Town of Boxford
Town Hall
Boxford, MA

2017

HVAC Systems

Prepared For:

Town of Boxford
7 Spofford Road
Boxford, MA 01921

Prepared By:

BLW Engineers, Inc.
311 Great Road, P.O. Box 1551
Littleton, MA 01460

May 5, 2017

Section 23 00 00 – Heating, Ventilating and Air Conditioning (HVAC)

GENERAL

The current HVAC system for the existing 14,000 square foot Town Hall/Library consists of two gas fired boilers, hot water circulating pumps, blower coils located in the attic, remote air cooled condensing units, a hot water distribution piping system to hot water heating equipment, refrigerant piping system, ductwork distribution systems, exhaust fans, hot water unit heaters, hot water fintube radiation and an automatic temperature control system.

The building has experienced significant heating and air conditioning related problems since it was renovated in 2004.

EXISTING CONDITIONS

The building is provided with heating from two Burnham V910 hot water boilers rated for 1,329 MBH gross output each; lead/stand hot water circulating pumps rated for 186 gpm at 60' TDH each; hot water distribution piping system and automatic controls.

The following equipment provides heating, ventilating and air conditioning to the building:

AREA	AHU/ACCU	CFM	OA CFM	COOLING	HW COIL
1ST Floor – East	AC-1/ACCU-1	2,225	645	72 MBH	183 MBH
1ST Floor – West	AC-2/ACCU-2	1,750	645	72 MBH	183 MBH
1ST /2nd Floor – Lobby	AC-3/ACCU-3	1,650	750	72 MBH	183 MBH
1ST Floor – Meeting	AC-4/ACCU-4	2,000	750	60 MBH*	183 MBH
2ST Floor – East	AC-5/ACCU-5	2,920	615	90 MBH	275 MBH
2ST Floor – Meeting	AC-6/ACCU-6	1,460	375	72 MBH	156 MBH
2ST Floor – West	AC-7/ACCU-7	2,670	735	72 MBH	183 MBH
1ST Floor – Tel/Data	AC-8/ACCU-8	555		24 MBH	

*Scheduled for 72 MBH in original design drawings

Each of the above systems, except AC-8/ACCU-8 which is a ductless split system, consists of an air handling unit in the attic with refrigerant coil, remote air cooled condensing unit at grade, interconnecting refrigerant piping, a hot water heating coil located in the supply air ductwork interconnected to the hot water distribution piping system, supply/return duct distribution systems to air outlets in the respective zone, outdoor air ductwork interconnect to the ventilation air duct distribution system and a wall mounted thermostat for zone temperature control.

At some point in the last several years, humidifiers were added to each of the systems. These systems have been largely ineffective largely because they do not have adequate capacity to provide humidification for the excessive outdoor air flows provided in the design for building ventilation.

Ventilation air was designed to be provided by SF-1, SF-2, EF-3 and EF-4; all the fans are constant volume fans that are designed to provide the scheduled outdoor air volume to each air handling system.

Bathrooms are provided with toilet exhaust by inline exhaust fans, EF-1 and EF-2, located in the attic. At the time of the building inspection it was noted that the 2nd floor bathroom fan, EF-2, was not operational and did not extend to the outdoors (exhausted directly into the attic space). Over the years, the Town has tried adding space temperature sensors in additional spaces to help provide zone temperature control.

The building is also provided with fintube radiation in the first level bathrooms, cabinet heaters in vestibules/stairs and hot water unit heaters in the storage, mechanical and attic areas of the building.

The following were noted or reported to be system operational issues:

1. Uneven heating/cooling within spaces within the same air conditioning/heating zone.
2. Ventilation air system overheats/overcools spaces and has been disabled.
3. Thermostat locations are not optimal increasing heating/cooling related issues.
4. System may have never been balanced and/or commissioned.

EVALUATION

BLW Engineers performed heating, cooling and ventilation calculations for each zone of the building; the building is provided with significantly more cooling and ventilation capacity than required.

