shall have a grommated outlet for use with a 10-32 rack mounting screw.
- D. Cable-ties shall be correctly sized to support the quantity and types of cables installed.
- E. Beam clamps shall be steel with threaded bolt type closure. Spring steel or "quickclip" type clamps are prohibited.
- F. Split mesh strain reliefs shall be properly sized for each cable that they support. Only one cable shall be installed in each split mesh strain relief.

2.05 BONDING AND GROUNDING JUMPER CABLE

- A. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following manufacturers:
1. Belden (No. 8669) or equal.
- B. Jumper cable shall be hollow braided, 60 amp capacity, copper.
- C. Provide equal conduct of as described in "B" above for aluminum equipment.

- D. Jumpers shall have compression or exothermic type terminals on both ends of cables. Terminals shall be compatible with jumper cable material and equipment material in order to not have any degenerative reaction.

2.06 UNSHIELDED TWISTED PAIR (UTP) CABLING SYSTEMS

- A. Provide all security data cabling as specified herein and shown on the Security drawings. The security cable and jacks shall be red in color.
- B. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following manufacturer's or equal:
 - Wire and Cable: Belden, Berk-Tek, CommScope, General Cable, Mohawk, or equal.
 - Patch Panels: Hubbell, Ortronics, Panduit, or equal
 - Patch Cables: Shall be provided by patch panel, Outlet or wire and cable manufacturer.
 - Cable Management: Shall be provided by patch panel manufacturer.

NOTE: Each of the products listed above shall be provided by a single manufacturer.
- C. UTP Pin/pair Termination Assignment
 - 1. The UTP cabling systems shall have EIA/TIA 568B Series standard pin/pair termination assignment. All conductors provided shall be properly and consistently terminated at both ends throughout the entire systems.
- D. Horizontal Cable –Security Data
 - 1. Provide & terminate cabling from each camera location to applicable IDF/MDF/Low Voltage rack locations.
 - 2. Data Cable shall be TIA/EIA-568-B.2-1 Category 6A Unshielded Twisted Pair (UTP) as specified.
 - a. Cable shall meet or exceed the approved TIA/EIA-568-B.2-1 Category 6A Unshielded Twisted Pair (UTP) cable standard for 24AWG four pair Category 6A cable.
 - b. Acceptable equal cables shall be General Cable Command LINX 6; and GenSPEED 6000 Category 6A cables.
 - c. Plenum rated cable - CMP rated jacket for Plenum applications.
- E. Cable Management
 - 1. Each equipment rack and equipment cabinet shall have cable management panels with horizontal and vertical brackets.
 - a. Cable management shall be EIA 19 inch (518mm) rack mounted 3.5 inch (88mm) high panel with horizontal and vertical patch cable, distribution rings, or approved equivalent and shall be provided above and below each patch panel in the equipment rack.
 - b. Equipment rack cable management shall be furnished by patch panel manufacturer.
 - c. Cable management for high density, IDC Type cross-connect block panels shall be distribution rings integral to the panel or approved equivalent. Cable management shall be provided above and below each cross connect block in the equipment rack.

F. Modular Jacks

1. Jacks shall be TIA/EIA Category 6A (UL Category 6A) with printed circuit board technology and integral board mounted, color-coded, high density, IDC type terminations. Provide 8 position modular jacks. Keyed jacks are not allowed. Jacks shall be able to withstand at least a minimum of 2000 mating cycles without any transmission degradation.
2. Modular jacks color shall be red.
3. Each 8-position modular jack shall have color-coded icons.
4. Modular jacks that allow pre-connectorized cables to be connected to the jacks are specifically prohibited. Cables shall have single point IDC Type connection to the jacks only.
5. Jack modules shall be flame retardant thermoplastic with integral cable strain relief. Color shall match faceplate.

G. Data Patch Panels for Security

1. Patch panels shall be EIA nineteen inch (518mm), rack mounted, TIA/EIA Category 6A, UL Category 6A type patch panels with integral printed circuit board, color-coded, high density, IDC type terminations and 8 position modular jacks. Keyed jacks are not allowed. Jacks shall be able to withstand at least a minimum of 2000 mating cycles without any transmission degradation.
2. Provide high density rack mounted patch panels.
3. Modular Jacks that allow pre-connectorized cables to be connected to the jacks are specifically prohibited. Cables shall have single point IDC type connection to the jacks only.
4. Each port shall have color-coded identification label. Continuous label strips for multiple in-line ports are acceptable. Silk screened identifiers "1" through "96" are acceptable.
5. Patch panel shall have horizontal strain relief bar on mounted rear.
6. Data Port Labeling Standard
 - a. <Closet>-<Patch Panel>-<Cable Purpose><Patch Panel Port Number>
For Example: 3330-B-D43, This signifies that IDF Room 3330 Panel B on Data Patch Panel port 43

H. Patch Cables and Line Cords

1. Patch cables and line cords shall be factory pre-connectorized, TIA/EIA Category 6A (UL Category 6A), 4 UTP, 8-position modular jack, stranded conductors. Patch cables and line cords shall be able to withstand at least a minimum of 2000 jack mating cycles without any transmission degradation.

I. Cross Connect Cabling

- J. Cross-connect cabling shall be NRTL certified that it meets or exceeds the TIA/EIA UL category rating of the system installed.

2.07 INTEGRATED ELECTRONIC SECURITY SYSTEM, IESS

A. Overview

1. The IP Integrated Electronic Security System shall be a truly integrated platform in terms of both hardware and software. This means that the software shall be an all inclusive package with only one application necessary to view and operate the IP CCTV cameras as well as the access control system and intrusion system. Video badging integration and graphic map GUI shall be included. Any system that requires the operator to use multiple programs on the same workstation will not be acceptable. The system specified is based upon Genetec. The school district currently utilizes Genetec this system will be an extension of the existing district wide IESS System.
2. All systems referenced below shall be connected to a stand alone, dedicated security network as provided by the Security Contractor.
 - a. Unified IP CCTV Video
 - b. Access control network controllers and associated items.
 - c. Addressable Intrusion Alarm System
 - d. Servers and Workstations
 - e. Network Electronics
3. Manufacturers: Genetec is the Basis of Design.
 - a. Genetec Security Center with Omnicast Enterprise, S2 and Lenel
 - b. Or equal
4. The Installing Contractor shall meet all qualifications as defined within this specification.
5. Integration between the IP Video, Access control and Intrusion alarm system is defined as follows:
 - a. Each door contact, motion detector, panic button, shall be individually annunciated on the Unified Security Platform GUI.
 - b. The ACS shall support integration with the IP Video Surveillance System. Integration with the IP video surveillance system shall permit the user to view live and recorded video from one GUI and one single window. The same GUI shall be utilized for both the access control solution and the specified video surveillance solution. Switching from one application or GUI to another shall not be acceptable as well as utilizing two applications simultaneously to achieve the functionality specified is not allowed.
6. Access Control System Lockdown, Duress Functions and Shelter In Place
 - a. System shall be capable of programming the following features:
 - 1) Lockdown: Example of features that may be used:
 - a) Access Controlled Doors that are normally open (no credential needs to be presented to the card read) are secured (an employee must present their credential to the card reader).
 - b) Specific readers can be engaged (doors to interior office areas, all exterior doors secure, etc.)
 - c) Only specific credentials would be accepted by a card reader to unlock.
 - 2) Duress
 - d) Ensure a safe and effective manner of alerting onsite security personnel and staff members of an emergency (ie. medical emergency, irate parent or staff members, etc)
 - e) Deliver accurate indoor positioning data at the exact location of the individual in need of assistance.
 - 3) Shelter In Place

B. VIDEO STORAGE PARAMETERS

1. The quantity of TB and archivers shall be based on the following requirements.
 - a. 45 days of storage
 - b. 15 frames per second per camera
 - c. Max resolution each camera can support. Include additional future 25 cameras in storage capacity.
 - d. Record on motion at 12 hours per day of motion
 - e. Video storage servers shall be HP or approved equal.

C. HARDWARE AND SOFTWARE REQUIREMENTS

1. Unified Security Platform (USP)
 - a. Connection to IP based, network connected controllers in the field Customized views of the system based on an operator's access privileges.
 - b. Each workspace on the computer workstation shall be created and defined in terms of devices- gateways, sites, doors, and relays - and is configured to
 - c. Identify what areas of the system the operator can access and view, such as desktop display and card fields.
 - d. Up to five cards to any employee to avoid having to create five different entries in the system. Access levels can also be applied to ensure cardholders have access only to authorized areas.
 - e. Include a web interface for remote access to create, modify, and delete cardholders; and to export cardholder lists without the use of additional workstations. Ability to assign an access level to cardholders, manage access levels and schedules, manually operate doors, relays, and inputs, view last card transactions, receive reports securely by email, view live events in real-time or export in csv format and integrate and display live video from IP cameras, NVRs, etc. using WebViews.
 - f. Include the ability to have the access control information available on a mobile (smartphone or tablet) platform. Manage/create cards, lock/unlock doors and run reports using this app.
 - g. Include a graphical user map with camera and door icons available for migration into this utility.
 - h. Integrate IP CCTV cameras into this platform for camera callup, monitoring and playback. Camera callup by icon on the graphic map.
 - i. View and communicate with each remote audio/video intercom station.
 - j. Include a minimum of (2) TB of storage within the Microsoft Azure Cloud.
 - k. Include a video vault feature for storing video on all associated cameras for future camera callup of alarm or linked events.
 - l. Integrate the intrusion panel shown on the drawings to allow the system to receive intrusion events such as status of zones/devices, as well as manage partitions and user codes. The system software shall permit arming/disarming by partition via reader or manually.
 - m. The access control system shall be able to be rolled out on a district wide basis utilizing the same software platform and shall be able to have other remote sites connected to it on the same network.
 - n. Provide control relays as required for elevator integration.
 - o. Baseline software shall include: Five additional workstation licenses, five web station licenses. Additional multi-site and gateway licenses shall be available.
 - p. Provide additional Omnicast Enterprise and Synergis licenses to support all cameras/doors as required. Provide with SMA.
 - q. Provide Genetec Sipelia as required to support all audio devices as shown.
 - r. Provide DMP intrusion integration license.

2. System Controllers.
 - a. Ethernet 8 door controller which shall support 8 readers and expand inputs, outputs and relays with the addition of expansion modules.
 - b. Onboard Ethernet 128 bit AES encrypted communication.
 - c. Includes an anti-passback feature.
 - d. 100,000 card capacity and provisions for 20,000 concurrent events in stand-alone mode.
 - e. Supervised door lock outputs with internal or external power supply.
 - f. Battery supervision and monitoring.
 - g. 10/100 Base-T Ethernet port
 - h. Built in Web Configuration
 - i. Compatibility with weigand, proximity, ABA clock and date, bar code, magnetic, integrated keypad, smart card readers.
 - j. Provide Genetec Sy series panels with Cloudlink.
3. Elevator Controller.
 - a. Provide control relays as required to interface to the elevator controller. Provide (1) relay per floor, per elevator.
 - b. Battery supervision and monitoring.
 - c. 10/100 Base-T Ethernet port
 - d. Compatibility with weigand, proximity, ABA clock and date, bar code, magnetic, integrated keypad, smart card readers.
 - e. Provide Genetec Sy series panels with HID V-series boards and Cloudlink.
4. Access Control Server
 - a. Connect to existing server and existing database.
5. Video Directory Server
 - a. Connect to existing Directory Server. Provide camera and client licenses as required, plus 25 future camera licenses.
6. Video Archive Servers.
 - a. Windows Server 2016 OS with 5 calcs.
 - b. Intel® E3-1240 v5 processor
 - c. 16GB RAM.
 - d. (2) 1TB 7200RPM SAS mirrored hard drives in a RAID1 configuration for OS.
 - e. Provide long term storage as required to meet storage parameters as defined herein. All drives must be configured as RAID5.
 - f. DVD-ROM drive
 - g. 10/100/1000 NIC card
 - h. Gold level support with 3-year warranty and support plan.
 - i. Redundant power supplies.
 - j. Provide HP Servers (Proprietary) or approved equal.
7. SIP based AV Intercom (Sipelia) Server.
 - a. Windows Server 2016 OS with 5 calcs.
 - b. Intel® E3-1240 v5 processor
 - c. 16GB RAM.
 - d. (2) 1TB 7200RPM SAS mirrored hard drives in a RAID1 configuration
 - e. DVD-ROM drive
 - f. Dual 10/100/1000 NIC card
 - g. Gold level support with 3-year warranty and support plan.
 - h. Redundant power supplies.
 - i. Provide HP Servers (Proprietary) or approved equal.

8. Security Control Workstation (Client)
 - a. Provide security workstations with the following specifications. Provide a UPS with battery backup for 10 minutes for each workstation. The security control workstation shall be used for the USP.
 - 1) Intel Xeon Processor E5-1607 (Four Core, 3.0 GHZ, 10M) or higher.
 - 2) Microsoft Windows 7/8 Professional.
 - 3) 8GB RAM
 - 4) 200 GB of storage or more.
 - 5) NVIDIA Quadro NVS 510, 2GB, QUAD MON, 4 MDP or better. Provide with quad monitor card.
 - 6) 1280x1024 or higher screen resolution
 - 7) 10/100/1000 Ethernet Network Interface Card
 - 8) 16x DVD/RW Drive
 - 9) Energy Star qualified.
 - b. Provide a 27 in. LCD monitor with each workstation.
 - c. Provide Dell Precision T3600 series or approved equal.
 - d. Provide a minimum of one.

9. System Setup Workstation (head end rack)
 - a. Provide a rack mounted workstation to configure and manage all servers.
 - b. Provide with KVM extender.
 - c. Provide a 17 in. LCD monitor.
 - d. The workstation shall have a USB port and keyboard.
 - e. Provide one KVT-317A or approved equal.

10. Core and Edge Network Switch
 - a. Provide Power over Ethernet (PoE) network switch(s) for all cameras, access control panels, encoders/decoders, security workstations, video servers, and access control servers.
 - b. Each switch shall have 20 percent spare capacity per closet/IDF/MDF.
 - c. Each closet shall support 10/100mbs per port with a minimum of 1000GB on the back bone/core switch. The fiber infrastructure shall be only utilized for connectivity from each IDF to the MDF/core switch. The use of any portion of the copper back bone shall not be allowed.
 - d. Provide a layer 3 core switch which shall support each IDF/remote security closet with 1000gbs bandwidth over the fiber infrastructure. In addition to the support of each closet, provide a dedicated 1000gbs for each server (access control and video). Provide 20 percent 1000gbs copper ports and 20 percent spare 1000gbs fiber ports at the core switch/head end.
 - e. PoE network switches must support by same manufacturer a redundant power supply option. Though not a requirement at this time, proposed network switches must have this option without replacement of network switches.
 - f. Provide Uninterruptible Power Supply (UPS) for each closet/IDF/MDF to support the network PoE Switches. Provide a 1500VA UPS in each rack that houses security equipment. Each network switch shall be located in each IDF/MDF as required by the integrator.
 - g. Provide HP Aruba 5400R series (no substitutions allowed) or approved equal for the core switch in MDF. Provide fiber GBIC cards and module as required to support each IDF and/or security closet as shown on the drawings and riser diagram.
 - h. Provide HP Aruba 2930M series (no substitutions allowed) for each edge switch. Each switch shall include a minimum of one (1) fiber GBIC card and module.
 - i. Provide an interface to the owner's LAN as required.

11. Interior Fixed Megapixel Vandal Dome Camera
 - a. Provide cameras with the following specifications for all indoor fixed cameras as shown on the drawings.
 - 1) H.264, MJPEG video compression.
 - 2) Onvif compliant.
 - 3) A minimum of 2 Megapixel resolution
 - 4) Day/night capable.
 - 5) Motion detection.
 - 6) IK10 rated housing.
 - 7) Wide Dynamic range sensor.
 - 8) 3mm – 9mm varifocal lens.
 - 9) RJ-45 Ethernet Port.
 - 10) PoE powered.
 - 11) Provide Axis P3365-V or approved equal.

12. Exterior Fixed Megapixel Vandal Dome Camera
 - a. Provide cameras with the following specifications for all outdoor fixed cameras as shown on the drawings.
 - 1) H.264, MJPEG video compression.
 - 2) Onvif compliant.
 - 3) A minimum of 5 Megapixel resolution
 - 4) Day/night capable.
 - 5) Motion detection.
 - 6) IK10 rated housing.
 - 7) Wide Dynamic range sensor.
 - 8) 3mm – 9mm varifocal lens.
 - 9) RJ-45 Ethernet Port.
 - 10) PoE powered.
 - 11) Provide Axis P3367-VE or approved equal.

13. Exterior PTZ Megapixel Dome Camera and Housing
 - a. Provide PTZ cameras with the following specifications for all outdoor PTZ cameras as shown on the drawings.
 - 1) Image sensor: 1/2.3" progressive scan, 8.0 megapixels
 - 2) Pan: 360 deg. endless, Tilt +20 to -90deg., 12x optical zoom, 12 x digital zoom, total 144x zoom
 - 3) Day and Night
 - 4) Shutter time: 1/10000s to 1s
 - 5) Resolution: 3840x2160 Ultra HD
 - 6) Video compression: H.264 and Motion JPEG
 - 7) Frame rate per camera: 50/60fps at 1080p; 25/30 fps @4K
 - 8) Video streams: Multiple, individually configurable
 - 9) Audio streaming: Two-way
 - b. The power source shall be high powered Power over Ethernet (IEEE 802.3af).
 - c. Provide Axis Q6128-E PTZ Dome Network Camera or approved equal. Provide with appropriate mounting bracket.

14. Interior/Exterior Multi-head dome camera
 - a. Provide Arecont Vision AV12176DN or equal for interior multi-head cameras as shown on the drawings. Cameras which have a single imager and therefore require dewarping will not be acceptable. The contractor may utilize 4 separate cameras each with 3 megapixel imagers for a total of 12MP.
 - 1) The lens shall be selected based on the location of the camera and desired field of view. This should be documented in the submittals.