The major issues with the heating, ventilating and air conditioning system is as follows:

1. Zoning: The units in the attic are single zone systems that each serve spaces with different uses, occupancies and have different exposures to the outdoors. Even though there are eight units that provide eight heating/cooling zones within the building, the only spaces of each zone that will truly be satisfied is the zone with the zone thermostat controlling the respective system. The existing units do not have the capacity to add variable air volume terminal units and/or reheat coils due to the limited fan capacity and the DX cooling coil.

2. Thermostat Locations: Several thermostat locations are not ideal to provide heating/cooling to each zone; thermostats are sometimes located in interior spaces or other locations that do not represent the heating/cooling requirements of the respective zone.

3. Ventilation: The ventilation air flows to each zone are excessive and significantly exceed code requirements. SF-1, SF-2, EF-3 and EF-4 are constant volume fans that are designed to provide the scheduled outdoor air volume to each air handling system. Each system operates heating or cooling upon a call from the zone thermostat, when the thermostat is satisfied it circulates

return/outdoor air until another call for heating or cooling; since the outdoor air volume is a significantly percentage of the total air flow of each system, the mixed air temperatures are very low in winter (40s) and very high in summer (85+) leading to very uneven air temperature distribution, humidification/dehumidication issues and difficulty in recovery to space temperature setpoints.

4. 2nd Floor Toilet Exhaust: the 2nd floor bathroom fan, EF-2, was not operational and did not extend to the outdoors (exhausted directly into the attic space).

5. Air Conditioning: The units were sized for the high mixed air temperatures due to the high percentage of outdoor air (up to 45% of total air flow); unfortunately, DX cooling systems do not operate well for outdoor air percentages exceeding 30 percent.

6. Balancing/Commissioning: It is not clear if the systems were ever properly balanced and/or commissioned which could be significantly impacting the operation of the system.

RECOMMENDATIONS

Option 1 – Existing System Upgrades

1. Relocate thermostats into more appropriate locations; add thermostats for averaging system operation.
2. Add controls for demand control ventilation and discharge air temperature control.
3. Modify supply ventilation system (F-1, F-2, EF-3 and EF-4) including variable speed controls to provide code required ventilation and/or demand control ventilation to the respective zones.
4. Repair 2nd floor toilet exhaust fan and extend to the outdoors.
5. Balance existing system to calculated airflows for heating and cooling.
6. Commission systems for proper sequence of operation.

Note: Option 1 would help alleviate some of the issues with the current system operation but will not entirely correct them; each system will still be a single zone system trying to satisfied multiple spaces within the zone.

The estimated construction costs for Option 1 is **$ 123,654.00**.

Option 2 – Existing System Replacement

1. Replace existing air cooled condensing units, refrigerant piping system, attic air handling units with new air cooled chiller, chilled water pumping/piping system, variable air volume terminal units for each zone within the building, variable air volume air handling units with hot/chilled water coils in the attic, ductwork modifications and a new system of automatic temperature controls.

2. Add controls for demand control ventilation and discharge air temperature control.
3. Modify supply ventilation system (F-1, F-2, EF-3 and EF-4) including variable speed controls to provide code required ventilation and/or demand control ventilation to the respective zones.
4. Repair 2nd floor toilet exhaust fan and extend to the outdoors.
5. Balance existing system to calculated airflows for heating and cooling.
6. Commission systems for proper sequence of operation.

Note: Option 2 would be fairly invasive to the building but would be the ideal solution for the solving the noted issues; probably 3-4 weeks disruption to the entire building for the installation of replacement equipment in the attic and then 1-2 weeks of interruption of the heating or cooling for each zone or could be performed with less disruption during mild spring or fall weather.

The estimated construction costs for Option 2 is **$ 558,687.00**.