- 2) The AV12176DN SurroundVideo® series network camera is WDR (Wide Dynamic Range), dual encoder (H.264 & MJPEG), 12 Megapixel resolution, Omn-Directional Day/Night IP camera, designed to provide an all-in-one solution with four integrated 3-Megapixel WDR sensors, IK-10 vandal resistant dome and housing, rated IP66 for water and dust protection, to use camera for indoor and outdoor applications.
 - 3) The AV12176DN is a PoE (IEEE 802.3af) compliant Day/Night camera, featuring WDR, PSIA compliance, privacy masking, extended motion detection and flexible cropping.
 - 4) Built with Arecont Vision's proprietary massively-parallel MegaVideo® technology, the AV12176DN has the ability to output multiple image formats allowing simultaneous viewing of the full resolution field of view and regions of interest for high definition forensic zooming.
 - 5) Binning technique improves low-light performance, increases sensitivity and produces better SNR by combining and averaging pixels. This camera offers over ten times the resolution of standard-resolution IP cameras with the ability to output full real time frame rates.
- b. Hardware
- 1) The camera shall have three configurations: AV12176DN-28 (4x 2.8mm M12 lenses), AV12176DN-08 (4x 8.0mm M12 lenses), AV12176DN-NL (no lenses, ordered separately).
 - 2) Lens options shall include the following IR corrected, F1.6, M12 lenses : 2.8mm, 4.0mm, 6.0mm, 8.0mm, 12.0mm, 16.0mm.
 - 3) The camera shall utilize four high sensitivity 3-Megapixel WDR CMOS sensors with 1/3.2" optical format, progressive scan and Active Pixel Count: 2048(H) x 1536(V) pixel array
 - 4) The camera shall integrate four 2.8mm M12 megapixel IR corrected lenses, 1/3.2", F1.6, Horizontal Field of View of 88°. (AV12176DN-28)
 - 5) The camera shall integrate four 8.0mm M12 megapixel IR corrected lenses, 1/3.2", F1.6, Horizontal Field of View of 33°. (AV12176DN-08)
 - 6) The camera shall have die-cast aluminum chassis with IK-10 vandal resistant dome. Entire enclosure to be rated minimum IP66 for water and dust protection.
 - 7) The camera shall have four individually adjustable 2-axis camera gimbals with 360° pan and 90° tilt for easy and accurate positioning.
- c. Imaging
- 1) The camera shall combine four image sensors for a user configurable field of view.
 - 2) The camera shall allow for multiple lens options for a user configurable field of view.
 - 3) The camera shall have dual standard compression support with simultaneous streaming of both H.264 and MJPEG formats.
 - 4) Each sensor of the camera shall feature automatic exposure, automatic multi-matrix white balance, shutter speed control to minimize motion blur, programmable resolution, brightness, saturation, gamma, sharpness and tint.
 - 5) The camera's shutter speed shall be 1ms - 500ms.
 - 6) The camera shall feature selectable 50/60 Hz flicker control, windowing, simultaneous delivery of full-field view and zoomed images at video frame rate, instantaneous electronic zoom, pan and tilt, and electronic image rotation by 180 degrees
 - 7) The camera shall have multi-streaming support of up to 8 non-identical concurrent streams (different frame rate, bit rate, resolution, quality, and compression format).
 - 8) The camera shall have wide dynamic range up to 100 dB and a maximum SNR of 51 dB

- 9) The camera shall have privacy masking, the ability to select multiple regions of an arbitrary shape to block the video. The camera shall have extended motion detection grid, a higher granularity grid of 1024 distinct motion detection zones. User can select between 64 zone based motion detection and extended motion detection to provide backward compatibility with the existing Video Management System (VMS) integration. This feature shall support RTP, HTTP and TFTP protocols, as well as the on-camera web interface.
 - 10) The camera shall feature streaming of the full field of view (FOV) and simultaneous multiple regions of interest (ROI) for forensic zooming.
 - 11) The camera shall provide 21 levels of compression quality for optimal viewing and archiving.
 - 12) It shall be possible to program the camera in binning mode to output lower resolution images: i.e. 4096(H) x 768(V) pixels (1/4 full resolution) at 17 FPS.
 - 13) The camera shall provide flexible cropping (Resolution windowing down to 1x1 pixels for JPEG and 2x2 pixels for H.264)
 - 14) The camera shall be able to save bandwidth & storage by running at 1/4 full resolution
 - 15) The camera shall feature MoonLight™ mode - extended exposure and noise cancellation
 - 16) The camera shall be able to support Picture-in-Picture: simultaneous delivery of full field of view and zoomed images
- d. Video
- 1) Video frame rate (up to):
 - f) 5.2FPS @ 8192x1536
 - g) 17 FPS @ 2048x1536
 - 2) Video frame rate in binning mode up to:
 - h) 17 FPS @ 4096x768
- e. Protocols
- 1) The camera shall have Real Time Streaming Protocol (RTSP) support allowing for compatibility with media players such as Apple QuickTime, VLC Player and others.
 - 2) The camera shall support both unicast and multicast communication protocol.
 - 3) The camera shall support RTSP, RTP over TCP, RTP over UDP (Unicast/Multicast), HTTP1.0, HTTP1.1, TFTP
 - 4) 100 Base-T Ethernet Network Interface
 - 5) Multi-streaming: 8 non-identical streams (2 active connections to each sensor)
- f. Electrical
- 1) General purpose opto-coupled input and output
 - 2) Power over Ethernet (PoE): PoE 802.3af
 - 3) Auxiliary Power 12-48V DC, 24VAC
 - 4) Power consumption: PoE – Class 3; auxiliary- 14W max
- g. Networking
- 1) The camera shall be equipped with a 100 Mbps LAN connector
- h. Environmental
- 1) Operating temperature -40°C (-40 °F) to +50°C (122 °F)
 - 2) Stable image temperature 0°C (32 °F) to +50°C (122 °F)
 - 3) Storage temperature -40°C (-40 °F) to +60°C (140 °F)
 - 4) Humidity 0% to 90% (non-condensing)
- i. Illumination
- 1) Color (non-binning): 0.5 Lux @ F2.0
 - 2) Color (binning): 0.25 Lux @ F2.0
 - 3) B/W: 0 Lux, IR sensitive (with additional IR light source)

- j. Compatible Accessories
 - 1) AV-WMJB – Wall Mount w/ Junction Box
 - 2) AV-PMJB – Pendant Mount w/ Junction Box
 - 3) AV-CRMA – Corner Mount Adapter
 - 4) AV-PMA – Pole Mount Adapter
 - 5) SO-CAP – Mount Cap
 - 6) SV-EBA – Electrical Box Adapter
 - 7) SV-JBA – Junction Box
 - k. Provide outdoor rated IP66 IK-10 impact resistant housing where installed exterior.
 - l. Provide appropriate bracket for installation based on the location of the camera.
15. Exterior Camera Fiber Transceivers (required when pole mounting cameras remotely from the main building)
- a. Provide fiber optic transceivers for all pole mounted and remote building mounted cameras. Transceivers shall be located at the base of the pole in a NEMA rated heated, lockable enclosure. Paint enclosure to match pole.
 - b. Provide American Fibertek MX2-MM-FX or equal media converters as required for each camera. Transmitter shall be located in NEMA rated enclosure at the pole. Receiver shall be located in the security rack.
 - c. Provide Altronix T2428100WP or equal outdoor rated power supply for each camera, located at the pole. Power supply shall be located in NEMA rated enclosure at the pole.
16. Auxiliary Power supply
- a. Provide a UL listed 12/24 auxiliary power supply with cabinet and batteries to support miscellaneous devices such as: long range readers, fiber transceivers, REX sensors, horns/beacons, motion detectors, etc.
 - b. Provide Altronix or approved equal.
17. Card Reader
- a. Provide smartcard readers as shown on the drawings.
 - b. The reader shall have a 26-bit Weigand output.
 - c. The reader shall transmit on 13.56 MHz frequency.
 - d. The readers shall include a piezo buzzer and bi-color LED.
 - e. The reader shall be suitable for indoor and outdoor applications.
 - f. The reader shall operate up to 1000ft on 22AWG 3 twisted pair cable.
 - g. Snap and lock terminal block.
 - h. Provide with keypad where specifically shown.
 - i. Provide combination Card reader/keypad HID R40 or approved equal. Provide R10 for mullion mount applications.
 - j. Card reader shall have same characteristics as existing police station.
18. Long Range Reader
- a. Provide long range reader at Parking Garage entrance.
 - b. The reader shall transmit between 865 - 868 MHz / 902 - 928 MHz.
 - c. The reader shall be suitable for outdoor applications.
 - d. Up to 5 meter read range.
 - e. Provide with polycarbonate housing to mount to stanchion/wall bracket. Stanchion/wall bracket by others.
 - f. Provide HID SE U90 or approved equal.
19. Cards
- a. Provide multi technology UHF/iClass credentials.
 - b. Credentials must be able to function with both the standard readers and gate reader.
 - c. Provide HID 601 or approved equal.

- d. Provide 500.
20. Door Contacts
- a. Furnish and install 3/4 in. recessed magnetic door contacts as shown on the drawings.
 - b. Provide Sentrol/GE 1076C or equal dual output door contact or equal unless noted below.
 - c. Provide DPDT contacts for all doors. The second pole will be wired and connected to the intrusion alarm system addressable module.
21. Request-to-exit devices
- a. Furnish and install motion request-to-exit sensors as shown on the drawings and as required. Utilize doors that have hardware which have integral request-to-exit switches as required. Coordinate with door hardware.
 - b. Provide DS 150i or approved equal with trim plate if required to mount above the door.
22. Electric strike/magnetic locks power supply
- a. Electric strikes and magnetic locks power supplies as needed and required shall be furnished by the door hardware provider. Installed and wired by the Electrical Sub-contractor, connected to IESS by Security Contractor.
23. Locking Devices (Electric strike/Magnetic locks/Electric locks/Electric Hinges)
- a. Furnished and installed by others. Installed and wired by the Electrical Sub-contractor.
24. Video Intercom Unit
- a. Direct network connection with Static or Dynamic IP
 - b. Full open duplex communications
 - c. Power over Ethernet (POE) supported
 - d. Rugged 11 gauge stainless steel faceplate
 - e. True tamper resistant construction
 - f. Rugged call button
 - g. Weather resistant
 - h. Sensitive electret microphone
 - i. Mounts in industry standard 3 gang switch backbox
 - j. Mic Open LED
 - k. Full Supervision (speaker, microphone, station electronics, cable, network)
 - l. Wide angle camera (up/down angle adjustable)
 - m. Camera resolution of 1MP.
 - n. Provide Commend ES931ACW with custom recessed backbox or approved equivalent. Any equivalent manufactures must be fully compatible with the Unified Security platform.
 - o. Provide with Unified Security system license.
25. Duress Stations
- a. Provide remote duress panic switch as shown on the drawings. Each duress button shall be wired to the intrusion panel via addressable module for camera call-up and general alarm conditions. Each button shall report and be programmed independently of one another.
 - b. Provide Sentrol 3045 or approved equal.
26. Battery backup
- a. Provide battery backup of all servers, workstations, network controllers, network switches, auxiliary power supplies and intrusion panel.
 - b. Provide rack mount UPS units for all rack mount security equipment and floor mounted for all workstations.

- c. Provide a minimum of 10 minutes backup.
 - d. Provide APC or approved equal.
27. Intrusion Alarm Control Panel
- a. Provide an intrusion system as required and as shown on the plans. The cost of monitoring the facility at a UL listed central station shall be included for a period of one year. Arrange account information with the building owner at the time of setup.
 - b. The intrusion alarm panel shall be fully integrated to the USP. Include integration module for network connection to the access control system for full software integration.
 - c. Provide all labor, materials, equipment, and services to perform all operations required for the complete installation and related work as shown in all contract documents.
 - d. All motion detectors, roof hatches and exterior doors shall report and be individually annunciated on the intrusion alarm LCD system keypad and access control system. Corridor motions sensors shall be individually addressable. Classroom motions sensors shall be grouped within each section to an addressable input module. LCD keypads shall be able to arm and disarm the intrusion alarm system and shall allow for system programming.
 - e. Once armed, any motion detector, door contact, and glass break shall both cause the audible sounder to sound and call the central station.
 - f. The control panel shall be capable of supporting Dynamic Host Communication Protocol (DHCP) Internet Protocol (IP) addressing.
 - g. The control panel shall be capable of two-way network communication using standard Ethernet 10BaseT in a LAN, WAN, or Internet configuration.
 - h. Provide an addressable intrusion alarm control panel complete with enclosure, power supply, and door lock.
 - i. The panel must support up to 240 addressable points.
 - j. The panel must be able to support 8 independent partitions.
 - k. Provide with battery back up and battery harness for a minimum of 4 hours.
 - l. Provide DMP XRN series or approved equal.
28. Intrusion Alarm Keypad
- a. Provide 2-Line, 32-character platinum keypad as shown on the drawings.
 - b. The keypads can be used to both arm and disarm the intrusion system.
 - c. Shall include backlighting, display of zone status, system status, trouble conditions, event buffer, system instructions, date and time.
 - d. Provide DMP or approved equal.
29. PIR Motion Detectors / Addressable input points
- a. Provide addressable motion sensors (ceiling and wall mounted where shown). Sensors shall process their signals independently and shall have coverage patterns individually adjustable.
 - b. Each PIR shall be wired to the intrusion alarm system on an addressable loop. Include booster boards where necessary to ensure signal integrity.
 - c. Provide long range detectors as shown on the plans and as required.
 - d. Wiring connections shall be made in equipment cabinets. Conductors other than that of detector will not be allowed at each device. There shall be no exposed wiring leading to/from detectors.
 - e. Catalog, model and type numbers itemized herein for motion detectors are those of DSC.
 - f. Detectors shall be mounted on ceiling type wiremold box.
 - g. Fields of view that are directed at heat sources such as fans, radiators and other areas that may cause false alarms shall be masked out.
 - h. Provide DMP MX series wall and ceiling mount models utilizing multi-signal level processing or approved equal.
 - i. Provide addressable input module for door contacts and non-addressable devices – DMP Model 914 series or approved equal.

30. Door Contacts/switches
 - a. Provide recessed door contacts/switches as shown on the drawings. Contacts shall be 3/4 inch and have wire leads of sufficient length for splices to be made in wiremold box or mud type box located adjacent to door. Provide GE model #1078C or approved equal for interior doors. Provide DPDT contacts for all exterior doors, GE model #1076-D or approved equal.
 - b. In event that circumstances prevent the use of recessed contacts in some locations, surface contacts may be used, subsequent to approval of Architect.
 - c. Wiring for door contacts shall be concealed.
 - d. Door contacts shall not be wired in series with exception of double doors which may be wired to panel as single door location.
 - e. There shall be no splices in door frames or jambs. Door contact connections shall be made in wiremold or mud switch box located adjacent to door.

31. Overhead Door
 - a. Provide overhead door contacts as shown on the drawings. Provide one zone input module per device.
 - b. Provide Sentrol 2200 series or approved equal.

32. Service, SMA and Preventative Maintenance Agreement
 - a. The Systems Integrator shall perform quarterly and annual preventative maintenance services on all systems and equipment as specified in this section for a period of one year after substantial completion. Quarterly visits shall consist of workstation/server re-boots, network utilization reports, and workstation/server utilization reports. Annual visits shall consist of a Genetec software upgrade and any OS upgrades that are required as a result of the Genetec upgrade.
 - b. Include a one year manufactured approved software maintenance agreement for the entire IESS.
 - c. Components and parts that are found to be defective, have failed operationally or which exhibit signs of near term failure will be identified during each preventive maintenance inspection or test. If the component or part is covered under a current Systems Integrator or factory warranty, said part or component will be replaced at no charge to CUSTOMER including labor during normal business hours.
 - d. For any equipment requiring repair or replacement that is not covered, an estimate will be prepared and submitted for approval on a reimbursable basis and repair authorization shall be issued in writing by an authorized representative of the CUSTOMER before proceeding with the work.

33. Response Time
 - a. Should an emergency arise, the Systems Integrator personnel will assess the situation either by phone or remote diagnostics, or both, and will determine the required course of action with the CUSTOMER.
 - b. On-Site Response Time: If it is determined that a site visit is required, the Systems Integrator personnel will arrive at the affected premises within four hours of the request of the CUSTOMER.
 - c. If the resolution of the emergency service call requires the Systems Integrator to provide service for equipment that is not listed in this specification section, CUSTOMER will be liable for charges and expenses prevailing for such service.
 - d. Emergency Service will be provided during the following periods.
 - 1) Provide Emergency Service Monday through Friday 8:00 AM – 5:00PM excluding evenings and weekends, city, state, federal and Systems Integrator observed holidays at no additional charge to the base annual service fee. Labor for travel time is included under this Agreement.

- 2) The Systems Integrator will provide a response time as stated and agreed to above. Emergency Service requested by the CUSTOMER to be provided outside of the above stated times will be reimbursed by the CUSTOMER as shown below.
 - e. Emergency Service during the following periods is not included.
 - 1) Emergency Service Monday through Friday 5:00PM – 8:00AM, weekends, city, state, federal and Systems Integrator observed holidays are not included. Emergency Services provided under this scope will be reimbursable by the CUSTOMER to the Systems Integrator at then current Systems Integrator published service labor rates and standard service charges (Minimum Labor Charge, Vehicle Charges, Round Trip Travel Time, Mileage).
34. Provide 8 hours of video taped training broken up into (2) 4 hour sessions. The training shall be done once the system is complete and operational and all programming is complete. The training shall include step by step instruction of the sequence of operation at each door type, moves adds, changes, and use of all supplied IESS equipment.

PART 3 - EXECUTION

3.01 GENERAL

- A. Verify the exact location prior to bid of all items that may be indicated and determine exact location of all electrical items that are not indicated on the Drawings.
- B. Include the cost of all work including sub-letting of any work that may be required to complete the work indicated in order to avoid work stoppages and jurisdictional disputes. The work to be sublet shall conform with precedent agreements and decisions of record. Jurisdictional assignment shall be a responsibility under this Section's contractual obligation.
- C. Do not install equipment and materials which have not been reviewed by the Architect. Equipment and materials which are installed without the Architect's review or without complying to comments issued with the review shall be removed from the project. No payment will be made for unapproved or removal if it is ordered removed. The Installer shall be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.
- D. Obtain detailed information on installation requirements from the manufacturers of all equipment to be furnished, installed or provided. At the start of construction, check all Contract Documents, including all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing.
- E. Equipment and systems shall not be installed without first coordinating the location and installation of equipment and systems with the Construction Manager, AHJ and all other Trades.
- F. Any and all material installed or work performed in violation of above requirements shall be re-adjusted and corrected by the Installer without charge.
- G. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the electrical outlets, conduit and equipment, to determine the exact location of all outlets.

- H. After installation, equipment shall be protected to prevent damage during the construction period. Openings in conduits and boxes shall be closed to prevent the entrance of foreign materials.
- I. Home runs indicated are not to be combined or reduced without written consent from the Architect.
- J. All connections to equipment shall be made as required, and in accordance with the approved submittal and setting drawings.
- K. Delivery, Storage and Handling:
 - 1. Deliver, store, protect and handle products in accordance with recommended practices listed in Manufacturer's Installation and Maintenance Manuals.
 - 2. Deliver equipment in individual shipping splits for ease of handling, mount on shipping skids and wrap for protection.
 - 3. Inspect and report concealed damage to carrier within specified time.
 - 4. Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation. Meet the requirements and recommendations of NFPA 70B and the Manufacturer. Location shall be protected to prevent moisture from entering enclosures and material.
 - 5. Handle in accordance with NEMA and the Manufacturer's recommendations and instructions to avoid damaging equipment, installed devices and finish.
 - 6. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer shall be required to brace the equipment suitably to insure that the tilting does not impair the functional integrity of the equipment.
- L. Site Observation:
 - 1. Site observation visits will be performed randomly during the project by the Engineer. Reports will be generated noting observations. Deficiencies noted on the site visit reports shall be corrected. All work shall comply with the Contract Documents, applicable Codes, regulations and local Authorities whether or not a particular deficiency has been noted in a site visit report.
 - 2. Be responsible to notify the Engineer and AHJ ten working days prior to closing in work behind walls, raised access floors, ceilings, etc., so that installed work can be observed prior to being concealed.
 - 3. Work concealed prior to observation and correction of deficiencies shall be made accessible for review at the discretion of the Architect. Bear all costs for allowing worked to be reviewed.
 - 4. Areas shall stay accessible until deficiencies are corrected and accepted. Notify the Architect when all deficiencies are corrected. Return reports with items indicated as corrected prior to re-observation by the Architect.
- M. Project Open House:
 - 1. If the Owner elects to have an open house at the end of the project, provide assistance to the Owner. Cooperate and provide manpower to operate and demonstrate systems during the open house as requested by the Owner. Coordinate open house with superintendent of schools.

N. Change Orders, Modifications, Revisions and Directives:

1. When change orders, modifications, revisions or Architect's Directives are issued or authorized, provide the required additional material, equipment, personnel and workers to prevent delays in the work, and to complete the work within the time limit of the Contract unless a specific time extension is requested with the change and accepted. Include costs for expediting deliveries where required.
2. Requests for additional compensation shall be submitted broken down and associated by item, tasks and Drawing or sketch number with material and labor costs, so quantities can be easily verified.
3. Requests shall be properly and adequately identified so the scope of work can be clearly determined. Indicate who originated change in work.
4. Submit on all credits broken down as requested for adds. Credits shall be separately identified and accounted for. Do not indicate as net changes with adds.
5. Unit costs for labor and material shall be equal for adds, deletes and credits.

3.02 WORK

- A. Loose materials shall not be stored on-site. A "gang box" is acceptable to be placed in a location agreeable to the Owner and the Construction Manager. The Installer is responsible for all equipment and materials and for their delivery until the system is accepted by the Owner.
- B. A trailer may be used for the storage of materials to be located on the Owner's property at a location designated by the Owner and the Construction Manager. Such on-site storage shall be kept locked by the Installer. Security for the trailer and its contents shall be strictly the responsibility of the Installer.
- C. Protect existing in spaces where work is being performed to protect it from damage and from the accumulation of dirt.
- D. Any ceilings, walls, floors, furniture, equipment, furnishings, etc., damaged by the work of this Section shall be replaced, or at the Owner's option, repaired with similar materials, workmanship and quality.
- E. This contractor is responsible for coring through any existing firestopping where using sleeves that have been firestopped to run new wiring. Provide new firestopping where firestopping was removed for new wiring.
- F. Work includes field survey of existing conditions, systems, equipment and tracing of existing circuits in order to determine scope of work.
- G. Clean and touch up all equipment, materials and work sites at the completion of work in each area.
- H. Certain portions of the work area may be occupied during construction. Determine which areas and schedule work accordingly and include necessary premium time.
- I. Make sure necessary provisions to provide continuous service of all existing systems throughout all occupied areas.

3.03 EQUIPMENT RACKS, CABINETS AND BRACKETS

- A. Securely mount equipment racks, cabinets and wall mounted relay brackets to the building structure. Proper supports such as 3/8 in. lag screws and expansion anchors shall be used. Proper quantity of supports shall be utilized. Dry wall screws and other types of supports not specifically approved to support equipment are specifically prohibited. Submit mounting supports for approval before installation.
- B. Position racks, cabinets, and wall mounted relay brackets in order to have minimum 3-foot clearance for easy access. Equipment racks, cabinets and relay brackets mounted on or against walls shall have 3-foot clearance in front of deepest component. Free standing equipment racks and cabinets shall have 3-foot clearance in front and rear of deepest components. Provide 3-foot clearance between free standing equipment racks or cabinets and any other obstruction to allow access from front to rear of rack or cabinet for maintenance.
- C. The Electrical Subcontractor shall provide cable tray over each rack and cabinet as required to facilitate a neat and orderly installation of cables and to secure the top of the racks to the structure. Cables shall drop straight down to equipment racks. Cable trays shall be secured at both ends to the structure and connected together as required for a complete contiguous installation. Utilize listed supports to support the cable tray to the building structure as well as the equipment rack and cabinet. Submit mounting supports for approval by Engineer and AHJ before installation.
- D. Install terminating components such as patch panels (UTP, Fiber optic); cable management, etc. into the racks, cabinets and wall mounted relay brackets.
- E. Patch Panels: Mount patch panels onto the rack(s) in top-to-bottom fashion with the first patch panel mounted at the top of the rack. Uniquely label each patch panel according to the numbering convention outlined in the SECTION on labeling. Each port shall also have color coded identifiers. Refer to details on the Drawings.
- F. Cable Management: All cables shall enter the wiring closet to within the equipment racks and/or brackets. Secure the bundle(s) to the rack strain relief and wire management behind the patch panels and cross connect block panels. Install horizontal and side-mounted vertical cable management panels and brackets for routing and management of patch cables. Maintain EIA/TIA and BICSI standards on bundling, supporting and bend radii.
- G. Once the cabling system has been installed and terminated, install all active components and surge protected power strips into the racks, cabinets and wall mounted relay brackets.
- H. Surge Protected Outlet Strips: Mount UPS and surge protected outlet strips per Manufacturer's directions. Refer to details on the Drawings for mounting location.

3.04 TERMINATIONS

- A. All copper or fiber conductors of every cable shall be completely terminated at both ends.

3.05 CABLE PATHWAYS

- A. Provide all equipment and cabling for a complete installed operating system. In general, pathways, outlet boxes and grounding are provided by the Electrical Subcontractor. CAT 6A Ethernet cables for all CCTV locations are provided by the I.T. Sub-Contractor.
- B. All pathways provided under this Section shall comply with fill capacities as per Code, EIA/TIA 569A and BICSI.
- C. Cable bending radius shall not be less than minimum required by EIA/TIA and BICSI.

- D. Cabling installed concealed shall be supported from the building structure (e.g. cable trays, snake tray) hook and loop (velcro).
- E. Cables shall be installed no closer than 12 inches (305mm) to electrical equipment and wiring. When cables are required to cross power wiring, they shall only do so perpendicular to the power wiring. Telecommunications cabling and power wiring shall only cross each other the minimal number of times as required due to building design limitations.
- F. Clearances: Clearances between cabling and other building systems as required by EIA/TIA 569A and BICSI shall be maintained throughout the building.
- G. All cables shall be installed in a neat and workman-like manner. Cables shall be installed parallel and perpendicular to building elements.
- H. Provide expansion fittings and adequate cable slack at all building expansion joints.
- I. Fire/smoke seal all conduits, raceways, sleeves, slots etc. where cables pass from one location to another, provided by electrical subcontractor.

3.06 CABLE SUPPORTS

- A. Provide strain relief hardware for backbone cables at each floor level as they pass from one floor to the next.
- B. Provide hook and loop (Velcro) cable wraps at all panels, equipment racks and cabinets. Cable ties are specifically prohibited.
- C. Hook and loop (Velcro) cable wraps shall be used. Cable-ties are specifically prohibited for fiber optic cables.
- D. When pathways are not provided or specified, provide hook and loop (velcro) supports from the building structure as required for cable runs to the cable drop location. Maximum distance between supports shall be three feet. Maximum number of cables per support shall be thirty. Provide additional supports as required when cable quantities exceed thirty and to maintain required bending radius of cables. Cables installed exposed or in areas subject to abuse (below 10 feet (3m) above finished floor) or in accessible areas shall be installed in conduit.
- E. All cables shall be supported directly from building structure. Under no circumstance shall cable be installed using cross bracing, plumbing/sprinkler pipes, ceiling systems or any other system that is not a specifically approved method to independently support cables. Cables shall not be allowed to rest on ceiling tiles, duct work, piping, etc. Supports shall be provided as required in order for cables to avoid contact with any other building system. Bundle cables in groups by room and floor.

3.07 CABLE PROTECTION

- A. Provide bushings in all metal studs and the like where cables will pass through. Bushings shall be of two (2) piece construction with one piece inserted through the opening and the second piece locking it into place. Single piece bushings with locking tabs or friction fit are specifically prohibited.
- B. Cables to be installed in existing enclosed open bays or furred spaces where conduit stubs are not provided shall be protected from chafing or any damage. The Installer shall verify that the warranty shall not be violated before installing any cabling in these locations.
- C. Provide cutting, coring, sleeves and bushings and seal as required at all penetrations.

- D. Cables damaged during installation or construction shall not be repaired. They shall be completely replaced with new cable.

3.08 INSTALLATION

- A. All cabling shall be installed in conduit where indicated on plans, or shall be installed open using other methods, approved by city electrician and engineer, such as cable tray & snake tray.
 - 1. Install wiring, per manufacturers recommendations.
 - 2. All wiring shall be new, concealed in pipe where exposed.
 - 3. Install wiring for detection and signal circuit as specified. Make wiring connections to new or existing door hardware devices as required.
- B. All conduits, raceways, innerduct, etc. shall have pull strings remaining after cable is pulled.
- C. Impedance and Level Matching:
 - 1. Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- D. Control Circuit Wiring:
 - 1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
 - 2. All housings are to be located as specified and shown on drawings.
 - 3. Make installation in strict accordance with approved manufacturer's drawings and instructions.
 - 4. The Installer shall provide necessary transient protection on the AC power feed, all station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.
- E. Splices, Taps, and Terminations:
 - 1. Make splices, taps and terminations on numbered terminal punch blocks in junction, pull, and outlet boxes, terminal cabinets and equipment enclosures.
 - 2. Identification of Conductors and Cables:
 - a. Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
- F. Weatherproofing:
 - 1. Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.09 GROUNDING

- A. General:
 - 1. The Telecommunications systems comprising of cable tray, snake tray, equipment cabinets, racks and non-current carrying metallic parts shall be grounded according to the Massachusetts Electrical Code.
 - 2. In general, the grounding shall be as specified, as indicated on the Drawings and as required by the Electrical Code.

B. Methods:

1. Provide equipment grounding connections for integrated sound, voice and video systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
2. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.
3. The installer shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.
4. The installer shall note in his system drawings, the type and location of these protection devices as well as all wiring information.
5. The installer shall furnish and install a dedicated, isolated earth ground from the central equipment rack and bond to the incoming electrical service ground buss bar.

C. Telecommunications Grounding

1. Raceways including wireways, conduits, cable trays, snake tray, etc. installed for low voltage or fiber optic cabling shall be made electrically continuous for grounding purposes. Provide hollow braided copper jumpers between sections equal to Belden No. 8669 (60A Ampacity). Provide equal impedance conductor for aluminum raceway.
2. Bond raceways to the ground bus located in the equipment cabinet. Bond raceways in each room they terminate in.

D. Telecommunications Equipment Bonding & Grounding

1. Provide grounding and bonding as required by EIA/TIA-607 standards, codes and the equipment manufacturers.
2. Make final grounding conductor connection to cabinet around bus.
3. Each individual piece of equipment shall have an individual grounding conductor to the ground bus within the cabinet.
4. All equipment shall have bonding jumpers between them (i.e. between cable tray, snake tray and equipment rack, etc.).
5. Equipment integral to an equipment rack (i.e. shelves, panels, cable management, etc.) shall be considered bonded.
6. Equipment that is not integral to an equipment rack (i.e. shelf mounted electronic equipment, cable tray, snake tray, etc.) require individual bonding jumpers between the equipment and the rack.
7. Properly clean and prepare all surfaces for a complete bonding and grounding termination.
8. Install grounding bus in all equipment racks and cabinets.

3.10 SLEEVING AND BUSHINGS

- A. Raceways and openings shall be laid out in advance to permit their provision in the work. Sleeves and raceway shall be set before new masonry is constructed. Any extra work required where sleeves or raceways have been omitted or improperly placed shall be performed at the expense of the Installer which made the error or omission, including coring.

1. Existing Construction: Where raceways and cable pathways must pass vertically through existing construction, coring shall be located as per the guidelines shown on the drawings.

- B. Provide sleeves for raceways, busways, snake trays and cable trays penetrating floors, fire walls, or smoke partitions. Install approved material to provide for fire stop.

- C. Provide waterproof seals inside and outside raceway when penetrating from the exterior or underground.
- D. Except where specified otherwise sleeves shall be made of galvanized metal to finish flush with building finish lines.
- E. Provide acoustic sealer in sleeves between occupied spaces.
- F. Sleeves installed in floors shall extend ten inches above the finished floor unless specifically indicated otherwise. Sleeves for busways shall extend four inches (100mm) above the floor.
- G. Provide sleeves in masonry construction and in full height (slab to slab) walls.
- H. Provide sleeves for any openings requiring fireproofing.
- I. Bushings in all conduits shall be provided by the Electrical Subcontractor in all metal studs and other openings where cables will pass through. Bushings shall be of two- p i e c e construction with one piece inserted through the opening and the second piece locking it into place. Single piece bushings with locking tabs or friction fit are specifically prohibited.

3.11 INTEGRATED SECURITY SYSTEM TESTING

- A. Security Management System
 - 1. Test in accordance with manufacturer's security management systems testing procedures.

3.12 TRAINING

- A. As a minimum training sessions shall consist of the following:
 - 1. General project information and review shall be by the General Foreman or Superintendent of the Trade.
 - 2. Specific system training shall be by a Factory Trained Representative.
 - 3. Provide a complete review of the project and systems including, but not limited to, the following:
 - a. In a classroom environment review each Record Drawing (use of typical is acceptable).
 - b. Note equipment layouts, locations and control points.
 - c. Review each system.
 - d. Review system design operation and philosophy.
 - e. Review alarms and necessary responses.
 - f. Review standard troubleshooting techniques for each system.
 - g. Review areas served by equipment.
 - h. Identify color codes used.
 - i. Review features and special functions.
 - j. Review maintenance requirements.
 - k. Review operation and maintenance manuals.
 - l. Respond to questions (record questions and answers).
 - 4. After classroom training, walk the entire project, review each equipment room and typical locations. Explain equipment and proper operation.
- B. During the instruction period the Owner and Maintenance Manual shall be used and explained.

- C. The Owner and Maintenance Manual material shall be bound in 3-ring binders and indexed. On the edge of the binder provide a clear see-through plastic holder with a typed card indicating the Project name, the Architect's name, the installer's name and the Volume number (e.g., Vol. No. 1 of 2).
 - D. Provide name, address and telephone number of the manufacturer's representative and service company for all items supplied so that the source of replacement parts and service can be readily obtained.
 - E. Include copies of manufacturers and installer's warranties and maintenance contracts and performance bonds properly executed and signed by an authorized representative.
 - F. Include copies of all test reports and certifications.
 - G. Providers of the IESS System shall provide training as part of their package. This comprehensive training plan shall address the following areas:
 - 1. Training, providers of the IESS System shall provide (80) hours of training as part of their package, this comprehensive training plan shall address the following areas:
 - a. System Orientation for all involved staff members.
 - b. Small group hands-on training sessions for all media center staff focusing on system-wide hardware and troubleshooting.
 - c. Small group hands-on software training sessions for all media center staff.
 - d. Small group hands-on sessions covering classroom media control equipment for all instructional staff.
 - e. Small group hands-on software training sessions for all instructional staff.
 - f. Follow-up training for media center staff.
 - g. Follow-up training for all instructional staff.
 - h. System Orientation for all Involved Staff Members, providers of the Media Management System shall provide a eight-hour orientation session for the entire school community prior to the system turnover date. This orientation session shall include a full demonstration of the systems working capabilities. The demonstration shall only include those features and functions that were specified. The equipment demonstrated shall be exactly the equipment installed at the facility.
 - H. The Security Management System Integrator shall coordinate with the System Administrators for two 8-hour Operator training sessions on the Operational System to be conducted on-site on the actual running system. Include city electrician and director of public services and engineering.
 - I. Contractor shall be required to provide professionally video recorded training sessions with Owners staff and provide one copy to the Owner.
- 3.13 ACCEPTANCE DEMONSTRATIONS
- A. Prior to the Acceptance Demonstration, the installer shall issue a letter stating that the system has been installed and tested to meet the specifications noted herein and that the system is 100% functional and operational and ready for use.
 - B. Systems installed under this Section shall be demonstrated to the Owner and Architect. Demonstrations are in addition to necessary testing and training sessions. Notify all parties at least 7 days prior to the scheduled demonstration. Schedule demonstrations in cooperation with and at times convenient to all parties and so as to not disturb ongoing activities.

- C. Systems shall be tested prior to the demonstrations and each system shall be fully operational and tested prior to arranging the Acceptance Demonstration. Final payments will be withheld until a satisfactory demonstration is provided for all systems indicated or requested.
- D. If the demonstration is not totally complete, performing all functions, features and connections or interfaces with other systems, or if there is a failure during the demonstration, additional demonstrations shall be arranged. Provide and pay for all costs, labor and expenses incurred for all attendees for each additional demonstration required for acceptance and demonstration of complete system operation.
- E. Demonstrations shall be scheduled in ample time to complete all activities prior to final acceptance and Owner occupancy. Demonstrations shall take place at least 45 days prior to the scheduled project completion date and 45 days prior to owner's use and occupancy.
- F. The city electrician shall be trained and factory certified to operate the systems.
- G. As a minimum, provide demonstrations for systems indicated under "Work Included" under Part One of the Specifications. Provide demonstrations of additional systems as requested by the Owner, or City Electrician.

3.14 PROJECT OWNER COORDINATION

- A. Prior to Substantial Completion of the project and in ample time to address and resolve any coordination issues, request and arrange meetings between the Owner, Owner's Vendors and Consultants, Architect and Construction Manager to discuss the Scope of Work for each system being provided and the interface required for a fully functional and operational system upon project completion. Initial meetings shall be scheduled three months prior to the scheduled Substantial Completion date or as soon as Submittals are submitted and reviewed for projects with shorter schedules.
- B. At these meetings the required interface with the Owner shall be reviewed, requests for information required to complete programming or for coordination shall be presented and system operation and philosophy shall be discussed.
- C. Additional meetings shall be held as requested by any party so that all issues are resolved and with the goal and intent being that all systems are fully operational and functional upon project Substantial Completion and that the responsibility for all components required is clearly established.

3.15 CLEANING UP

- A. Upon completion of all work, and testing, thoroughly inspect all exposed portions of the installation and completely remove all exposed labels, markings, and foreign material.
- B. The interior of all boxes and cabinets shall be left clean; exposed surfaces shall be cleaned and plated surfaces polished.
- C. Repair damage to finish surfaces resulting from work under this Section.
- D. Remove material and equipment from areas of work and storage areas.
- E. All equipment shall be clean from dirt, dust, and fingerprints prior to final acceptance.
- F. Touch up all damaged pre-finished equipment using materials and methods recommended by the Manufacturer.

3.16 PROJECT CLOSEOUT

- A. Provide close out submittals as required herein and in SECTION 011000 – GENERAL REQUIREMENTS including but not limited to the following close out submittals.
1. Operation and Maintenance Manuals
 2. Record Drawings.
 3. Test Reports.
 4. Extra Materials.
- B. Obtain written receipts of acceptance close out submittals submitted. Receipts shall specifically detail what is being delivered (description, quantity and specification section) and shall be dated and signed by firm delivering materials and by the Owner.
- C. All sketches, drawings, and charts herein are for the purpose of providing for specifications in a simplified format. Errors and omissions in such does not relive the Contractor of the responsibility for providing a fully complete, secure and properly operating IESS suitable for the intended use. Bidders must obtain a complete set of Project Drawings and Specifications to determine the full scope of work. In case of conflict the Project Drawings and Specifications shall prevail.

END OF SECTION

SECTION 311000
SITE CLEARING

PART 1-GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Protecting existing trees and vegetation to remain, including temporary fencing for trees in close proximity to construction operations.
 - 2. Removing existing trees and vegetation indicated to be removed.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above and below grade site improvements.
 - 6. Protection of Existing Utilities.
 - 7. Utility Demolition as required to accommodate new construction.
 - 8. Protection and Abandonment of Utilities.
 - 9. Disconnecting, capping or sealing of utilities as required.
- B. Alternates: Not Applicable.
- C. Items to Be Installed Only: Not Applicable.
- D. Items to Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 312000 – EARTH MOVING for soil materials, excavating, backfilling, and site grading and removal of site utilities.
 - 2. Section 312500 – EROSION AND SEDIMENTATION CONTROLS for required erosion and sedimentation control measures.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more

than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain the Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
 - 1. Schedule indicating proposed sequence of operations for demolition work for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise protection.
 - a. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
 - b. Coordinate with Owner's continuing occupation of portions of existing building, adjacent buildings, and with Owner's partial occupancy of completed portions of proposed building or additions.
 - 2. Preconstruction survey photographs sufficiently detailed, of existing conditions of existing buildings, trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Section 017700 - CONTRACT CLOSEOUT identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner's Representative and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on the Owner's premises where indicated.

- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until erosion and sedimentation control measures are in place.
- E. Protection of Existing Improvements: Provide protection necessary to prevent damage to existing improvements indicated to remain in place or outside of the limit of work. Protect improvements on adjoining properties and on the Owner's property.
 - 1. Restore improvements damaged by Contractor's clearing activities to their original condition, at no additional expense to the Owner.

1.7 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Construction Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

PART 2-PRODUCTS (NOT USED)

PART 3-EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to the Owner's Representative.

3.2 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 - 3. Maintain fenced area free of weeds and trash.

4. Except as otherwise directed, cutting and trimming of existing trees will not be permitted.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
1. Cover exposed roots with burlap and water regularly.
 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 4. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by the Designer.
1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the Designer.

3.3 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
1. Arrange with utility companies to shut off indicated utilities. The Contractor is responsible for coordinating and scheduling with the authorities having jurisdiction the removal and/or abandonment of existing utilities as required to complete the work.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner's Representative or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify the Owner's Representative not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without the Owner's Representative's written permission.
- C. Utility pipes designated to be abandoned in place shall be plugged at their ends with watertight brick masonry or cement mortar with a minimum thickness of 8 inches.
- D. Utility pipes designated to be removed shall consist of the complete removal and disposal of the entire length of pipe and backfill and compaction of the void with ordinary borrow. When the void is within the footprint of the new building, gravel borrow shall be used to backfill the void.

- E. Utility structures designated to be abandoned in place shall have their cast iron castings removed and disposed, inlet and outlet pipes plugged, the bottom of the structures shall be broken, the void of the structure shall be backfilled and compacted with ordinary borrow, and the top of the structure shall be removed so that it is at least 36 inches below finished grade.
- F. Utility structures designated to be removed shall consist of the removal and disposal of cast iron castings, plugging of inlet and outlet pipes, removal of the structure, and backfill and compaction of the void with ordinary borrow. When the void is within the footprint of the new building, gravel borrow shall be used to backfill the void.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 4. Use only hand methods for grubbing within tree protection zone.
 - 5. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust or contamination by air-borne weed seed.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile topsoil within tree protection zones.

3.6 EXCESS TOPSOIL

- A. Topsoil that has been stripped and stockpiled, but is not needed after the completion of all final topsoil spreading and grassing, shall be removed and legally disposed of off site by the Contractor per local, state, and federal standards.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off the Owner's property.
 - 1. Burning on site is prohibited.
 - 2. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

3.9 CLEANUP AND REPAIR

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site.
- B. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by site demolition work.

END OF SECTION

SECTION 312500
EROSION AND SEDIMENTATION CONTROLS

PART 1-GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Control measures to prevent all erosion, siltation, and sedimentation of wetlands, waterways, construction areas, adjacent areas and off-site areas.
 2. Control measures shall be accomplished adjacent to or in the following work areas:
 - a. Soil stockpiles and on-site storage and staging areas.
 - b. Cut and fill slopes and other stripped and graded areas.
 - c. Constructed and existing swales and ditches.
 - d. Retention ponds.
 - e. At edge of wetlands areas, if applicable, as shown on Drawings.
 3. The Contract Drawings indicate the minimum requirements for sedimentation and erosion control. The Contractor shall install all measures needed to control sediment and erosion as required by the Contractor and Sub-contractor's construction methods and operations, the weather conditions, and as directed by the Engineer.
 4. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional cost to the Owner.
 5. Periodic maintenance of all sediment control structures shall be provided to ensure intended purpose is accomplished. Sediment control measures shall be in working condition at the end of each day.
 6. After any significant rainfall, sediment control structures shall be inspected for integrity. Any damaged device shall be corrected immediately.
- B. Alternates: Not Applicable.
- C. Items to Be Installed Only: Not Applicable.
- D. Items to Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 311000 – SITE CLEARING for protection of existing trees and other vegetation to remain.
2. Section 312000 – EARTH MOVING for soil materials, excavating, backfilling, and site grading and removal of site utilities.