Estimated Construction Costs

BLW

BLW ENGINEERS, INC.
311 Great Road, Post Office Box 1551, Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

Construction Cost Estimate

Project phase: Evaluation
Trade Specification Section: 23 00 00
26 00 00
By: KRB **Checked By:** KRB

Project: HVAC Evaluation - Option 1
Boxford Town Hall
Project Number: 17079.00

Sheet 1 of 1
Date 05.05.17

Description	Qty	Units	Material Unit Cost	Material Total	Labor Unit Cost	Labor Total	Total
Option 1 - Existing System Upgrades							
00 10 00 - General Conditions							
General Conditions							12,500
23 00 00 - HVAC							
New Exhaust Fan	1	EA	750	750	500	500	1,250
Extend Exhaust to Outdoors	1	EA	1,500	1,500	3,500	3,500	5,000
Variable Speed Drives	4	EA	1,250	5,000	750	3,000	8,000
Automatic Temperature Controls							
Relocate Thermostats	14	EA	250	3,500	750	10,500	14,000
Demand Control Ventilation	7	EA	1,000	7,000	3,000	21,000	28,000
Discharge Temperature Controls	7	EA	500	3,500	1,500	10,500	14,000
Commissioning	1	LS			5,000	5,000	5,000
Balancing	1	LS			5,000	5,000	5,000
26 00 00 - ELECTRICAL							
Power Wiring	1	LS	1,500	1,500	3,500	3,500	5,000
Subtotal				$ 22,750		$ 62,500	$ 97,750
15% Overhead & Profit							$ 14,663
Subtotal							$ 112,413
10% Contingency							$ 11,241
TOTAL							**$ 123,654**

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Construction Cost Estimate

Project phase: Evaluation
Trade Specification Section: 23 00 00
26 00 00
By: KRB **Checked By:** KRB

Project: HVAC Evaluation - Option 2
Boxford Town Hall
Project Number: 17079.00

Sheet 1 of 1
Date 05.05.17

Description	Qty	Units	Material Unit Cost	Material Total	Labor Unit Cost	Labor Total	Total
Option 2 - Existing System Replacement							
00 10 00 - General Conditions							
General Conditions							50,000
23 00 00 - HVAC							
Demolition	1	LS			10,000	10,000	10,000
New Air Cooled Chiller (40 tons)	36	tons	750	27,000	400	14,400	41,400
New Variable Volume AHU(s)	14,000	cfm	4	56,000	1.75	24,500	80,500
New Variable Air Volume Terminal Units	18	EA	750	13,500	750	13,500	27,000
New Chilled Water Pumps	2	EA	750	1,500	500	1,000	2,500
New Chilled Water Distribution Piping	1	LS	750	750	500	500	1,250
New Chilled WaterWater Specialties	1	LS	15,000	15,000	30,000	30,000	45,000
New Hot Water Piping Distribution (for reheats)	1	LS	12,500	12,500	25,000	25,000	37,500
Ductwork Revisions	1	LS	10,000	10,000	20,000	20,000	30,000
Extend Exhaust to Outdoors	1	EA	1,500	1,500	3,500	3,500	5,000
Variable Speed Drives	4	EA	1,250	5,000	750	3,000	8,000
Automatic Temperature Controls							
New Chilled Water System Controls	1	LS	10,000	10,000	15,000	15,000	25,000
Zone Controls	18	EA	250	4,500	750	13,500	18,000
Demand Control Ventilation	4	EA	1,000	4,000	3,000	12,000	16,000
Discharge Temperature Controls	4	EA	500	2,000	1,500	6,000	8,000
Commissioning	1	LS			5,000	5,000	5,000
Balancing	1	LS			5,000	5,000	5,000
26 00 00 - ELECTRICAL							
Demolition	1	LS			5,000	5,000	5,000
Power Wiring	1	LS	5,000	5,000	12,500	12,500	17,500
New Duct Smoke Detectors	1	LS	1,500	1,500	2,500	2,500	4,000
Subtotal				$ 169,750		$ 221,900	$ 441,650
15% Overhead & Profit							$ 66,248
Subtotal							$ 507,898
10% Contingency							$ 50,790
TOTAL							**$ 558,687**