1.3 SUBMITTALS

- A. Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
 1. At least 20 days prior to the start of the project, the Contractor shall submit an Appendix by a qualified person to the Draft Stormwater Pollution Prevention Plan (SWPPP) indicating project phasing, Contractor operation areas, work areas, stockpile locations, construction staging/sequencing, and sedimentation and erosion control measures to be used. This Appendix shall become part of the SWPPP that is to be updated and maintained by the Contractor.
 2. As part of the Contract Closeout procedures, the Contractor is responsible for filing a Notice of Termination with the EPA once the project has been completed and is permanently stabilized. Stabilization is complete when all temporary storm water and erosion controls have been removed, all permanent storm water and erosion controls are in place and functional and all vegetated areas are at least 70% viable.
 3. The Contractor shall provide the manufacturer's literature, material specification, and installation instructions for sedimentation and erosion control materials and devices for approval. Do not order materials until approval of certifications or test results has been obtained. Delivered materials shall match the approved submittals.
 4. LEED Supporting Documentation: Submit LEED supporting documentation as outlined in Section 018110 SUSTAINABLE DESIGN REQUIREMENTS for materials and products that have been extracted, harvested, or recovered, as well as manufactured within 500 miles of the project site.

1.4 QUALITY ASSURANCE

- A. When applicable, comply with the requirements of Stormwater Pollution Prevention Plan prepared for the NPDES permit, which are incorporated herein by reference, and all other applicable requirements of governing authorities having jurisdiction. The specifications and drawings are not represented as being comprehensive, but rather convey the intent to provide complete slope protection and erosion control for both the project site and adjacent property.
 1. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to a sediment and erosion control plan specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- B. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas which are subject to

severe erosion, and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation, are to be identified and receive special attention.

- C. The Contractor shall install and maintain sedimentation control devices during construction to prevent the movement of sediment from the construction site to off site areas, into adjacent water bodies via surface runoff or into underground drainage systems. Measures to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at no additional cost to the Owner.
- D. All land-disturbing activities are to be planned and conducted to minimize the size of the area to be exposed at any one time, and the length of time of exposure.
- E. Surface water runoff originating upgrade of exposed areas should be controlled to reduce erosion and sediment loss during the period of exposure.
- F. When the increase in the peak rates and velocity of storm water runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving stream bed, provide measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream.
- G. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.
- H. The Contractor is responsible for cleaning out and disposing of all sediment once the storage capacity of the sediment facility is reduced by one-half.
- I. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- J. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

1.5 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 - 1. "Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials", prepared by the Massachusetts Department of Environmental Protection, Bureau of Resource Protection, dated March 1997, reprinted May 2003.

1.6 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.7 PERMITS, CODES, AND REGULATIONS

- A. Comply with all rules, regulations, laws, and ordinances of the City and State, and all other authorities having jurisdiction over the project site. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.
- B. Comply with all applicable regulations of the Commonwealth of Massachusetts Department of Environmental Protection (DEP) and the EPA.
- C. The Contractor shall comply with the requirements of the NPDES CGP for this project.

1.8 STORM WATER POLLUTION PREVENTION PLAN

- A. A professional engineer has prepared a Draft Storm Water Pollution Prevention Plan (SWPPP). The Contractor shall locate the SWPPP and review its contents thoroughly. Upon the award of the Contract, the Contractor becomes responsible for implementing the SWPPP and meeting the requirements and standards detailed within the SWPPP. The Contractor is also responsible for all record keeping associated with maintaining the SWPPP and for maintaining in good operating condition all SWPPP controls. The Contractor shall modify the SWPPP as necessary to reflect changes in project scope, schedule, or approach. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.
- B. The Contractor shall fill out all pertinent information within the SWPPP.
- C. The Contractor shall locate the EPA "Notice of Intent for Storm Water Discharges Associated with CONSTRUCTION ACTIVITY Under a NPDES General Permit" (NOI) form in the SWPPP. The Contractor is responsible for signing and filing his copy of the NOI at least 14 calendar days prior to the start of any construction activity and placing a signed copy along with proof of mailing in the SWPPP.
- D. The Contractor is responsible for obtaining a copy of the Owner's filed copy of the NOI form and proof of mailing and placing it in the SWPPP.
- E. The Contractor is responsible for filling in the Contractor and Sub-Contractor information in the areas indicated within the SWPPP and for completing the Contractor's Certification portion of the SWPPP.
- F. The Contractor is responsible for maintaining the following records on site:
 - 1. Completed SWPPP as indicated in sections B, C, D, and E.
 - 2. Completed Inspection Reports

3. Completed Maintenance Reports
 4. Construction Activity Reports
 5. Spill Records
 6. Other Materials relevant to the NOI Permit and SWPPP
 7. A copy of the Notice of Termination
- G. The Contractor is responsible for filing a Notice of Termination once the project has been completed and is permanently stabilized. Stabilization is complete when all temporary storm water and erosion controls have been removed, all permanent storm water and erosion controls are in place and functional and all vegetated areas are at least 70% viable.
- H. All labor, materials, equipment, and services necessary to make the work comply with the above requirements shall be provided by the Contractor without additional cost to the Owner.

PART 2-PRODUCTS

2.1 MATERIALS

- A. Straw Bales: Wire or nylon bound bales of straw, oriented around sides, rather than over and under.
- B. Stakes: Stakes for bales shall be one of the following materials: Wood stakes of sound hardwood 2 by 2 inches in size or steel reinforcing bars of at least No. 4 size. Lengths shall be approximately three feet.
- C. Straw Wattles
1. Straw wattles shall consist of weed free rice straw inside biodegradable netting. Straw wattles shall measure at least nine (9) inches in diameter.
 2. Stakes for wattles shall be one of the following materials. Lengths shall be approximately two feet (2').
 - a. Wood stakes of sound hardwood, one inch by one inch (1" x 1") in size.
 - b. Steel reinforcing bars of at least No. 4 size.
- D. Siltation Fence
1. Fabricated or prefabricated unit consisting of the following filter fabric properties:

a. Grab Tensile Strength (lbs)	124	ASTM D4632
b. Elongation at Failure (%)	15	ASTM D4632
c. Mullen Burst Strength (PSI)	280-300	ASTM D3786
d. Puncture Strength (lbs)	60-65	ASTM D4833
e. Water Flow Rate (gal/min/sf)	8-10	ASTM D4491
f. Apparent Opening Size (Sieve)	30	ASTM D4751
g. Ultraviolet Radiation Stability (%)	70-80	ASTM D4355

2. Use only commercially available fabric that is certified in writing by the manufacturer for the purpose intended.
 3. Acceptable fabric materials include "Mirafi Envirofence" by Mirafi Construction Products, "Style 2130" by Amoco Fabrics Co., and "IVI 3617C Silt Fence" by Indian Valley Industries, Inc., or approved equal by the Engineer.
 4. Silt fence posts: Posts may be wood or metal. Wood post shall be a minimum 1½ inch by 1½ inch by 5 feet long hardwood stakes commonly used to support siltation fabric. Metal posts shall be a minimum of 1 inch wide and 5 feet long. Posts shall be spaced at a maximum distance of 8 feet on center.
 5. Provide suitable heavy nylon cord for securing abutting silt fence posts.
- E. Fencing: Steel posts shall be standard 6-foot long metal stamped drive stakes commonly used to support snow fences. Fencing shall be new four-foot height wood lath snow fencing. Provide suitable steel staples or heavy nylon cord for securing filter cloth to support system.
- F. Crushed Stone: Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements.

Percent Passing by Weight		
Sieve Size	1 1/2-inch Stone	3/4-inch Stone
2-inch	100	---
1 1/2-inch	95-100	---
1 1/4-inch	---	---
1-inch	35-70	100
3/4-inch	0-25	90-100
1/2-inch	---	10-50
3/8-inch	---	0-20
No. 4	---	0-5

- G. Protective Measures: As temporary coverings on ground areas subject to erosion, provide one of the following protective measures, and as directed by the Designer with concurrence of the Owner's Representative:
1. Hay or straw temporary mulch, 100 pounds per 1,000 square feet.
 2. Wood fiber cellulose temporary mulch, 35 pounds per 1,000 square feet.
 3. Tackifier for anchoring mulch or straw shall be a non-petroleum based liquid bonding agent specifically made for anchoring hay or straw.

4. Provide natural (jute, wood excelsior) or man-made (glass fiber) covering with suitable staples or anchors to secure to ground surface. Note that wire staples and non-biodegradable coverings shall not be used for any area that will be mown turf.
 5. Temporary vegetative cover for graded areas shall be undamaged, air dry threshed straw or hay free of undesirable weed seed.
- H. Temporary Covers for Drainage Structures
1. Filter fabric for use as temporary covers for drainage structures shall be the same as noted above for siltation fence.
 2. Wire mesh for use at temporary drainage structure covers shall be 6" x 6", W2.9 welded wire mesh.
 3. Crushed stone shall be as specified herein before.
 4. Silt-Sac, Hydro-FloGard + Plus Catch Basin Insert, Ultra-DrainGuard Insert, or approved equal, may be used in lieu of hay bales and filter fabric at catch basins.

PART 3-EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The Contractor shall provide suitable and adequate means of sedimentation and erosion control during construction. Control measures shall prevent all erosion, siltation, and sedimentation of waterways, drainage systems, construction areas, adjacent areas and off-site areas. Work shall be accomplished on and/or adjacent to the following work areas:
1. Earthwork stockpiles and on-site storage and staging areas.
 2. Cut and fill slopes and other stripped and exposed graded areas.
 3. Constructed and existing swales and ditches.
 4. Unestablished lawns and seeded embankments.
- B. Means of protection as noted on the Contract Drawings indicate the minimum provisions necessary. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional expense to the Owner.
- C. Periodic maintenance of all sediment control installations shall be provided to ensure intended purposes are accomplished. Sediment control measures shall be in working condition at the end of each day.
- D. After any significant rainfall, sediment control devices shall be inspected for integrity. Any damaged device shall be corrected immediately.
- E. The Contractor shall provide adequate means of control of runoff, as to not detrimentally impact downstream conditions during construction. The Contractor shall plan his operations so that permanent drainage mitigation systems such as detention/retention/infiltration basins and chambers are in place and properly functioning prior to connecting upland drainage flows to these systems. The Contractor shall plan his

operations such that downstream drainage mitigation measures are in place and functioning before attempting to tie in upgradient drainage systems.

- F. In the event that the Contractor is unable to sequence the work so that construction of the permanent drainage mitigation systems precedes the upland work, then the Contractor shall submit a plan indicating his proposed methods of otherwise controlling runoff from the site.
- G. The "Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas" should be consulted as a guide for the selection and installation of Best Management Practices to suit the conditions encountered.

3.2 STRAW BALE BARRIERS

- A. Excavation shall be to the width of the bale and the length of the proposed barrier to a minimum depth of 4 inches.
- B. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another. In swales and ditches, the barrier shall extend to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale.
- C. Staking shall be accomplished to securely anchor bales by driving at least two stakes or rebars through each bale to a minimum depth of 18 inches.
- D. The gaps between bales shall be filled by wedging straw in the gaps to prevent water from escaping between the bales.
- E. The excavated soil shall be backfilled against the barrier. Backfill shall conform to ground level on the downhill side and shall be built up to 4 inches on the uphill side. Loose straw shall then be scattered over the area immediately uphill from a straw barrier.
- F. Inspection shall be frequent and repair or replacement shall be made promptly as needed.
- G. Bales shall be removed when they have served their usefulness so as not to block or impede stormwater flows or drainage.

3.3 STRAW WATTLE BARRIERS

- A. Install straw wattles in locations as shown on Contract Drawings and as directed.
 - 1. Wattles shall be placed in a row with ends overlapping a minimum of two (2) feet.
 - 2. Each wattle shall be embedded in the soil a minimum of two (2) and a maximum of six (6) inches.
 - 3. Wattles shall be securely anchored in place by stakes or rebars driven through the wattles and a minimum twelve (12) inches into the soil. Stakes shall be placed four (4) feet on center.
- B. Inspection shall be frequent and repair or replacement shall be made as needed.

- C. Wattles shall be removed when they have served their usefulness so as not to block or impede stormwater flows or drainage.

3.4 STABILIZED CONSTRUCTION ENTRANCE AND STONE BERMS

- A. Stone size: Use ASTM designation C-33, size No. 2 (1-1/2" to 2-1/2"). Use crushed stone.
- B. Length: As effective, but not less than 50 feet.
- C. Thickness: Not less than eight inches.
- D. Width: Not less than full width of all points of ingress or egress, but not less than 25 feet.
- E. Washing: When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through the use of sand bags, gravel boards or other approved methods.
- F. Maintenance: The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spoiled, dropped, washed or tracked onto public rights-of-way must be removed immediately.
- G. Place crushed stone berms in locations required and as directed. Berms shall have side slopes of 1:3 or less.
- H. Inspect stone berms periodically and replace and/or regrade crushed stone as required.

3.5 SILT FENCING

- A. Excavate a 6-inch trench along the upstream side of the desired fence location.
- B. Drive fence posts a minimum of 1'-6" into the ground. Install fence, well-staked at maximum eight-foot intervals in locations as shown on Drawings. Secure fabric to fence and bury fabric end within the six-inch deep trench cut.
- C. Lay lower 12 inches of silt fence into the trench, 6 inches deep and 6 inches wide. Backfill trench and compact.
- D. Overlap joints in fabric at post to prevent leakage of silt at seam.
- E. Inspect siltation fence after major storm events and periodically and remove accumulated sediment and debris. If a breach or failure of the siltation fence occurs, the fence shall immediately be restored.

3.6 EROSION CONTROL GRASSING

- A. Grassing shall be applied according to the Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials.

3.7 INLET PROTECTION

- A. Install silt fence or straw bales around inlet as specified herein.
- B. Install temporary covers at drainage structure locations that may be subject to erosion infiltration and as directed by the Engineer.
- C. Inspect drainage structures periodically. Remove sediment accumulation and regrade or replace materials as required.

3.8 DUST CONTROL

- A. Throughout the construction period the Contractor shall carry on an active program for the control of fugitive dust within all site construction zones, or areas disturbed as a result of construction. Control methods shall include the following: Apply calcium chloride at a uniform rate of one and one-half (1 ½) pounds per square yard in areas subject to blowing. For emergency control of dust apply water to affected areas. The source of supply and the method of application for water are the responsibility of the contractor.
- B. The frequency and methods of application for fugitive dust control shall be as directed by the Designer with concurrence by the Owner's Representative.

3.9 TEMPORARY PROTECTIVE COVERINGS

- A. Place temporary soil coverings to control erosion and sedimentation on all disturbed or graded areas as required by the construction methods employed and as directed by the Engineer. Erosion control matting shall be installed in all areas seeded or hydroseeded with slopes of one vertical foot to three-foot horizontal, or steeper, immediately after such areas have been seeded and a hay mulch applied as follows:
 - 1. The area to receive matting shall have been recently seeded and shall have a smooth surface free from stones, clods or depressions.
 - 2. Roll out of the matting perpendicular to the slope, do not stretch the fabric. In drainage swales, center the fabric along the flow line. Install the matting in a check slot at the top and bottom of the slope and at the edges of the area to be covered. Check slots shall be six inches deep and six inches wide. Fabric shall extend down one wall of the check slot and across the full width of the base. Overlap edges of matting rolls four (4) inches minimum and overlap the ends eighteen (18) inches minimum.
 - 3. Install staples in check slots, edges, center, and ends of rolls by driving specified steel staples two feet on center over the entire area to be covered except at check slots and ends of rolls, where staples shall be placed six inches on center. All staples shall be driven below finished grade.

4. Fill check slots with loam and tamp firmly.
 5. Reseed check slots and all disturbed areas per Specifications.
 6. Following matting installation, roll the entire area with a smooth drum roller weighing between fifty and seventy-five (50-75) pounds per linear foot of roller. The finished installation of matting shall be firmly in contact with the seeded area and provide a smooth, finished appearance free from lumps or depressions.
- B. Install erosion control matting as a temporary ground cover in all disturbed or graded areas subject to erosion and as directed by the Engineer. The temporary ground cover shall protect the site from erosion until a full permanent lawn can be installed. Install and anchor in place temporary erosion control matting in accordance with manufacturer's printed instructions or as directed by the Engineer and remove all temporary erosion control matting prior to installation of a permanent lawn.
- C. Inspect protective coverings periodically and reset or replace materials as required.

3.10 TEMPORARY PROTECTIVE COVERINGS (AFTER GROWING SEASON)

- A. Place temporary covering for erosion and sedimentation control on all areas that have been graded and left exposed after October 30. Contractor shall have the choice to use either or both of the methods described herein.
- B. Hay or straw shall be anchored in-place by one of the following methods and as approved by the Designer with concurrence by the Owner's Representative: Mechanical "crimping" with a tractor drawn device specifically devised to cut mulch into top two inches of soil surface or application of non-petroleum based liquid tackifier, applied at a rate and in accordance with manufacturer's instructions for specific mulch material utilized.
- C. Placement of mesh or blanket matting and anchoring in place shall be in accordance with manufacturer's printed instructions.
- D. Inspect protective coverings periodically and reset or replace materials as required.

3.11 REMOVAL AND FINAL CLEANUP

- A. Once the site has been fully stabilized against erosion, and with the approval of the Owner's Representative remove sediment control devices and all accumulated silt. Dispose of silt and waste materials offsite. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated.

END OF SECTION

SECTION 321216
ASPHALT PAVING

PART 1-GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Hot-mix asphalt paving, including walkways, ramps, and curbs.
 - 2. Hot-mix asphalt patching.
 - 3. Pavement-marking paint.
 - 4. Setting of Curb.
- B. Alternates: Not Applicable.
- C. Items To Be Installed Only: Not Applicable.
- D. Items To Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 312000 - EARTH MOVING for aggregate subbase and base courses and for aggregate pavement shoulders.

1.3 SUBMITTALS

- A. Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
- B. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities. Submit shop drawings for curbing items.
- D. Material Certificates: For each paving material, from manufacturer.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
1. Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments. All references to method of measurement, basis of payment and payment items in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned herein.
 2. ASTM: American Society for Testing and Materials
 3. AASHTO: American Association of State Highway and Transportation Officials
 4. ACI: American Concrete Institute
 5. MUTCD: Manual on Uniform Traffic Control Devices

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the Massachusetts Highway Department (MHD).
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the Massachusetts Highway Department (MHD) for hot mix asphalt paving work.
1. Comply with requirements of the Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, including supplemental specifications and special provisions.
 2. Comply with requirements of the Americans with Disabilities Act (ADA) and the Massachusetts Architectural Access Board (MAAB). If these requirements cannot be met with the grades and slopes indicated on the plans, notify the Designer immediately.
 3. Comply with requirements of the local authority having jurisdiction concerning the location and construction of accessible curb cuts.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

- d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 60 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

1.8 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Construction Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.9 ADA AND MAAB COMPLIANCE

- A. Comply with American with Disabilities Act (ADA) and the requirements of the Massachusetts Architectural Access Board (MAAB).

1. Slopes: Walkways as defined by Section 22.1 of 521 CMR₂ shall be graded to a maximum of 4.5%. The cross-pitch (perpendicular to travel) for walkways and paths shall be constructed at 1.5%. The slopes of ramps and side slopes on handicap curb cuts as defined by Section 21.1 of 521 CMR shall be constructed at 7% maximum. Ramps as defined in Section 24.1 of 521 CMR₂ shall be constructed to a maximum slope of 7%.
2. The Contractor is to assume that sidewalk grades will be verified and checked with a 2-foot long electronic 'smart level'.
3. A 5'-0" minimum level, 1.5% pitch, area shall be provided at entrances to buildings. Puddling or ponding of water at the entrances will not be accepted.
4. Handicap parking spaces and access aisles shall be graded level with the slope not to exceed 1.8% in any direction.
5. The requirements specified hereinabove shall supersede the grades indicated on the Drawings. If these requirements cannot be met with the grades indicated on the Drawings, the Designer shall be notified immediately for direction.

PART 2-PRODUCTS

2.1 AGGREGATES

- A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- C. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.
- D. Reclaimed Asphalt Pavement (RAP): Provide material obtained from the highways or streets by crushing, milling, or planing existing hot mix asphalt pavements.
 1. The proportion of RAP to virgin aggregate for base course mixtures and intermediate course mixtures shall be limited to a maximum of 40% for drum mix plants and 20% for modified batch plants. The maximum amount of RAP for surface course mixtures shall be 10%.
- E. RECLAIMED BASE COURSE
 1. The work under this item shall consist of scarifying and pulverizing in place the existing asphalt pavement and underlying material, mixing and blending the material, and spreading and compacting the mixture to the lines and grades shown on the Contract Drawings.
 2. Equipment such as rear-mounted ripper crushers and cold planing/milling equipment will not be permitted to perform the work under this item.
 3. Prior to scarifying and pulverizing the pavement, the Contractor shall locate, protect, or remove all drainage and utility structure castings. All lowered structures shall be

protected and covered by a steel plate and all watergates shall be covered as well to prevent any materials from falling into the bottom sections. All materials that fall into any structures as a result of the Contractor's operations shall be removed by the Contractor at no additional cost.

4. The existing full bituminous pavement structure and underlying base materials shall be simultaneously crushed, pulverized, and blended into a homogenous material to create the following gradation:

<u>Sieve Designation</u>	<u>Percent Passing</u>
2-inch	100
1½-inch	70-100
½-inch	50-85
No. 4	30-60
No. 50	8-28
No. 200	0-10

5. The construction operation shall be performed in such a manner as to allow for continuous vehicular access as required by the project schedule. Emergency vehicular access shall be maintained at all times.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder, Performance Graded: AASHTO M320 or AASHTO MP 1a, performance grade as required by MHD Specifications.
- B. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: Fast Drying White Water-borne Traffic Paint and Fast Drying Yellow Water-borne Traffic Paint as specified in the "Standard Specifications" under Sections M7.01.23 and M7.01.24, respectively.
 1. Color: As indicated
- C. Detectable Warning Panels shall have dome geometry in accordance with ADA Regulations for Detectable Warning on Curb Ramps. They shall be raised truncated domes with a nominal diameter of 0.9-inches, a nominal height of 0.2-inches, and a center-to-center spacing of 1.6 inches to 2.4-inches. Panels shall be 24-inches deep in the direction of travel and the full width of the proposed ramp. The panel shall be a homogeneous glass and carbon reinforced composite, which is colorfast, and UV stable. The panel is to be colored throughout and not a painted coating. The color is to be contrasting to the background

sidewalk color. The panels shall have a compressive strength in excess of 10,000 psi, flexural strength in excess of 3,000 psi and a slip resistance in excess of 0.8 wet or dry.

- D. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.4 ASPHALT MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by MHD Specifications and designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types".

2.5 ASPHALT CURB

- A. Bituminous concrete curb shall conform to Section 501.64 of the Standard Specifications for Class 1 Bituminous Concrete Curb, Type-2 and Type-3 and shall meet the dimensions as shown on the Contract Drawings.
- B. Bituminous concrete shall meet the requirements of Dense Mix as specified in the Standard Specifications under Section M3.12.00.

2.6 GRANITE CURB AND EDGING

- A. Granite curb and edging shall be light gray in color, free of seams and other imperfections, which would affect its structural integrity. The front face of the stone shall be at right angles to the plane of the top and the ends and shall have a smooth surface. The ends of the stones shall be square with the planes of the top and front face to provide flush joints. Top surface shall be sawn cut with a split front face.
- B. Granite curb shall have a top width of 6 inches and a depth of 17 to 19 inches and a minimum length of 6 feet. Granite edging shall have a thickness of 5 to 6 inches and a depth of 11 to 13 inches with a minimum length of 4 feet.
- C. Granite curb to be set on a radius of 100 feet or less shall be cut to the required radius and shall have a minimum length of 6 feet or the length of the curb section, whichever is less. Granite edging set on a radius of 160 feet or less shall be supplied in lengths shorter than 6 feet but no less than 1 foot to provide a smooth appearance.
- D. The ends of all transition curb shall be cut with a power-driven saw to provide a flush vertical joint with adjacent curbing

PART 3-EXECUTION

3.1 GENERAL

- A. Subbase under paving shall be compacted as described in Section 312000, EARTH MOVING. Add material meeting the requirements of ordinary borrow to bring the subgrade to the required grade as necessary before placing base course.
- B. The gravel base course shall be spread in layers upon the prepared subgrade conforming to the required line and grade. Gravel shall be placed in compacted layers not more than 4 inches thick compacted to not less than 95 percent of the maximum dry density of the material. Any stone greater than 3 inches in size shall be removed. Compaction shall continue until the surface is even and true to line and grade.
- C. Gravel base course shall be placed on backfilled and compacted trenches to proper grade before placement of pavement.
- D. The edges of existing pavement that is to remain shall be saw cut to an even, straight edge using a power-driver rotary saw; use of a jackhammer is unacceptable. This includes road, parking lot, sidewalk, and utility trench edges.
- E. Asphalt courses shall be spread and compacted to the finished thicknesses as shown on the Contract Drawings. A smooth even surface shall be produced.
- F. Any joints at junctions of old and new pavements shall be sealed with tack coat and covered with sand.

3.2 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.3 COLD MILLING

- A. This work consists of removing bituminous or cement concrete pavements by use of a cold planer in areas designed on the Contract Drawings. The cold planer must be equipped with an elevating device capable of loading planed material directly into dump trucks while operative. It shall have all the necessary safety devices, such as reflectors, headlights, taillights, flashing lights, and backup signals so as to operate safely in traffic both day and/or night.
- B. The cold planer shall be designed and built for planing flexible pavements and possess the ability to plane cement concrete patches when encountered in bituminous pavement. It shall be self-propelled and have the means for planing without tearing or gouging the

underlying surface. Variable lacing patterns shall be provided to permit a rough grooved or smooth surface as directed.

- C. The cold planer shall be able to make up to a 3 inch cut or any specified lesser depth may be required in one pass. The minimum width of pavement planed in each pass shall be 6 feet, except in areas to be trimmed and edged. The machine shall be adjustable as to crown and depth and meet the standards set by the Air Quality Act for noise and air pollution.
- D. The planed surface shall conform to the grade and cross-slope required. The surface shall not be torn, gouged, shoved, broken, or excessively grooved. It shall be free of imperfections in workmanship that prevent resurfacing after this operation. Surface texture shall be as specified by the Engineer and excess material shall be removed so the surface is acceptable to traffic if required.
- E. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

3.4 PATCHING

- A. Existing Hot-Mix Asphalt Pavement: Saw-cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Existing Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
 - 1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a minimum rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.5 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Spread mix at minimum temperature of 250 deg F.
 - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 1. Average Density: ASTM D 2041, per MHD Specifications.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 ASPHALT CURBS

- A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F.
 1. Asphalt Mix: Same as pavement surface-course mix.
- B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.10 CURBING AND EDGING

- A. Construct curbing and edging of the type and at the locations shown on the Contract Drawings.
- B. Construct curbing and edging in accordance with the details shown on the Contract Drawings.
 1. The foundation for curb and edging shall consist of gravel spread upon the subgrade and after being thoroughly compacted shall be 6 inches in depth. The bottom of the curbstones shall be fully seated and supported on the compacted subgrade.
 2. The joints between curbstones shall be carefully filled with cement mortar and neatly pointed on all exposed surfaces.

3. After pointing, the curbstones shall be cleaned of all excess mortar.

- C. After curbing and edging is in place at the line and grade shown on the Contract Drawings, backfill and compact equally on both sides with subbase course material, as specified in Section 312000 – EARTH MOVING. Compaction shall be by vibratory, hand-operated equipment, and shall achieve the same density as specified for subbase course in Section 312000 – EARTH MOVING.

3.11 INSTALLATION TOLERANCES

- A. Accessibility: Comply with requirements of Massachusetts Architectural Access Board and ADAAG requirements. Remove and replace paving that does not meet required tolerances, when measured with a 2 foot straight edge.
- B. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
1. Base Course: Plus or minus 1/2 inch.
 2. Surface Course: Plus 1/4 inch, no minus.
- C. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within MHD Specification tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas.

3.12 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Designer.
- B. Allow paving to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.13 WHEEL STOPS

- A. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.14 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Cooperate with the Independent Testing Agency engaged by Owner for field quality control activities for the Work of this Section. Refer also to Section 014325 - TESTING AGENCY SERVICES.

- B. Test the plane of the finished surfaces of base, binder, and surface courses with a 16-foot straightedge, except use a 10-foot straightedge on vertical courses and on the top course of resurfaced streets which contain manhole covers, valve boxes, and the like.
- C. Carefully apply the straight edge immediately after the first compaction by rolling, and from then on as may be necessary until and after the final compaction of the material in place. Hold the straightedge in successive positions parallel to the road centerline and in contact with the road surface; check the entire area from one side of the pavement to the other.
- D. Correct irregularities which vary 3/8 inch from a true finished surface in base and binder courses, and 1/4 inch in top courses.
- E. Irregularities which may develop before the completion of rolling and while the material is still workable, may be remedied by loosening the surface mixture and removing or adding material as necessary. Should any unsatisfactory irregularities or defects remain after final compaction, the defective work shall be corrected by removing and replacing with new material to form a true and even surface.

3.15 OPENING TO TRAFFIC

- A. No vehicular traffic or loads shall be permitted on the newly completed pavement until all of the following conditions are met:
 - 1. Adequate stability has been attained.
 - 2. The material has cooled sufficiently to prevent distortion or loss of fines.
 - 3. The pavement has achieved a maximum temperature of 140 degrees F.
- B. If the climatic or other conditions warrant it, the period of time before opening to traffic may be extended at the discretion of the Designer.

3.16 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from the Project site, and legally dispose of them in an EPA-approved landfill.

END OF SECTION

SECTION 331000
WATER UTILITIES

PART 1-GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

1.2 DESCRIPTION OF WORK

- A. Provide labor, materials, and equipment necessary to construct the exterior water system complete, including connections to existing pipelines and testing, all as indicated on the Drawings and as specified, including but not limited to the following:
 - 1. Installation of ductile iron pipe, fittings, accessories, and appurtenant work, at the locations and to the lines and grades indicated on the Contract Drawings.
 - 2. The installation of hydrants, gate valves and boxes and concrete thrust blocks.
 - 3. Furnishing and installation of all materials required to connect to existing water mains, replace existing services, install new gate valves, remove existing gate valves, install corporation cocks, saddles, curb stops, service boxes, and abandoning of the existing water system (if applicable), all as shown on the Contract Drawings. All valves, 24 inches and larger shall be butterfly valves. All abandoned pipes shall be cut and capped at the main.
 - 4. In accordance with 528 CMR 11.00, work on the fire protection system, including hydrants and exterior underground piping, shall be performed by a Licensed Fire Protection Sprinkler Systems Contractor. The fire protection exterior underground piping will terminate at the valved tee connection to the water distribution system. The tee and valve will not be considered part of the fire protection system work.
- B. Unless otherwise indicated on the Drawings, exterior water lines shall be installed from a point 10 feet outside the building foundation walls to the potable water source
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections.
 - 1. Section 312000 – EARTH MOVING for excavation, backfill, and compaction requirements.
 - 2. Section 211000 – FIRE PROTECTION for fire protection service piping.
 - 3. Section 221000 – PLUMBING for potable water service piping.

1.3 SUBMITTALS

- A. Refer to Section 013300 – SUBMITTAL PROCEDURES, for submitted provisions and procedures.

1. Descriptive literature showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.
2. Product Data: Submit manufacturer's technical product data and installation instructions for potable water system materials and products.
3. Shop Drawings: The Contractor shall submit for review shop drawings or descriptive literature for potable water system, showing piping, fittings, couplings, valves, hydrants, materials, dimensions, restrained joint calculations, joints and other details, blocks, and anchors. All hydrants and valves furnished under the Contract shall be manufactured only in accordance with the Specifications and the approved Shop Drawings.
4. At project closeout, submit record drawings of installed potable water system piping and products, in accordance with requirements of Division 1. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor or Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2010 or higher).
5. Maintenance Data: Submit maintenance data and parts lists for water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual in accordance with requirements of Division 1.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 1. ASTM: American Society for Testing and Materials.
 2. ANSI: American National Standards Institute.
 3. AWWA: American Water Works Association.
 4. AASHTO: American Association of State Highway and Transportation Officials.
 5. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), Formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
 6. MassDOT, Construction Standards, latest Edition with amendments, hereinafter referred to as the "Construction Standards."
 7. Commonwealth of Massachusetts State Plumbing Code, latest edition.

8. Commonwealth of Massachusetts Regulations 528 CMR 12.00 Sprinkler Contractor Licensing Regulations.
9. Town/City Water Department Regulations.

1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of potable water systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- B. **Installer's Qualifications:** Firm with at least three years of successful installation experience on projects with potable water piping work similar to that required for this project.
- C. **Water Purveyor Compliance:** Comply with requirements of Purveyor supplying water to project, obtain required permits and inspections.

1.7 PROJECT CONDITIONS

- A. **Site Information:** Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that water system piping may be installed in compliance with Contract Drawings and referenced standards.
- B. **Interruption of Existing Water Distribution System:** Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to the requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of service without Architect's written permission.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate with interior building domestic water and fire protection system piping.
- B. Coordinate with other utility work.

- C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.
- D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

PART 2-PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

- A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Engineer to comply with installation requirements. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
 - 1. Ductile iron pipe shall be that of a manufacturer who can demonstrate at least five years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push on type, restrained joint, or mechanical joints, as required.
 - 2. All ductile iron water pipe shall conform to American Water Works Association (AWWA) C150 and AWWA C151.
 - 3. The ductile iron pipe shall be Class 52 and furnished in minimum nominal 18-foot lengths, with Push-on or Mechanical Joints as manufactured by U.S. Pipe and Foundry Company, Atlantic States Cast Iron Pipe Co., Clow Corporation, or approved equal with gaskets conforming to AWWA C111 "Rubber Gasket Joints". A minimum of two bronze wedges per joint shall be used to maintain conductivity and facilitate lock-on.
 - 4. All ductile iron pipes shall be rated for a minimum operating pressure of 350 psi.
 - 5. The ductile iron water pipe shall be double cement lined inside and then asphalt seal coated in accordance with AWWA C104 and AWWA C151. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.
 - 6. All water pipe shall be encased in polyethylene film when the trench is backfilled with control density fill.
 - 7. Fittings shall be ASTM A-536 ductile iron with mechanical joint fittings. All fittings 3 inches through 48 inches in diameter shall meet or exceed the requirements of AWWA C110. Compact fittings shall be ductile iron meeting or exceeding the requirements of AWWA C153. Fittings shall have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends. All fittings 4 through 24 inches shall be Class 350. All fittings greater than 24 inches shall be as specified above except they shall be Class 250. Compact fittings shall only be used in sizes 4 through 24 inches. Fittings shall conform to the weights, excluding accessories,

and dimension shown in the latest edition of the Handbook of Ductile Iron Pipe and come complete with all joint accessories as required. All accessories (gland, gaskets, T-bolts, and nuts) shall be in accordance with AWWA C111. All mechanical joint bolts (T-bolts) shall be Cor-Ten or equal.

8. In order to provide positive joint restraint, valve anchor tees/valves and restrained joints shall be used on fire services and on the 6-inch branch connections for hydrants.
9. Caps and plugs installed in all new work as indicated on the Contract Drawings shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to future connection.
10. Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross connections, whether or not specifically stated in the Contract Drawings and Specifications.
11. All pipe shall be marked with the class, thickness designation, and initials of the manufacturer.
12. If required the manufacturer shall supply the Engineer with certificates of compliance with these Specifications and certification that each piece of ductile iron pipe has been tested at the foundry with the Ball Impression Test, Ring Bending, or equal.
13. Thrust blocks shall be used at all bends and fittings as shown on the details. In addition, all bends and fittings shall be restrained with Megalug Series 1100 mechanical joint restraint. In the event that the use of thrust blocks is not practical or allowed, the Contractor shall provide an alternate method of joint restraint, at no additional cost to the owner, as approved and/or as directed by the Engineer. Restraint length calculations and restrained joint locations shall be provided by the contractor and submitted to the engineer for review. Restraint length values shall be calculated per the manufacturer's standards.
 - a. Restraint for standardized mechanical joints shall be incorporated in the design of the follower gland and shall impart multiple wedging action against the pipe, increasing its resistance as the pressure increases. The assembled joint shall maintain its flexibility after burial and shall maintain its integrity by a controlled and limited expansion of each joint during the wedging action. Restraining glands shall be manufactured of high strength ductile iron conforming to the requirements of ASTM A536, Grade 65-45-12. Wedging mechanisms shall be manufactured of ductile iron, heat treated to a hardness of 370 BHN minimum. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee head bolts conforming to the requirements of ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.53/C153 of latest revision. Twist-off nuts shall be incorporated in the design of the wedge activation screws to ensure proper torque. The mechanical joint restraining device shall have a water working pressure rating of 350 psi minimum (in sizes 4" thru 16") with a safety factor of at least 2:1 against separation when tested in a dead-end situation.
 - b. Restraint for push-on ductile iron pipe shall consist of a wedge action restraint ring on the spigot joined to a split ductile iron ring behind the bell. The restraint

ring shall have individually actuated wedges that increase their resistance to pull-out as pressure or external forces increase. The restraint ring and its wedging components shall be made of minimum grade 65-45-12 ductile iron conforming to ASTM A536. The wedges shall be heat treated to a minimum hardness of 370 BHN. Torque limiting twist off nuts shall be used to ensure proper actuation of the restraining wedges. The split ring shall be made of a minimum grade of 65-45-12 ductile iron conforming to ASTM A536. The connecting tie rods that join the two rings shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. The assembly shall have a rated pressure with a minimum two to one safety factor of 350 PSI in the sixteen-inch size and below 250 PSI in the eighteen through thirty-six-inch sizes. Push on joints on ductile iron pipe shall be restrained with Megalug Series 1700 restraint harness.

14. Insulation shall be manufactured by Thermal Pipe Systems, Atlas Insulation, or Insulated Piping Systems Inc., or other approved manufacturer. Insulation shall be factory foamed-in-place polyurethane foam insulation having nominal thickness of 1 1/2-inch, with an in-place density of 2.5 pcf, and a "K" factor of 0.16 BTU*in./hr.*°F*sq. ft. Straight joints between insulated pipe lengths, and the end sections of non-insulated pipe shall be sealed with heat shrinkable wrap-around polyethylene as supplied by manufacturer and installed in field by Contractor. Insulation jacket shall be 20-gauge corrugated aluminum preformed to be fastened with stainless steel screws and bands. Jacket shall have one layer of one mil polyethylene film with a protective coat of 40-pound virgin Kraft paper to act as a moisture and galvanic corrosion barrier.
15. Pipe for use with split couplings shall be as specified except that the ends shall not have bells or beads but shall have cast or machined shoulders or grooves as necessary for the couplings to be used and shall conform to the specifications of the manufacturer of the couplings. If split couplings are used with grooved ductile-iron pipe, the minimum pipe wall thickness shall be as follows:

Nominal Pipe Size (In.)	Thickness Class
4-12	53
14-18	54
20	55
24	56

16. Pipe for use with sleeve-type couplings shall be as specified except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.

B. COUPLINGS AND ADAPTERS FOR DUCTILE IRON PIPE

1. Sleeve type couplings for plain end pipe shall be provided with plain rubber gaskets and steel, tee head bolts with nuts. Couplings shall be Dresser style 38 or 138,

furnished preassembled, as manufactured by Dresser Industries, Inc., Smith Blair, Coupling Systems, Inc., or equal.

2. Couplings or adapters as required for connecting existing pipe to new pipe or new pipe to new pipe shall be furnished as required and designed for compatibility with the pipe and operating pressures encountered. Couplings shall be Dresser Style 162 as manufactured by Dresser Industries Inc., or equal. Flanged adapters shall be Dresser Style 128, or equal. Couplings for ductile iron to cast iron pipe shall be Style 53, and for ductile iron to transite pipe shall be style 153, as manufactured by Dresser Industries, Inc., or as manufactured by Smith Blair, Coupling Systems, Inc. or equal. Transition couplings shall be Style 162 as manufactured by Dresser Industries, Inc. or approved equal.
3. Split couplings may be used for connecting gray cast iron or ductile iron. If split couplings are used with grooved ductile iron pipe, the minimum pipe wall thickness shall be as specified. Split couplings shall be made of malleable iron and shall be suitable for use with grooved-end or shouldered-end, cast iron pipe. They shall be Victaulic couplings made by the Victaulic Company of America, Elizabeth, New Jersey; Gruvagrip couplings made by Gustin-Bacon Manufacturing Company, Kansas City, Missouri; Groove couplings made by Eastern Malleable Iron Company, Pittsburgh, Pennsylvania; or equal products.
4. Flexible Couplings: Sleeve type couplings for plain end ductile iron pipe shall be provided with plain rubber gaskets and steel, track head bolts with nuts.
5. Couplings shall be furnished pre-assembled by the manufacturer.
6. Couplings shall be given a shop coat compatible with the same outside coating as the pipe specified above.
7. All couplings shall be furnished with the pipe stop removed.
8. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe. The gaskets shall have metallic tips to provide electrical continuity through the joint.
9. The Contractor shall provide suitable filling rings where the layout of the flanged piping is such as to necessitate their use. In materials, workmanship, facing, and drilling, such rings shall conform to the 125-pound ANSI Standard. Filling rings shall be of suitable length with nonparallel faces and corresponding drilling, if necessary, to ensure correct assembly of the adjoining piping or equipment.
10. Couplings for exposed pipe shall be of steel and shall be Dresser Style 38, Smith-Blair Style 411, Baker Allsteel, or equal. The couplings shall be provided with steel bolts and nuts.
11. At the Contractor's option, flexible connections in the piping shall be sleeve-type couplings, split couplings or mechanical joint pipe as herein specified.

C. INSPECTION, TESTS, AND ACCEPTANCE FOR DUCTILE IRON PIPE

1. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to "AWWA Standard for Ductile Iron Pipe, for Water and Other Liquids" (AWWA H3) and (AWWA C151).
2. All tests shall be made in accordance with the methods prescribed by the above mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.
3. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor.
4. All ductile iron pipe to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of the inspection of a reasonable amount of disapproved pipe, will be borne by the Owner.