Calculations

BLW

BLW ENGINEERS, INC.
311 Great Road, PO Box 1551 Littleton, Massachusetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford**	**Date**
Trade Specification Section:	15500		00.00.00
By:	**Checked By:**	**Project No.:** **17076**	

Design Conditions:

Location	**Temps.**		**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88	74	9 °F	

I. Envelope Assumptions

Component	Value	
wall ht	12.00	ft
window ht	5.00	ft
ceiling ht	12.00	ft
lighting	2.00	W/ft2
activity lvl	255.00	BTU/hr
window shading	0.83	SC

Component	R-value	U-value	
wall	13.00	0.08	BTU/hr ft2 F
window	2.50	0.55	BTU/hr ft2 F
skylight	2.50	0.40	BTU/hr ft2 F
roof	20.00	0.05	BTU/hr ft2 F
door	1.25	0.80	BTU/hr ft2 F
slab	10.00	0.10	BTU/hr ft2 F
floor	30.00	0.03	BTU/hr ft2 F

Equipment Assumptions

DeR - Derated Heating requirement (60% derate at 0F)

Total is based on cfm from sensible calc and OA req

Total Heating based on MAT being heated to 90

II. HVAC Loads w/o treating air w/o treating air

	Space	OA Req	Sens Clg	Total Clg	Clg CFM	-	Min Htg	Total Htg	Htg CFM	Area	-	btuh/sf	sf/ton	Occ.	MAT Clg DB	MAT Clg WB	LAT Clg DB	LAT Clg WB	MAT Htg	LAT Htg	DeR
1	100 LOBBY	4	4,754	6,495	220	-	2,616	3,368	220	70	-	48	129	0	78	65	56	55	69	83	4.36
2	101A TAX DROP	2	1,709	2,354	79	-	1,566	1,875	79	35	-	54	178	0	78	65	56	55	68	90	2.61
3	101B MAIL DROP	1	1,902	2,591	88	-	1,580	1,865	88	24	-	78	111	0	78	65	56	55	69	89	2.63
4	102 STAIR #1	5	155	368	7	-	0	328	7	79	-	4	2573	0	85	71	56	55	30	72	0
6	101 CORRIDOR	40	10,097	14,787	467	-	8,683	12,325	467	666	-	19	540	0	79	65	56	55	65	89	14.5
7	105 STAIR #2	7	585	1,006	27	-	2,657	3,166	27	114	-	28	1360	0	81	67	56	55	55	163	4.43
8	110 MACHINE ROOM	2	322	510	15	-	0	194	15	41	-	5	965	0	80	66	56	55	60	72	0
9	107 PANTRY	80	2,852	6,505	132	-	0	5,533	132	113	-	49	208	8	84	70	56	55	33	72	0
10	109 A/V CLOSET	5	205	449	9	-	0	364	9	87	-	4	2324	0	84	70	56	55	36	72	0
11	108 CHAIRS	9	172	511	8	-	0	541	8	73	-	7	1715	0	88	74	56	55	9	72	0
12	111 STAIR #3	7	589	1,012	27	-	2,663	3,177	27	115	-	28	1364	0	81	67	56	55	55	163	4.44
13	112 COPY	2	322	510	15	-	0	194	15	41	-	5	965	0	80	66	56	55	60	72	0
14	106 LARGE MTG. RM	261	24,940	41,833	1,155	-	19,847	39,537	1,155	842	-	47	242	42	80	67	56	55	56	88	33.1
15	114 CLERK WAITING	44	3,748	6,446	174	-	3,040	6,313	174	400	-	16	745	4	81	67	56	55	55	88	5.07
16	115 CONF. 1	43	2,619	4,910	121	-	0	3,080	121	138	-	22	337	7	82	68	56	55	48	72	0
17	116 CUST./EQUIP STORAGE	16	2,488	3,857	115	-	5,608	6,940	115	274	-	25	852	0	79	66	56	55	61	117	9.35
18	117 MECHANICAL	13	3,611	5,248	167	-	2,959	4,178	167	217	-	19	496	0	79	65	56	55	65	88	4.93
19	118 ELECTRICAL	3	1,039	1,490	48	-	1,599	1,908	48	52	-	37	419	0	79	65	56	55	66	103	2.66