D. FLANGED JOINTS FOR DUCTILE IRON PIPE

1. For flanged joints, gaskets shall be ring gaskets of rubber with cloth insertion. Gaskets twelve (12)-inches in diameter and smaller shall be 1/16-inch thick, gaskets larger than twelve (12)-inch shall be 3/32-inch thick.
2. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the Contract Drawings, be Grade B conforming to the ASTM Standard Specification for Carbon Steel, Externally and Internally Threaded Standard Fasteners, Designation A307. Bolts and studs shall be of the same quality as machine bolts. Flanged ductile iron pipe from 3 to 48-inches in diameter shall be classified by Underwriters Laboratories Inc. in accordance with AWWA C115.

2.2 SERVICE TUBING, CORPORATIONS, STOPS, SADDLES, AND VALVE BOXES

- A. Service tubing shall meet the requirements of Federal Specification WW-T 7996 and shall conform to ASTM specification B75, B68 and B88 as they apply to Type K Copper Tubing.
- B. Copper Tube Size (CTS) Polyethylene Tubing for domestic water uses shall conform to AWWA C901, ASTM D3350, and ASTM D2737 and shall have a working pressure rating of 200 psi. Tracer wire shall be attached to the tubing and connected to upstream piping of the associated water meter for the water service, as applicable.
- C. The Contractor shall furnish and install, including necessary taps and connections, corporation stops, CTS Polyethylene Tubing, curb stops and wastes.
- D. The corporation stops shall meet the most recent revision of the AWWA standard "Threads for Underground Service Line Fittings." (AWWA C800).

- E. Corporation stops shall be sized as shown on the drawings and be brass compression-type with CC thread (Mueller Brand with compression nut with set screw). Corporation stops shall open in the standard direction for the Town of Boxford.
- F. Curb Stops: Curb stops shall be sized as shown on the drawings and be brass compression-type with drain (Mueller Brand with compression nut with set screw). Curb stops shall open standard direction for the Town of Boxford.
- G. Tapping Saddles: Service connections shall be tapped with Size 2" X 8" double strap service saddles.
- H. Fittings and Boxes: Service boxes shall be cast iron. Extension service boxes of the required length and having slide-type adjustment shall be installed at all service box locations. The boxes shall have housings of sufficient size to completely cover the curb stop and shall be complete with identifying covers
- I. Service boxes shall be 2 ½" Buffalo Style, heavy cast iron, tar coated, sliding type, consisting of three (3) pieces; a flanged bottom piece, a flanged top piece and bolted cover with the word "water" cast on the top. A minimum 6-inch overlap is required between sliding sections. The boxes lengths shall be as necessary to suit ground elevation.

2.3 IDENTIFICATION

- A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils. minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer

PART 3-EXECUTION

3.1 INSPECTION

- A. General: Examine areas and conditions under which potable water system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Engineer.
- B. The Contractor is responsible for the provisions and all test requirements specified in herein. In addition, all pipe and appurtenances may be inspected at the plant for compliance with these specifications by an independent testing laboratory.
- C. All tests shall be made in accordance with the methods prescribed by the above-mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.
- D. Inspection of the pipe and appurtenances may also be made after delivery. The pipe and appurtenances shall be subject to rejections at any time on account of failure to meet any of the specifications requirements, even though samples may have been accepted as satisfactory at the place of manufacture.
- E. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor at no cost to the Owner.

3.2 HANDLING PIPE

- A. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.
- B. Pipe shall be stored above ground at a height no greater than 5-feet, and with even support for the pipe barrel.
- C. Only nylon protected slings shall be used for handling the pipe. No hooks, chains or bare cables will be permitted.
- D. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.

3.3 INSTALLATION OF PIPE AND PIPE FITTINGS

- A. The Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross connections, whether or not specifically stated in the Contract Drawings and Specifications.
- B. Care shall be taken in loading, transportation, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before placement, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer or Owner's Representative.

- C. If any defective pipe is discovered after it has been placed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense. All pipe and fittings shall be kept clean until they are used in the work, be thoroughly cleaned before placement, and when placed, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm even bearing throughout the length of the pipe shall be constructed by compacting sand gravel borrow around the pipe and up to 18 inches above the pipe.
- D. Blocking will not be permitted.
- E. A minimum horizontal separation of ten (10) feet shall be maintained between and existing, proposed or relocated sewer and the new water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, it is permitted to install a water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located eighteen (18) inches above the top of sewer. Where the horizontal clearance is less than ten (10) feet or the vertical clearance is less than eighteen (18) inches and the sewer crosses under the water main, both water main and sewer main shall be constructed of mechanical joint cement lined ductile iron pipe for 10-feet on either side of the crossing. One (1) full length of water pipe shall be centered over the sewer at the crossing. If the sewer crosses over the water main, regardless of the vertical separation, both pipes shall be concrete encased for a distance of ten (10) feet to either side of the respective centerline.
- F. Provide minimum cover over piping of 5-feet below finished grade.
- G. Extend water systems from the water main located within the public way and terminate potable water piping 10-feet 0-inches from the building foundation. Provide temporary pipe plug for piping extension into building if required by construction progress.
- H. All pipes shall be sound and clean before placement. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be temporarily closed by watertight plug or other acceptable means. Alignment shall be maintained during placement. The deflection at joints shall not exceed sixty percent of that recommended by the manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities, which may be encountered upon opening the trench. Solid sleeves shall be used only where allowed by the Engineer.
- I. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on type bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be inspected for damage and shall be re-mortared as required to ensure a continuous lining.
- J. Mechanical joint restraints shall be used for all valves, bends, hydrants and piping section less than 50 feet. The contractor shall restrain all pipe runs to the lengths indicated on the approved restrained joint calculation shop drawings.

- K. Jointing of ductile iron push on pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8 inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to ensure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
 - 1. Jointing Ductile Iron Pipe (Push-On Type): Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.
 - 2. Jointing Mechanical Joint Fittings: Mechanical joints at valves, fittings, and where designated shall be installed in accordance with the "Notes on Method of Installation" under ANSI Specification A 21.11 and the instructions of the manufacturer. To assemble the joints in the field, the Contractor shall thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no condition shall extension wrenches or pipes over handles or ordinary ratchet wrenches be used to secure greater leverage.
- L. Installation and jointing of ductile iron pipe shall be in accordance with AWWA C600, Sections 9b and 9c, latest revision, as applicable.
- M. Service tubing shall be installed with minimum 6-inches of sand bedding and 12-inches sand cover. Service tubing shall have a minimum total cover of 5 feet.

3.4 INSTALLATION OF VALVES AND APPURTENANCES

- A. Cleaning and Prime Coating Valves and Appurtenances (Except Epoxy Coated Valves)
 - 1. Prior to shop prime coating, all surfaces of the valves and appurtenances shall be thoroughly clean, dry, and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer or Owner's Representative.
 - 2. All ferrous surfaces shall be sand blasted or pickled according to SSPC-SP6 or SSPC-SP8, respectively.
 - 3. All gears, bearing surfaces and other surfaces not to be painted shall be given a heavy coat of grease or other suitable rust resistant coating unless otherwise specified herein. This coating shall be maintained as required to prevent corrosion during any period of storage and installation and shall be satisfactory through the time of final acceptance.
- B. Installation

1. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired before they are installed.
 2. Care shall be taken to prevent damage to valves and appurtenances during handling and installation. All materials shall be carefully inspected for defects in workmanship and materials, all debris and foreign material cleaned out of valve openings, etc., and all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment that does not operate easily, or are otherwise defective, shall be repaired or replaced.
- C. Shop Painting Valves and Appurtenances
1. Interior and exterior surfaces of all valves which are not factory epoxy coated shall be given two coats of shop finish of an asphalt varnish conforming to AWWA C504 for Varnish Asphalt. The pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.
- D. Buried Valves
1. Install valves as indicated with stems pointing up. Provide valve box over underground valves. Buried valves and boxes shall be set with the operating stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping selected excavated material under and at the sides of the valve.
- E. Valve Boxes
1. Valve boxes shall be installed vertically, centered over the operating nut, and if they are within the limits of the roadway or within limits where the plowing of snow will take place in the winter, the tops of the boxes shall be set $\frac{1}{2}$ " below the top of the finished grade. In locations where these boxes are not likely to be disturbed, the tops shall be set flush with the adjoining ground. Boxes shall be adequately supported during backfilling to maintain vertical alignment.
- F. Corporation Cocks
1. The tapping machine shall be rigidly fastened to the pipe as near the horizontal diameter as possible. The length of travel of the tap should be so established that when the stop is inserted and tightened with at 14" wrench, not more than one to three threads will be exposed on the outside. When a wet tapping machine is used, the corporation stop shall be inserted and tightened in accordance with the manufacturer's specifications.
- 3.5 BACKFILLING
- A. General: Conduct excavation and backfill operations for utility installations in accordance with Section 312000 – EARTH MOVING, local requirements, and the contract documents.
- B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

3.6 FIELD QUALITY CONTROL

A. Testing of Water Main/Service:

1. Prior to pressure testing, the entire line shall be water jetted to remove any rocks or debris that may have inadvertently entered the pipe during construction.
2. The Contractor in accordance with AWWA C651-99 specifications or latest revision will make pressure and leakage tests thereof, to determine that the ductile iron pipe is structurally safe and free of excess leakage. Pipeline shall be subject to a hydrostatic test of 150 pounds per square inch (psi) or 150% of the static pressure, whichever is greater. The Contractor shall furnish all equipment, materials, and labor for testing. Testing shall be done between valved off sections in approximately 1000-foot maximum section of the main. The Contractor shall furnish at his own expense the water needed for all water main testing.
3. Once the pipeline section has been filled at normal pressure and all entrapped air removed from the line, the Contractor shall raise the pressure to the approved test pressure by a special pressure pump taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumpage into the pipeline. The pipe shall maintain this pressure, within 5 psi, for a minimum of two hours during which time the line shall be checked for leaks. The measured water leakage shall not exceed the maximum allowed leakage as determined by the following equation for the section under test:

$$L = SDP^{1/2} / (133,200)$$

Where:

L = Allowable leakage, gallons per hour

S = Length of pipe section tested, feet
(1,000-foot maximum)

D = Nominal pipe diameter, inches.

P = Average test pressure (psi)

Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair same at his expense. Pipe shall be flushed and chlorinated when leakage does not exceed above standard. Approval does not absolve the Contractor from his responsibility if leaks develop within the new main or water services (to curb box) later within the period of warranty.

B. Testing of Fire Protection Service:

1. Testing of fire protection services shall conform to the most current NFPA requirements.

C. Chlorinating and Flushing:

1. Prior to chlorination, the Contractor shall properly flush mains. In general, flushing shall be performed at a flow rate required to achieve a minimum velocity of 2.5-feet per second (approximately 900 GPM in a 12-inch diameter main and 400 GPM in 8-

- inch diameter main). Flushing shall be performed for a sufficient period of time to allow for a minimum of 3 volume changes of water in the main (approximately 20 minutes per 1,000-foot of 8-inch main at the above flow rate).
2. Chlorinating shall be accomplished by pumping a chlorine solution into the mains. Water shall be allowed to enter the new water mains until the mains are full of a solution containing 25-ppm available chlorine. The valves shall then be closed and the chlorinated water allowed to stay in the mains for 24 hours. At the end of this period, the chlorine residual shall be at least 10 mg/l. If it is less than 10 mg/l measured, Contractor shall flush and rechlorinate the mains at no cost to the Owner. All valves and hydrants shall be operated to ensure their proper disinfection and shall be manipulated to prevent superchlorinated water from entering the existing distribution system. After this period, the Contractor shall flush the mains until clear, clean water is being discharged.
 3. Chlorinating and flushing shall be done in accordance with AWWA C651-99 Specifications.
 4. Twenty-four hours after the main has been flushed of chlorinated water, bacteriological samples shall be taken. Water samples shall be taken from corporation stops along the length of the water main. A minimum of two (2) samples shall be taken, per 3,000 foot of pipe or on each street, whichever is greater, each in duplicate, in sterile bottles and sent to a State approved private laboratory for analyses. The Contractor shall perform all necessary work including delivery of samples to a certified laboratory, and shall include the cost of sampling and analysis in his bid price. The results of the tests on these samples will determine the acceptance of the work and allow these new mains to be connected to the District's system. The failure of any sample to pass the laboratory tests shall require the Contractor to reflush and rechlorinate the mains and resample and test the water until acceptable results are obtained, all at no additional cost to the Owner.
 5. The Contractor shall submit a Disinfection report detailing the following:
 - a. Type and form of disinfectant used.
 - b. Date and time of disinfectant injection start and time of completion.
 - c. Test locations.
 - d. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - e. Date and time of flushing start and completion.
 - f. Disinfectant residual after flushing in ppm for each outlet tested.
 6. The Contractor shall submit a Bacteriological Report detailing the following:
 - a. Date issued, project name, and testing laboratory name, address, and telephone number.
 - b. Time and date of water sample collection.
 - c. Name of person collecting samples.
 - d. Test locations.

- e. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
 - f. Coliform bacteria test results for each outlet tested.
 - g. Certification that water conforms, or fails to conform, to bacterial standards.
7. Contractor shall note that work under this Contract shall NOT be considered completed until satisfactory installation and testing of the water mains have been completed.

3.7 FINAL INSPECTION

- A. Final inspection and acceptance of pipe, valves, appurtenances, and hydrants shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system. Prior to placing the systems in service, all components shall be inspected, with the Owner's Representative present, to ensure that no debris or other contaminants are present. If necessary, the Contractor shall clean and flush piping.
- B. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

END OF SECTION 331000

SECTION 333200
SEPTIC SYSTEM

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Installation of Septic Tank and Distribution Box.
2. Pump Chamber and Pump
3. Force Main
4. Leaching Trenches.
5. Appurtenant Piping.

- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 311000, Site Clearing for site clearing and topsoil stripping.
2. Section 312000, Earthwork for excavation, backfill and compaction requirements.

1.3 SUBMITTALS

- A. Refer to SECTION 01300 - SUBMITTALS for submittal provisions and procedures. In accordance with Conditions of the Contract the following is to be submitted:

1. Product Data: Submit manufacturer's technical product data and installation instructions for septic system's materials and products.

2. Shop Drawings: Submit shop drawings for septic system, showing pipe materials, size, locations, and inserts. Include details of underground structures, connections, and cleanouts. Show interface and spatial relationship between piping and nearby structures.
3. Record Drawings: At project closeout, submit as-built drawings stamped by a registered surveyor of installed septic systems, showing exact location and inverts of septic tank(s), pump station, distribution box, soil absorption system and underground structures. Provide the Owner/Architect an electronic copy in Autocad format.
4. Maintenance Data: Submit maintenance data and parts lists for septic system materials and products. Include this data, product data, shop drawings and record drawings in maintenance manual.
5. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 1. Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments, hereinafter referred to as the "Standard Specifications." All references to method of measurement, basis of payment and payment items in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned therein.
 2. ASTM: American Society for Testing and Materials.
 3. Commonwealth of Massachusetts Plumbing Code, latest edition.
 4. Commonwealth of Massachusetts State Environmental Code Title V, 310 CMR 15.00, latest revision.
 5. Local Board of Health Regulations

1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

- B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of septic system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- B. Installer's Qualifications: Firms with at least three years of successful installation experience on projects with septic systems work similar to that required for project.

1.7 PROJECT CONDITIONS

- A. General: Place barricade around soil absorption field for duration of construction project to prevent construction vehicles from being driven across field. Comply with all notes shown on the Contract Drawings for septic system construction.

PART 2 – PRODUCTS

2.1 IDENTIFICATION

- A. Underground-Type Plastic Line Marker: Manufacturer's standard, permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6-inches wide x 4-mils thick. Provide green tape with black printing reading "CAUTION SEWER LINE BELOW".
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification markers which may be incorporated in the work include: Repnet, Inc.; Emed Co., Inc., Seton Name Plate Corp., or approved equal.

2.2 SOIL ABSORPTION SYSTEM

- A. General: Provide pipe, fittings and washed stone for soil absorption trenches, complete with elbows, tees, adapters, couplings, collars, and joint materials as shown on the Contract Drawings. Use the following materials:
 - 1. Pipe shall be PVC, schedule 40 and shall have 5/16-inch perforations five feet on center. The perforations shall be alternately placed at the 5 o'clock and 7 o'clock positions.

2.3 SEPTIC TANK

- A. General: Provide septic tank of dimensions and capacity as indicated on the Contract Drawings. Septic tanks shall be Rotundo & Sons, Inc., E.F.Shea, Scituate Precast or approved equal.

B. Manholes: Provide a minimum of three (3) 24-inch diameter access manholes on each septic tank with castings to grade in the locations shown on the Contract Drawings.

1. Castings shall be equivalent to E.L. LeBaron No. LK-110 marked "SEWER", Neenah Foundry Co., No. R-1550-A or approved equal.

C. Inlet and Outlet Fittings: Provide inlet and outlet tees in the septic tank at the elevations shown on the Contract Drawings.

2.4 DOSING CHAMBER

A. General: Provide dosing tank of dimensions and capacity as indicated on the Contract Drawings with an inside height of as shown on the Contract Drawings.

B. Access Hatch: Provide aluminum access hatch over the pump chamber. Access hatch shall be installed in the flat top of manhole structure as shown on the Contract Drawings. Hatch shall be installed at finish grade.

1. Access hatch shall be aluminum and equivalent to L. W. Products, Thompson Fabricating, U.S.F. Fabrication or approved equal. Hatch shall have nominal dimensions of [36-inches by 48-inches].

C. Inlet and Outlet Fittings: Provide watertight inlet and outlet connections at the elevations shown on the Contract Drawings.

2.5 DOSING CHAMBER PUMP SYSTEM

A. Equipment: Shall be equivalent as specified on the contract drawings

1. Pumps: Contractor shall install two pumps which shall be equivalent to model specified on contract drawings

2. Guide Rails: Guide rails shall be galvanized schedule 40 steel pipe mounted to the concrete chamber.

3. Piping: The piping in the dosing chamber shall be flanged cast iron. The discharge risers from the two pumps shall be connected within the dosing chamber such that there is a single discharge from the dosing chamber exiting the chamber with at least 5 feet of cover. Force main outside chamber shall be PVC SDR 21. Contractor shall supply necessary fittings to make the transition from cast iron to PVC.

4. Float switches shall be as specified by the pump manufacturer with 20-feet of cable. Provide float switches at the elevations shown on the Contract Drawings and one mounting bracket.
5. Control Panel: The same company as the pump and rail system shall manufacture the control panel. The control panel shall mounted as indicated on the Contract Drawings. Equipment mounted in the control panel shall include: steel back panel, IEC motor starters with 3-pole bi-metal overload relay for each pump, pump circuit breakers, control circuit fuse, alarm circuit fuse, control circuit breaker, control circuit transformer, two hand-off-auto switches, alarm test switch, two pump run lights, terminal blocks, ground lugs, flashing alarm light, full inner door, overload reset button, override relay, and alternator relay.
6. Control System: The control system for the dosing chamber shall have the capability to perform the following tasks: start one pump on high level, turn the operating pump off when the level reaches a low level, start the second pump and activate an alarm when the level reaches a high water level, and activate an alarm condition if the water level reaches a low level in the chamber. All levels shall be activated by float switches placed at the elevations shown on the Contract Drawings. The control panel also shall be capable of alternating starts of the two pumps. The high water alarm condition shall activate an alarm horn and an alarm beacon mounted on the top of the control panel. The Contractor shall also provide the following additional features on the control panel: elapsed time meter for each pump, convenience outlet, lightning arrestor, and low level cut-off. Within the control panel lights shall be provided and labeled for each of the alarm conditions to make it possible to determine what caused the alarm. The Contractor is responsible for providing a fully functioning system as described.
7. Alarm Signaling: The contractor shall provide alarm signaling from the dosing chamber control panel to the annunciator panel mounted in the mechanical room of the building. Any and all alarm conditions from the dosing chamber shall be relayed to the annunciator panel as a single "Dosing Chamber Alarm Condition."

2.6 ANNUNCIATOR PANEL

- A. Provide and install an annunciator panel. The annunciator panel shall be mounted in the location determined by the owner. The same manufacturer as the control panels for the dosing chamber and the tight tank shall manufacture the annunciator panel. The annunciator panel shall have red lights mounted on the front cover for the following conditions:
 1. "Dosing Chamber Alarm Condition."
- B. The lights on the panel shall each possess a reset button to clear the alarm.

PART 3 – EXECUTION

3.1

- A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.
- B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand or washed stone to the indicated level on the Contract Drawings.
- C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.2 GENERAL INSTALLATION

- A. General Locations and Arrangements: The Contract Drawings (plans and details) indicate the general location and arrangement of the underground sanitary sewerage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. Use manholes for changes in direction of gravity lines and at one hundred (100) foot intervals, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- E. Install piping pitched down in direction of flow, at minimum slope of ¼-inch per foot, except where indicated otherwise on the Contract Drawings.
- F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated.

3.3 INSTALLATION OF IDENTIFICATION

- A. General: During back-filling/top-soiling of septic system's piping and components, install continuous underground-type plastic line marker, located directly over buried lines and leaching field perimeter at 6-feet to 8-inches below finished grade.

3.4 LEACHING TRENCHES

- A. Grading: Place piping at elevations noted on the Contract Drawings.
- B. Piping: Lay piping solidly bedded in filtering material. Provide full bearing for each section throughout its length, to true grades and alignment.
- C. After piping has been installed, place additional filtering material around sides and top to compacted depth as indicated on the Contract Drawings.
- D. Testing Lines: Test and check piping before backfilling. Remove obstructions, replace damaged components, and retest system until satisfactory.
- E. Backfilling: Immediately backfill field with the proper material, mounding but not compacting soil to the indicated elevations. Do not permit construction equipment on backfilled trenches.

3.5 INSTALLATION OF TANKS

- A. General: Install as indicated on the Contract Drawings, and in accordance with the manufacturer's installation instructions.
- B. Tests: Fill tank(s) with water and let stand overnight. If water level recedes, locate and repair leaks, and retest at no cost to Owner. No leakage is allowed.

3.6 INSTALLATION OF PUMP SYSTEM

- A. General: Install all equipment in accordance with manufacturer's instructions.
- B. Chamber: Install precast chamber on a 12-inch minimum thickness of crushed stone. The chamber shall be set level and plumb.
- C. Equipment: Install all chamber equipment in accordance with manufacturer's instructions. Seal chamber penetrations with non-shrink grout.
- D. Force Main: Install force main to the distribution manifold as shown on the Contract Drawings. Lay piping at a slope(s) that will not create high or low points between the dosing chamber and the manifold.

- E. Testing: Provide the services of a manufacturer's trained technician to start-up and test the system. Pumps shall be throttled with the gate valves to create sufficient TDH to reduce discharge rate to XX gallons per minute. The performance of the system for lead pump, lag pump, high water alarm, and alternation, and reset shall be demonstrated to the approval of the Engineer.

3.7 FIELD QUALITY CONTROL

- A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.
- B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
 - 2. Flush piping between manholes, if required by local authority, to remove collected debris.
- C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
 - 1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2-feet of backfill is in place, and again at completion of project.
 - 2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, the Contractor shall correct such defects at no cost to the Owner and reinspect.
 - 3. Prior to acceptance of the sanitary sewerage system, the Contractor shall submit to the Engineer for review a system As-Built Plan stamped by a Professional Land Surveyor Registered in the Commonwealth of Massachusetts.

END OF SECTION 333200

SECTION 334000
STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to construct the storm drainage system complete, including connections to existing structures and testing, as indicated on the Drawings and as specified.
- B. Unless otherwise indicated on the Drawings, building drain service lines shall be installed from a point 10 feet outside the building foundation walls to the point of disposal.
- C. Related Work: The following items are noted and included in this Section and will be performed under the designated sections:
 - 1. Section 312000 – EARTH MOVING for excavation, backfill, & compaction requirements.
 - 2. Section 221400 – FACILITY STORM DRAINAGE for building storm drainage piping.

1.3 SUBMITTALS

- A. Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
 - 1. Product Data: Submit manufacturer's technical product data and installation instructions for storm drain system materials and products.
 - 2. Submit descriptive literature for piping, fittings, couplings, and appurtenances showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.
 - 3. Submit shop drawings for storm drain systems, showing piping and manhole materials and sizes.
 - 4. Submit shop drawings of complete layout of detention/retention structures, including all fittings and appurtenances.
 - 5. The precast concrete structure shop drawing submittals for the manholes, catch basins, vaults, and tanks shall contain erection drawings showing connections, cast-in items, waterproofing details, lifting hooks, and production drawings showing elevations, sections, and details indicating sizes and quantities of reinforcement.
 - 6. Submit shop drawings for structure frames, grates, and covers.

7. Filter fabric: Submit the manufacturer's information.
8. For trench drains submit shop drawings showing a schematic plan of the entire trench drain system, listing all parts being provided with exact centerline dimensions suitable for installation. Copies of the manufacturer's recommended method of installation and assembly shall be submitted for review.
9. For water quality structures and stormwater quality filter treatment structures submit shop drawings for the structure and performance. Shop drawings shall detail the structures precast concrete components, inserts, and castings. Where an external bypass is required, the manufacturer shall provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.
10. The Contractor shall submit buoyancy calculations for storm drainage structures assuming groundwater is one (1) foot below finish grade. If buoyancy is an issue the structure(s) shall be modified to prevent uplift. All buoyancy calculations and precast concrete structure designs shall be prepared and sealed by a professional Civil Engineer licensed in the state of Massachusetts.
11. Prior to the acceptance of the storm drainage system, the Contractor shall submit to the Engineer, for review and approval, As-Built Drawings that indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor or Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2010 or higher).
12. Prior to acceptance of the storm drainage system, the Contractor shall submit the results of the pipe deflection measurements and the video inspection reports.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 1. ASTM: American Society for Testing and Materials.
 2. ANSI: American National Standards Institute.
 3. AASHTO: American Association of State Highway and Transportation Officials.
 4. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), Formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
 5. MassDOT Construction Standards, latest Edition with amendments, hereinafter referred to as the "Construction Standards."

1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

- A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm drain systems.
- B. Utility Compliance: Comply with the Town of Boxford regulations, standards, and guidelines pertaining to storm drainage system installation and inspections.
- C. Plumbing Code Compliance: Comply with applicable portions of Massachusetts Plumbing Code and National Standard Plumbing Code, latest editions, pertaining to selection and installation of storm drain system's materials and products.
- D. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of storm drain system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- E. Installer's Qualifications: Firms with at least three years of successful installation experience on projects with storm drain work similar to that required for the project.

1.7 PROJECT CONDITIONS

- A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that storm drainage system structures and piping may be installed in compliance with Contract Drawings and referenced standards.
- B. Interruption of Existing Storm Drainage System: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to the requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Architect's written permission.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate with interior building storm drain system piping.

- B. Coordinate with other utility work.
- C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.
- D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

PART 2 – PRODUCTS

2.1 MANHOLES AND CATCH BASINS

- A. General: Provide precast reinforced concrete structures as indicated and complying with ASTM C 478.
- B. Manhole Top: Precast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated in the Contract Drawings. Tops shall be designed to meet H20 loadings.
- C. Base and Riser Sections: Precast concrete, with base riser section with integral floor. Diameter, base and riser thicknesses shall be as indicated on the Contract Drawings.
- D. Cement: Type II.
- E. Concrete strength: 4,000 psi minimum.
- F. Precast concrete sections shall have tongue and groove joints.
- G. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a flexible, watertight joint, made with preformed butyl rubber joint sealant conforming to ASTM C990 or with a rubber gasket joint conforming to ASTM C443. Sealants and/or gaskets shall be installed in accordance with the manufacturer's written instructions.
- H. Manhole Steps: Steps for manholes shall be non-skid raised edge-front steel reinforced polypropylene plastic type with at least 13-inch-wide stepping surface. Steps shall meet the requirements of ASTM C-478 and AASHTO M-199. Steel shall be 1/2-inch grade 60 conforming to ASTM A615 encapsulated with molded copolymer polypropylene. The polypropylene shall conform to ASTM D-4101. Rungs shall protrude no more than 6 inches from the wall. The portion of the legs to be embedded in the precast section shall have fins and be tapered to ensure a secure bond. Steps shall start a foot above the shelf of the manhole floor and continued twelve inches on center spacing up through the completed height of the unit. The steps shall finish no lower than twenty-four (24)-inches below the rim elevation. Placement into precast walls shall be by a method recommended by the supplier of the precast manhole sections. Steps shall be installed per the manufacturer's specifications.
- I. Pipe Connections: Drainage structures shall have plain beveled openings to accept the type of pipe specified. Pipe openings shall be minimum size required to receive the pipe and shall be accurately set to conform to the required line and grade. Drain pipe shall be joined

to the wall of the concrete manhole or catch basin with non-shrink grout or flexible manhole sleeve as indicated on the drawings. Grout mixture shall follow instructions provided by manufacturer. Flexible manhole sleeves shall be cast in the walls of the manholes during the manufacturing process. Flexible manhole sleeves shall be NPC Kor-N-Seal Pipe-to-Manhole Connector as manufactured by Trelleborg Pipe Seals Milford, Inc., Milford, NH; Z-Lok as manufactured by A-Lok Products, Inc., Tullytown, PA; Tylox CIB Series Cast-In Boot Connector as manufactured by Hamilton Kent, Winchester, TN; or approved equal.

- J. Storm Drainage Brick Masonry: Bricks shall be sound, hard, uniformly burned, regular, and uniform in shape and size. Underburned or salmon brick shall not be acceptable. Only whole brick shall be used.
 - 1. Bricks for raising manhole and catch basin frames to finished grade shall conform to ASTM C32, Grade MS.
 - 2. Mortar shall be in conformance with ASTM C270, Type M. The mortar shall be composed of one-part Portland cement, 3-1/2 parts sand, and ¼ parts hydrated lime, by volume. Portland cement shall be ASTM C150, Type II; hydrated lime shall be Type S conforming to ASTM D207.
 - 3. Sand shall be washed, cleaned, screened, well-graded with all particles passing a No. 4 sieve, and conform to ASTM C33.
- K. Inverts in drain manholes shall be constructed of cement concrete shaped to conform accurately to size of the adjoining pipe. Side inverts and main inverts where the direction changes shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerline of the adjoining pipe lines.
- L. For all manhole depths greater than 10 feet, the inside diameter of the manholes shall be at least 5'-0".
- M. Safety landings will be installed inside manholes greater than 16-feet in depth.
- N. When installing manholes on existing lines and when flows cannot be diverted, drop-over manholes shall be used. Drop-over manholes shall be precast with opening cast in the sidewalls of sufficient size to fit over the existing line(s) to remain in service. Drop-over manholes shall be set on a precast or cast-in-place concrete base slab. Drop-over manholes shall be manufactured to the same requirements and dimensions as standard manholes.

2.2 MANHOLE FRAMES AND COVERS

- A. Frames and covers shall be of cast iron conforming to the requirements of ASTM A48, Class No. 30 and shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Manhole covers shall be machined to fit securely and evenly on the frame. Frames and covers shall be designed to accept H20 loads, have a diamond surface finish, and frame height of 6 to 9-inches. Covers shall be equal to Item Numbers 12665 and 12685 (6" and 8-1/8" frame heights, respectively) as manufactured by General Foundries Inc. Catalog numbers are provided to establish a

standard of quality and configuration of castings. Covers shall bear the word "DRAIN" in 3-inch-high letters.

2.3 CATCH BASIN FRAMES AND GRATES

- A. Catch basin grates located at low points shall consist of a 24-inch square grate with a minimum frame height of 8 inches unless otherwise noted on the drawings. Frames and grates shall be of cast iron and designed to accept H2O loads. Catch Basin Frames and Grates shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Single frames and grates shall be equal to Item Numbers 22444-SQH, 22464-SQH, and 22484-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. ADA Compliant frames and grates shall be equal to Item Numbers 22444-ADA, 22464-ADA, and 22484-ADA (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Double frames and grates shall be equal to Item Numbers 24844-SQH, 24864-SQH, and 24884-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Four and three-flange frames shall be provided as required. Catalog numbers are provided to establish a standard of quality and configuration of castings.
- B. Catch basin cascade frames and grates shall consist of a 24-inch square grate with a minimum frame height of 8 inches unless otherwise noted on the drawings. Frames and grates shall be of cast iron and designed to accept H2O loads. Cascade frames and grates shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Cascade frames and grates shall be equal to Item Numbers 22444-CAS, 22464-CAS, and 22484-CAS (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Four and three-flange frames shall be provided as required. Catalog numbers are provided to establish a standard of quality and configuration of castings.

2.4 CATCH BASIN HOODS

- A. All catch basins shall have hoods installed over the outlet pipe. Hoods shall be cast iron removable or hinged traps that fit over the catch basin outlet pipe. Traps shall be approximately 19-inches wide by 18-inches high and extend 11-inches from the wall of the structure. Catch Basin Hoods shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Hoods shall be equal to Item Number MATRP as manufactured by General Foundries Inc. Catalog numbers are provided to establish a standard of quality and configuration of castings.

2.5 AREA DRAIN

- A. Area drains required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration. The

drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals conforming to ASTM F477. The pipe bell spigot shall be joined to the main body of the area drain. A PVC cap shall be installed at the bottom of the area drain sump. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454. Area drains shall be manufactured by Nyloplast or approved equal.

- B. Grates and frames furnished for all area drainage shall be ductile iron for sizes 8", 10", 12", 15", 18" and 24" and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for area drains shall be capable of supporting H-20-wheel loading for vehicular traffic areas or H-10 loading for pedestrian traffic areas unless otherwise noted. 12" and 15" square grates shall be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black. Grates in walkways shall meet ADA requirements. Grates in planting beds shall be domed grates. The grates furnished for area drains bioretention areas shall be 24" in diameter. All area drain grates should include a locking device. Area drain grates shall be manufactured by Nyloplast or approved equal.

2.6 WATER QUALITY STRUCTURE

- A. The water quality drainage structure models indicated on the Contract Drawings are Stormceptor® as manufactured by the Stormceptor Corporation, Rockville, MD. Equivalent structures include Vortechs as manufactured by Vortechtechnics, Inc. of Portland, ME, and Downstream Defender as manufactured by Hydro International of Portland, ME. Other acceptable equivalent manufactured devices may be used if following requirements are met. Prior to acceptance, the contractor shall receive written approval for use of said substitution from the Town of Boxford and/or their authorized representatives.
- B. The water quality structure shall have a proven laboratory test record of having the capability to remove a minimum of 80% of the sediment load from the low-flow storm conditions from the total catchment area of the drainage system. Laboratory testing methods shall conform to the "Technology Acceptance Reciprocity Partnership" (TARP) Tier II protocol or other acceptable equivalent method and shall have the capability of removing clay and silt size particles.
- C. The available water quality structure laboratory performance documentation shall achieve a grade of "2" or better as rated through the "Massachusetts Stormwater Evaluation Project" (MAStep).
- D. The water quality structure shall be installed underground as part of the stormwater system.
- E. The structure shall be constructed of precast concrete components.

- F. Precast Concrete Sections: All precast concrete components shall be designed and manufactured to a minimum live load of AASHTO HS-20 truck loading.
- G. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a flexible, watertight joint, made with preformed butyl rubber joint sealant conforming to ASTM C990 or with a rubber gasket joint conforming to ASTM C443. Sealants and/or gaskets shall be installed in accordance with the manufacturer's written instructions.
- H. Frame and Cover: The frame and cover shall clearly indicate with lettering the unit's name cast into the cover to allow for easy identification in the field.
- I. Concrete: Precast concrete components shall meet the requirements of ASTM C478.
- J. Fiberglass: The fiberglass portion of the water treatment structure shall be constructed in accordance with ASTM D409, Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks. The internal fiberglass insert shall be bolted and sealed watertight inside the reinforced concrete component.
- K. The water quality structure shall be vertically oriented with easy access to facilitate maintenance.
- L. The first 16 inches of oil storage should be lined with fiberglass or other coating acceptable to the Engineer to provide double-wall containment of any hydrocarbon-based material.
- M. Water quality structure shall be equipped with high flow bypass that shall be physically separated from the separation area to prevent mixing.
- N. The structure shall be maintainable from the surface via access points without requiring entry into the structure.
- O. The structure shall be designed to prevent the formation of secondary eddy currents or scour conditions.
- P. The structure shall be able to be installed to the invert elevations of the drainage system as detailed on the Contract Drawings.
- Q. The water quality structure shall be capable of containing floatable substances such as oil and gasoline within the structure during normal operation as well as periods of service and repair. Floatables containment shall be achieved without the use of floatable additives.
- R. The water quality structure shall not be compromised by backwater conditions i.e., trapped pollutants should not be resuspended and scoured from the interceptor during backwater conditions.
- S. Calculations stamped by a Professional Engineer shall be supplied to demonstrate that the water quality structures will accept the design flow rates without causing a backwater condition.

- T. Inspection: All precast concrete sections shall be inspected to ensure that dimensions, appearance, and quality of the product meet the requirements of ASTM C478.

2.7 PVC DRAINAGE PIPE

- A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
- B. PVC (Polyvinyl Chloride) Gravity Sewer Pipe and Fittings: ASTM D3034, SDR 35, for elastomeric gasket joints. Pipe 18 to 36 inches in diameter shall conform to ASTM F679, T-1 heavy wall. The pipe shall have a Standard Dimension Ratio (SDR) of 35 and a pipe stiffness of 46 psi.
- C. Joints: PVC pipe shall have an integral wall bell and spigot push-on joint with elastomeric gaskets secured in place in the bell of the pipe. The bell shall consist of an integral wall section with solid cross section elastomeric gasket, factory assembled, securely locked in place to prevent displacement during assembly. Pipe joints shall conform to ASTM D3212 and elastomeric gaskets shall conform to ASTM F477.
- D. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an "assembly stripe" imprinted thereon to which the bell end of the mated pipe will extend upon proper joining of the two pipes.
- E. PVC gravity sewer fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and spigot configurations compatible with that of the pipe.

2.8 CORRUGATED POLYETHYLENE PIPE

- A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
 - 1. Corrugated polyethylene pipe shall have an interior surface that is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind.
 - a. Pipe shall conform to AASHTO M252, Type S for 4- through 10-inch diameter pipes.
 - b. Pipe shall conform to AASHTO M294, Type S or ASTM F2306 for 12- through 60-inch diameter pipes.
 - c. Fittings shall conform to AASHTO M252, AASHTO M294 or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.

2. Pipe and fittings shall be high-density polyethylene meeting the requirements of ASTM D3350.
3. Pipe units shall have a minimum laying length of 20-feet except as otherwise indicated or allowed by the Engineer.
4. Pipe shall be installed with a minimum 12-inch cover for AASHTO H-20 loading.

B. CORRUGATED POLYETHYLENE FLARED END SECTION

1. The pipe shall have an interior surface that is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. Flared end section shall be high-density polyethylene meeting ASTM D3350 minimum cell classification 213320C. Metal threaded fastening rods shall be stainless steel.

C. JOINTS ON CORRUGATED POLYETHYLENE PIPE

1. The pipe and fitting joints shall be bell-and spigot with watertight gaskets in accordance with the requirements of ASTM D3212.
2. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
3. Pipe entrances at catch basins shall be made with a mortar made with Type II cement. Mortar mixture shall follow instructions provided by cement manufacturer. Pipe connections at drain manholes and water quality structures shall be made with integral flexible rubber sleeves and Corrugated Pipe Adapters designed for use with the pipe and sleeves.

2.9 SUBSURFACE INFILTRATION CHAMBERS

- A. Subsurface detention chambers shall be HDPE chamber system as manufactured by StormTech, Cultec, or similar. The chambers will be handled, stored, and installed according to manufacturer's specifications and details. The chambers will be placed on a drainage course bed with a minimum of depth of six inches. The chambers shall not be placed with backfill depths greater than 96" to surface as per manufacturer's details.
- B. The nominal storage volume of stormwater chambers shall be 74.9 cubic feet per chamber, including the volume of drainage course bedding.
- C. The galley shall have both of its ends open to allow for unimpeded hydraulic flows and for visual inspection and maintenance of the row's entire length. The galley shall have a circular, indented, flat surface on the top for an inspection port or clean-out.
- D. The galley shall be analyzed and designed using AASHTO methods for thermoplastic culverts contained in the LRFD Bridge Design Specifications, 2nd Edition, including Interim Specifications through 2001. Design live load shall be the AASHTO HS20 vehicle. Design shall consider earth and live loads as appropriate for the specified depth of fill.

- E. The end cap shall be designed to fit into any corrugation of a galley, which allows capping a galley that has its length trimmed and segmenting rows into storage basins of various lengths.
- F. The end cap shall have saw guides to allow easy cutting for various diameters of pipe that may be used to inlet the system. The end cap shall have excess structural adequacies to allow cutting an orifice of the required size at any invert elevation.
- G. The primary face of an end cap shall be curved outward to resist horizontal loads generated near the edges of beds.

2.10 WATER STORAGE TANKS FOR NONPOTABLE WATER REUSE

- A. All storage tanks shall be furnished and installed as single wall fiberglass reinforced plastic UL. Sizes and fittings shall be as shown on the contract drawings. Tank manufacturer shall be in the business of manufacturing tanks to Underwriter Laboratories (UL) Standard 1316. The tank must be manufactured to meet or exceed the requirements of ANSI/AWWA-D120 (Thermosetting Fiberglass Reinforced Plastic Tanks).
- B. The tank shall be manufactured with 100% resin and glass-fiber reinforcement with no sand fillers, and shall be compatible with non-potable water products.
- C. Tanks must be vented. Tanks are designed for operation at atmospheric pressure only.
- D. Tanks shall be capable of storing non-potable water not to exceed 150 degrees Fahrenheit at the tank interior surface.
- E. Loading Conditions – Tanks shall meet the following design criteria:
 - 1. Internal Load – Tank shall withstand a 5-psig air-pressure test with 5:1 safety factor. When tank is designed for on-site testing, contractor shall individually test tank for leakage prior to installation. Maximum test pressure is 5 psig.
 - 2. Vacuum Test – To verify structural integrity, every 10-ft diameter tank and smaller shall be designed to withstand a vacuum test to 11.5 inches of mercury.
 - 3. Surface Loads – Tank shall withstand surface H-20 axle loads when properly installed according to tank manufacturer’s current Installation Manual and Operating Guidelines.
 - 4. External Hydrostatic Pressure – Tank shall be capable of being buried in ground with 7 feet of overburden over the top of the tank, the hole fully flooded and a safety factor of 5:1 against general buckling.
 - 5. Tank shall support accessory equipment – such as drop/fill tubes – when installed according to tank manufacturer’s current Installation Manual and Operating Guidelines.
- F. Flanged Manways:
 - 1. The standard manway is 24-inch, nominal internal diameter, which is supplied by the manufacturer (30-inch and 36-inch manways are optional).