20	118A EMERG. ELEC.	1	368	532	17	-	516	636	17	21	-	30	473	0	79	65	56	55	65	100	0.86
21	119 CLERK	35	15,878	22,350	735	-	11,250	15,122	735	408	-	37	219	2	78	65	56	55	67	86	18.7
22	120 VAULT	10	1,108	1,796	51	-	2,021	2,772	51	162	-	17	1082	0	80	66	56	55	58	108	3.37
23	121 WOMEN	24	3,115	4,930	144	-	2,761	4,630	144	144	-	32	351	3	80	66	56	55	60	90	4.6
24	122 JAN	2	53	126	2	-	0	112	2	27	-	4	2573	0	85	71	56	55	30	72	0
25	123 MEN	24	2,872	4,607	133	-	2,774	4,622	133	145	-	32	378	3	80	66	56	55	59	91	4.62
26	OPEN LIBRARY AREA	254	22,463	38,324	1,040	-	19,050	38,062	1,040	1,497	-	25	469	15	80	67	56	55	55	89	31.8
27	125 TAX COLLECTOR	40	11,463	16,608	531	-	9,261	13,028	531	468	-	28	338	2	79	65	56	55	65	88	15.4
28	126 COLLECTOR OFFICE	10	3,519	5,037	163	-	3,335	4,364	163	121	-	36	288	1	79	65	56	55	66	91	5.56
36	201 CORRIDOR	33	9,595	13,884	444	-	10,097	13,215	444	546	-	24	472	0	79	65	56	55	66	93	16.8
37	202 CO	19	19,343	26,472	896	-	13,544	16,700	896	309	-	54	140	0	78	65	56	55	69	86	22.6
38	203 JAN	2	159	271	7	-	166	300	7	30	-	10	1328	0	80	67	56	55	55	93	0.28
39	204 MEN	8	587	1,034	27	-	229	791	27	44	-	18	511	1	81	67	56	55	53	80	0.38
40	206 STAIR #5	5	476	812	22	-	496	899	22	90	-	10	1330	0	80	67	56	55	55	93	0.83
41	207 DEAD FILE STORAGE	5	790	1,221	37	-	1,698	2,113	37	85	-	25	835	0	79	66	56	55	61	115	2.83
42	208 SMALL MTG. ROOM	128	10,516	18,248	487	-	7,182	16,689	487	414	-	40	272	21	81	67	56	55	54	86	12
43	208.1 MECH. CLOSET	3	526	794	24	-	260	498	24	47	-	11	711	0	79	66	56	55	63	82	0.43
44	209 WOMEN	8	637	1,112	29	-	276	867	29	50	-	17	539	1	81	67	56	55	53	81	0.46
45	210 STAIR #1	7	767	1,252	36	-	1,421	1,956	36	116	-	17	1112	0	80	66	56	55	58	109	2.37
46	212 DEAD FILE STORAGE	5	792	1,223	37	-	1,703	2,118	37	85	-	25	834	0	79	66	56	55	62	115	2.84
47	213 STAIR #3	6	498	849	23	-	520	941	23	94	-	10	1328	0	80	67	56	55	55	93	0.87
48	214 ADMIN WAITING	41	4,657	7,556	216	-	4,920	8,089	216	373	-	22	592	4	80	66	56	55	58	93	8.2
49	215 FINANCE OFFICE	29	6,772	9,988	314	-	7,346	9,932	314	341	-	29	410	2	79	65	56	55	64	94	12.2
50	216 ACCOUNTANT	13	2,472	3,735	114	-	3,121	4,247	114	139	-	31	447	1	79	66	56	55	63	97	5.2
51	217 FINANCE DIRECTOR	13	3,882	5,617	180	-	4,463	5,722	180	137	-	42	293	1	79	65	56	55	66	95	7.44
52	218 MAIL/COPY	21	5,527	8,063	256	-	4,613	6,543	256	182	-	36	271	2	79	65	56	55	65	89	7.69
53	219 DEAD FILE STORAGE	5	471	804	22	-	492	891	22	89	-	10	1328	0	80	67	56	55	55	93	0.82
54	220 SELECTMEN	24	10,119	14,312	468	-	8,279	10,887	468	285	-	38	239	1	79	65	56	55	67	88	13.8
55	ASSISTANT ADMINISTRAT	16	4,798	6,916	222	-	4,574	6,079	222	183	-	33	318	1	79	65	56	55	66	91	7.62
56	222 TOWN ADMINISTRATOR	24	10,009	14,172	463	-	8,439	11,053	463	288	-	38	244	1	79	65	56	55	67	89	14.1