2. All manways will be furnished complete with gasket, bolting hardware, and cover.
 3. Location(s) shall be indicated on tank drawings.
 4. Manway extensions shall be Fiberglass Reinforced Plastic (FRP).
- G. Tank Bottom Deflector Plates: These plates shall be installed under each service fitting and manway opening.
- H. Ladders: Ladders shall be the standard ladder as supplied by the tank manufacturer (fiberglass, stainless steel, or aluminum).
- I. Fittings:
1. All inlet/outlet stub outs shall be FRP, and shall be flat-faced, flanged and conform to ANSI B16.5 150# bolting patterns.
 2. Flexible connectors must be used on all piping connections. Piping must be free to move independent of the tank.
 3. All metal fittings and other metal components must be coated to protect against corrosion.

2.11 FILTER FABRIC

- A. Filter Fabric used, as a drainage medium shall consist of a non-woven fabric made from polypropylene or polyethylene filaments or yarns. The fabric shall be inert to organic chemicals commonly encountered in the soil. Edges of filter fabric shall overlap a minimum of one foot. The fabric shall conform to the following recommended property tests:

Property	Unit	Test Method	Minimum Value
Weight	oz/sy	ASTM D-5261-92	4.8
Grab Strength	lbs	ASTM D-4632-91	120
Grab Elongation	percent	ASTM D-4632-91	50
Trapezoid Tear Strength	lbs	ASTM D-4533-91	50
Mullen Burst Strength	psi	ASTM D-3786-87	225
Puncture Strength	lbs	ASTM D-4833-00	65
Apparent Opening Size (AOS)	U.S. std. Size Sieve	ASTM D-4751-99A	70

2.12 CRUSHED STONE

- A. Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements.

Percent Passing by Weight		
Sieve Size	3/4-inch Stone	1/2-inch Stone
1-inch	100	---
3/4-inch	90-100	---
5/8-inch	---	100
1/2-inch	10-50	85-100
3/8-inch	0-20	15-45
No. 4	0-5	0-15
No. 8	---	0-5

2.13 DRAIN COUPLINGS

- A. Drain Couplings shall be pressure rated at least equal to that of the pipe. The coupling sleeve, shall be 1/4-inch minimum thickness elastomeric polyvinylchloride with a minimum tensile strength of 1500 psi. The sleeve shall fit snugly onto the pipe to be joined and be resistant to common chemicals present in storm water. Adjustable pipe clamps shall consist of a slotted band that mate with the worm gear screw and a screw housing all manufactured of stainless steel, and suitable for underground service.

2.14 CLEANOUTS

- A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.
- B. The drain cleanouts shall be minimum 6-inch diameter or sized to match the service pipe, whichever is greater. The cleanout shall be complete with a flush mount over. The cleanout cover shall be clearly marked "DRAIN" and shall be minimum eight inches in diameter or two inches greater than the cleanout size, whichever is greater. Cleanouts shall include a watertight cap.

2.15 IDENTIFICATION

- A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils. minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation

Color	Utility
Safety Green	Sanitary Sewer, Storm Sewer

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

- A. General: General Locations and Arrangements: Contract Drawings indicate the general location and arrangement of the underground storm drainage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. Any modifications to the layout of the storm drainage system shall be submitted to the Engineer for review and approval at least five days prior to the start of the affected work.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations, accepted practices, and utility owner's requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. All pipe shall be laid in the dry. Adequate measures shall be taken to prevent floatation of pipe in the trench.
- D. Whenever encountered within the trench, existing abandoned water, sewer, and/or drain lines shall be removed within the trench limits, unless otherwise noted. The remaining portion of the abandoned lines shall be plugged at all open ends.
- E. When bell and spigot pipes are used, bell holes shall be dug in the bedding to accommodate the bells. They shall be deep enough to ensure that the bell does not bear on the bottom of the hole but shall be excessively wide in the longitudinal direction of the installation.
- F. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into an existing storm drain is indicated.
- G. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited without the written approval of the Engineer.
- H. Install piping pitched down in direction of flow as indicated on the Contract Drawings.
- I. Extend storm drainage system piping to connect to building drain services, of sizes and in locations indicated on the Contract Drawings.
- J. Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
- K. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe

shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.

- L. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- M. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.
- N. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.
- O. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.
- P. Alignment and Placement: All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
 - 1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.
 - 2. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stake as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.
- Q. Cleaning: Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water and debris from entering any existing drainage system.
 - 1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.
 - 2. Flush lines between manholes to remove collected debris.
- R. Review of Completed Storm Drain System: The completed drain system shall be visually inspected by the Owner's Representative. If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material,

the defect shall be replaced or repaired as directed by the Engineer or the Owner's Representative. The Contractor shall coordinate and provide site access for inspection.

3.2 PVC PIPE

- A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
- B. PIPE HANDLING
 - 1. All pipe and fittings shall be carefully handled from the truck onto the ground and into the trench or excavation so as to prevent damage to the pipe. Pipes shall be kept free of dirt and foreign material, especially on the inside. Joint ends of pipe shall especially be kept clean.
 - 2. Pipe stored on site shall be protected from heat and direct sun light and shall be suitably ventilated.
 - 3. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.
- C. ALIGNMENT AND PLACEMENT OF PVC PIPE
 - 1. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade.
 - 2. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.
 - 3. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.
 - 4. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.
 - 5. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
 - 6. Full lengths of pipe shall be used in the installation except that partial lengths may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
 - 7. Pipe entrances to structures shall be cut flush with the inside face of the structure, and cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the sewage flow. The method of cutting and finishing shall be subject to the approval of the Engineer.
 - 8. The Contractor shall protect the installation at all times during construction. The movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's own risk.

9. Drain pipes shall be laid to the required grades by use of a laser and target system, unless otherwise specifically approved by the Engineer.
10. Jointing of PVC drain pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to ensure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
11. PVC pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, is not acceptable.
12. Field-cut pipe ends shall be cut square and the pipe surface beveled to the size and shape of a factory-finished beveled end. All sharp edges shall be rounded off.

3.3 INSTALLATION OF CORRUGATED POLYETHYLENE PIPE AND PIPE FITTINGS

- A. General: Install Corrugated Polyethylene Pipe in accordance with ASTM D2321 and governing authorities having jurisdiction, except where more stringent requirements are indicated.
- B. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.
- C. Pipe Storage: Pipe sections shall not be stored on areas over the newly placed pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- D. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.
- E. Alignment and Placement: All pipe shall be placed with extreme care as to grade and alignment. Each pipe shall be so placed as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
 1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.
 2. The Contractor shall establish centerline and offset stakes at each manhole, plus intermediate centerline and offset stake as needed to ensure proper alignment and

grade between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.

3. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade. Bedding shall be crushed stone.
4. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.
5. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.
6. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.
7. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
8. Full lengths of pipe shall be used in the installation except that partial lengths may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
9. Pipe entrances to structures shall be cut flush with the inside face of the structure, and cut ends of the pipe surface within the structure shall be properly finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the stormwater flow. The method of cutting and finishing shall be subject to the approval of the Engineer.
10. The Contractor shall protect the installation at all times during construction. The movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's own risk.
11. Jointing of pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to ensure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
12. Each length of pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, is not acceptable.
13. Field-cut pipe ends shall be cut square.

3.4 INSTALLATION OF DRAIN MANHOLES AND CATCH BASINS

- A. The bases shall be supported on a compacted level foundation of gravel borrow a minimum of 12 inches thick. Crushed stone may be substituted for gravel borrow if field conditions at the bottom of the excavation are wet.

1. The Contractor shall install the manholes and catch basins as soon as the pipe laying reaches the location of the structures.
2. The Contractor shall accurately locate each manhole and catch basin and set accurate templates to conform to the required line and grade. Any manhole or catch basin which is not installed in the correct location or oriented improperly shall be removed and rebuilt in its proper location, alignment, and orientation at no additional cost to the Owner.
3. Manhole risers and tops shall be installed using approved butyl rubber sealant or rubber gasket for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints.
4. Openings shall be provided in the precast concrete manhole sections to receive entering pipes and these openings shall be made at the place of manufacture. Pipe entrances at catch basins shall have plain beveled openings to accept the type of pipe specified and to be sealed with non-shrink grout. Grout mixture shall follow instructions provided by manufacturer. Pipe connections at drain manholes shall be made as indicated on the Drawings with either non-shrink grout or integral flexible rubber sleeves and Corrugated Pipe Adapters designed for use with the pipe and sleeves. For grouted joints, surface between pipe and wall shall be completely filled with non-shrink grout and troweled to provide a smooth surface conforming to both the outside and inside structure wall.
5. Care shall be taken to ensure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so that the manhole steps shall be in alignment.
6. All holes used for handling shall be thoroughly plugged with non-shrink grout.
7. Cutting or tampering in the field, for purpose of creating new sidewall openings or altering existing openings, will not be permitted except at the discretion of the Engineer or if necessary concrete block manhole(s) shall be used.
8. All interior manhole joints where the sealing material is not flush with the inside wall shall be grouted with non-shrink mortar and finished by hand/wet-brush.
9. A cast-in-place concrete invert shelf and channel shall be poured and shaped to the lower half of the pipes
10. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

3.5 SETTING MANHOLE FRAMES AND COVERS AND CATCH BASIN FRAMES AND GRATES

- A. Manhole and catch basin frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Contract Drawings or as directed.

- B. Brick shall be used to bring the frames to the required elevation.
 - 1. Frames shall be set centered with the opening in the top of the precast structure on two to four courses of brick in a full bed of mortar. A thick ring of mortar extending to the outer edge of brick or concrete shall be placed all around the bottom flange of the cast iron frame. The mortar shall be smoothly finished to a height of 5 inches above the flange for 8-inch frames and sloped to shed water away from the frame.
 - 2. Completed brick installation shall be coated with mortar at least a $\frac{3}{4}$ inch thick on the outside to provide a fully sealed and watertight collar between the top manhole section and the cover frame.
 - 3. Only clean bricks shall be used in brick work to adjust frame elevations. The brick shall be moistened by suitable means.
- C. Manhole covers shall be left in place in the frame until completion of other work at the manholes.
- D. Where directed, the castings shall be temporarily set at such grades as to provide drainage during construction. The castings of structures located within the pavement area shall not be completely set to the established grade until the bottom course of pavement has been laid. The final setting of all other casting shall be performed at the proper stage of construction.

3.6 CHANGE IN TYPE

- A. When an existing catch basin is to be converted to a manhole, the frame and grate shall be carefully removed and a new frame and cover installed to finish grade. If in the opinion of the Engineer the existing casting is reusable, it may be reused in the work, otherwise, it shall be disposed of off-site.
 - 1. The sump of the catch basin shall be thoroughly cleaned of debris and silt and the interior surfaces brushed to remove contaminants.
 - 2. The sump shall be thoroughly filled with compacted gravel to a level no greater than 6 inches below the pipe invert. A cast-in-place concrete invert shelf and channel shall be poured and shaped to the lower half of the pipes.
 - 3. New openings in existing structures shall be carefully cut with power saws of the proper size and elevation to accept the new connection. Damage to the structure caused by the Contractor's construction methods shall be repaired at no additional cost.

3.7 INSTALLATION OF WATER QUALITY STRUCTURES

- A. Contractor shall take appropriate action to protect all structure components throughout the installation and construction process. Care shall be taken in loading, transporting, and unloading to prevent damage to materials during storage and handling.
- B. Install water quality structures per manufacturer's specifications.

- C. The installation of a precast concrete structure should conform to ASTM C 891 for the construction of manholes.
- D. The precast concrete structure shall be installed in sections in the following sequence:
 - 1. Aggregate Base: Structure shall be supported on a compacted level foundation of gravel borrow or crushed stone a minimum of 12 inches thick.
 - 2. Base Slab
 - 3. Treatment chamber section(s)
 - 4. Transition slab (if required)
 - 5. Bypass Section
 - 6. Connect inlet and outlet pipes
 - 7. Riser section and/or transition slab (if required)
 - 8. Maintenance rider section(s) (if required)
 - 9. Frame and access cover
- E. The precast base shall be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, shall be installed in accordance with the precast concrete manufacturer's installation requirements.
- F. Adjustment of the stormwater quality treatment structure can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the stormwater quality treatment structure has been constructed, any lift holes shall be plugged watertight with mortar or non-shrink grout.
- G. Internal components requiring field installation shall be installed by the Contractor in accordance with the manufacturer's specifications and installation requirements.
- H. Inlet and outlet pipes should be securely set into the structure using approved pipe seals (flexible boot connections) so that the structure is watertight.
- I. Grade rings shall be installed to set the frame and cover at the required elevation. The grade rings shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover shall be set in a full bed of mortar at the elevation specified.
- J. If precast tank sections are to be field assembled, adequate waterproofing shall be used at the joint to resist the waterhead at that joint.

3.8 AREA DRAINS

- A. Install area drains per manufacturer specifications.

- B. The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 2 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height.
- C. For H-20 load rated installations, a concrete ring shall be poured under and around the grate and frame as indicated on the Drawings.

3.9 TRENCH DRAINS

- A. Install trench drain structures per manufacturer specifications.

3.10 DRAIN COUPLINGS

- A. Couplings which are factory manufactured shall be installed at all connections from existing pipe to proposed pipe unless the existing pipe is the same material as the proposed pipe and the bell and spigot end of the pipes to be connected are compatible and free from defects. All drain couplings shall be installed in accordance with the manufacturer's recommendations for the types of pipe to be connected.

3.11 SUBSURFACE INFILTRATION CHAMBERS

- A. Install chambers, bedding, and inspection ports per manufacturer specifications.

3.12 CLEANOUTS

- A. Install cleanouts and extensions from drain pipe to cleanout at grade as indicated on the Contract Drawings. Set cleanout frame and cover in concrete 18 by 18 by 6-inches deep, except where location is in bituminous or concrete paving. Set top of cleanout 1-inch above surrounding earth grade or flush with grade when installed in paving.

3.13 INSTALLATION OF WATER STORAGE TANK FOR NONPOTABLE WATER REUSE

- A. Testing: Tank shall be tested and installed according to the manufacturer's installation instructions in effect at time of installation.
- B. Installation: Tank shall be installed according to the manufacturer's installation instructions in effect at time of installation. Contractor shall be trained by the tank manufacturer to install the tank.
- C. Hydrostatic Testing: Tank shall be hydrostatically tested after backfilling is completed to the top of the tank according to the manufacturer's instructions. All inlet and outlet piping shall be sealed with watertight caps or plugs. Tank shall be filled with water to a level that is 3 inches into the manway extension and left to stand for a minimum of 72 hours to allow for expansion and for air voids to dissipate. Water level shall be checked and additional water shall be added to fill the tank back to the standard testing level (a

level that is 3 inches into the manway extension). The tank shall be left to stand for a minimum of 72 hours and the water level shall be checked. If the water level drops more than 1/2-inch in the manway extension, the caps and plugs sealing the inlet and outlet piping shall be checked and the test shall be repeated. If the water level does not stabilize, there may be a leak in the system and the tank manufacturer shall be contacted. Observations shall be recorded and provided to the Engineer prior to acceptance of the system.

3.14 TAP CONNECTIONS

- A. Make connections to existing underground drainage structures, so that finished work will conform as nearly as practicable to requirements specified for new work. The contractor shall verify the location, size, invert, and type of existing pipes at all points of connection prior to make the connections.
- B. Make branch connections from side into existing piping by installing a wye or T-wyes, and couplings manufactured for use with the same type of pipe as indicated on the Contract Drawings. The Contractor shall install a 45-degree wye branch or 90-degree tee fittings in the drain pipe at all locations where storm service pipe connections are shown on the Drawings. Connections of the storm service pipes shall be made into the wye branches or tees by means of 45-degree bends. The connections shall be made thoroughly watertight and concrete shall be placed under each connection to bear on undisturbed earth and firmly support the connection.
- C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.
- D. Connections into existing drainage facilities shall be performed in accordance with the requirements of the Town of Boxford. The Contractor shall comply with all such requirements, including securing of all required permits and paying the costs thereof.

3.15 BACKFILLING

- A. General: Conduct excavation and backfill operations for structure and pipe installations in accordance with Section 312000 – EARTH MOVING, local requirements, and the contract documents.
- B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

3.16 INSTALLATION OF IDENTIFICATION

- A. Install continuous plastic underground warning tape during back-filling of trench for underground storm drainage system piping. Locate tape two-feet below finished grade, directly over piping.

3.17 FIELD TESTING OF CORRUGATED POLYETHYLENE PIPING

- A. The pipe shall be cleaned and visually inspected for offsets and obstructions prior to testing.
- B. The total length of each pipe installed on the project shall be tested or inspected for deflection. Conveyance pipes connecting at both ends to concrete drainage structures (catch basins, manholes, outlet control structures, water quality structures, etc.) shall be mandrel tested. Deflection of pipes used for stormwater detention/retention/infiltration systems, and pipes connecting to wye connections, building connections, trench drains, and other connections that do not allow mandrel testing shall be verified by visual inspection by the Owner’s Representative during installation.
- C. Mandrel tests shall be performed by the Contractor and observed by the Owner’s Representative not sooner than 20 days after completion of installation and compaction of backfill. Testing for pipes greater than 24-inch in diameter shall be tested prior to the installation of drainage structure cone and frame.
- D. Installed pipe shall be tested to ensure that the maximum deflection of the pipe does not exceed 7.5 percent of its base inside diameter. The base inside diameter is defined as the specified nominal diameter minus the allowable inside diameter tolerance of 1.5% but not more than 1/2 inch.
- E. A mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. The mandrel diameter shall be verified and approved by the Owner’s Representative prior to use. Use of an unapproved mandrel will invalidate the test. If the mandrel fails to pass through the pipe, the pipe will be deemed to be over-deflected.
- F. The mandrel shall be a rigid device, with an odd number of legs (9 legs minimum) having an effective length not less than its nominal diameter. The mandrel shall be fabricated of steel with pulling rings at each end.
- G. The minimum diameters at any point along the full length are as follows:

Nominal Size	Minimum Mandrel Diameter
6"	5.3"
8"	7.0"
10"	8.8"
12"	10.6"
15"	13.2"
18"	15.8"
24"	21.1"
30"	26.4"
36"	31.7"
42"	37.0"
48"	42.2"

54" 60"	47.5" 52.8"
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3.18 FIELD QUALITY CONTROL

- A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.
- B. Video Inspections: Seven days after the completion of the backfilling of each section of new pipe, as defined as a length of pipe between two manholes, the Contractor will provide a televised inspection of the pipe to be submitted to the Designer. The Owner's Representative shall be present during the recording. The recording shall be in DVD color format with audio and will show a clear picture of the inside of the new pipe. If the Designer determines that the DVD is unacceptable for review the contractor shall re-televisize the line until an acceptable DVD has been submitted. In the event that the pipe is not acceptable for any reason relating to the proper construction of the pipe according to these specifications, the Contractor will be responsible to re-excavate and repair the defects to the satisfaction of the Designer at no additional cost.
- C. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place watertight plugs in ends of uncompleted pipe at end of day or whenever work stops. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe eliminated.
 - 3. Flush piping between manholes to remove collected debris.
- D. Interior Inspection: If deemed necessary by the Owner's Representative, inspect piping to determine whether line displacement or other damage has occurred.
 - 1. Make inspections after pipe between manholes has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
 - 2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, the Contractor shall correct such defects and reinspect.
- E. Prior to acceptance of the storm drainage system, the Contractor shall submit the following to the Architect and to the local authority:
 - 1. System As-Built Plan stamped by a Professional Land Surveyor or Engineer Registered in the Commonwealth of Massachusetts.
 - 2. Video inspection DVDs and report: The report shall document the observations of the video inspections.
 - 3. Deflection test report: The report shall fully describe the test procedures and list the test results. The report shall be signed by the Contractor's superintendent.

3.19 FINAL INSPECTION

- A. Final inspection and acceptance of the storm drainage system shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system.
- B. Prior to placing the systems in service, all components shall be inspected, with the Owner's Representative present, to ensure that no debris or other contaminants are present. If necessary, the Contractor shall clean the structures and flush piping.
- C. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

END OF SECTION