57	223 REGULATORY WAITING	39	4,378	7,115	203	-	4,688	7,691	203	354	-	22	597	4	80	66	56	55	58	93	7.81
58	224 INSPECTIONAL DEPT.	24	10,100	14,273	468	-	8,288	10,866	468	280	-	39	235	1	79	65	56	55	67	88	13.8
59	225 BUILDING INSPECTOR	11	7,022	9,742	325	-	5,219	6,638	325	128	-	52	158	1	78	65	56	55	68	87	8.7
60	226 ZBA	13	2,865	4,258	133	-	3,048	4,208	133	156	-	27	440	1	79	66	56	55	64	93	5.08
61	227 HEALTH	21	5,143	7,556	238	-	5,355	7,258	238	248	-	29	394	1	79	65	56	55	65	93	8.92
62	228 HEALTH DIRECTOR	11	3,703	5,300	171	-	3,994	5,075	171	127	-	40	288	1	79	65	56	55	66	94	6.66
63	229 CONS COM/PLANNING	30	5,029	7,695	233	-	5,631	8,116	233	354	-	23	552	2	79	66	56	55	62	94	9.39
64	0 CONSERVATION DIRECT	9	3,337	4,761	155	-	3,935	4,879	155	109	-	45	275	1	79	65	56	55	66	96	6.56
65	CONSERVATION ASSISTA	10	3,114	4,487	144	-	3,525	4,497	144	118	-	38	316	1	79	65	56	55	66	95	5.88
66	232 PLANNER	9	2,430	3,550	112	-	2,742	3,601	112	110	-	33	372	1	79	65	56	55	65	95	4.57
67	~	0	0	0	0	-	0	#DIV/0!	0	0	-	0	0	0	0	0	56	55	9	#DIV/0!	0
68	~	0	0	0	0	-	0	#DIV/0!	0	0	-	0	0	0	0	0	56	55	9	#DIV/0!	0
69	~	0	0	0	0	-	0	#DIV/0!	0	0	-	0	0	0	0	0	56	55	9	#DIV/0!	0
70	~	0	0	0	0	-	0	#DIV/0!	0	0	-	0	0	0	0	0	56	55	9	#DIV/0!	0
	Total	**1,537**	**263,457**	**402,263**	**12,197**	-	**234,047**	**361,597**	**12,197**	**12,285**	-	**29**	**366**	**134**	-	-	-	-	-	-	**390**

BLW

BLW ENGINEERS, INC.
311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	100 LOBBY		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		70	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	70		+		5	x	0					=	4.2	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	11	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	308	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	6	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	3,135	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		6	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	300	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		70	ft2	x	1.30	W/ft2	x	3.412	Btuh/Watt							=	310	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		70	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	80	Btu/hr
												RSH				=	4,134	Btu/hr
												Safety Factor (15%)				=	620	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**4,754**	**Btu/hr**
												Airflow (20F delta T)				=	**220**	**CFM**

III. Heating Load

Walls					87.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	408	Btu/hr
Glass					39.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	1,308	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		70	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	376	Btu/hr
												Heating				=	2,093	Btu/hr
												Safety Factor (25%)				=	523	Btu/hr
									(not treating air)			**MIN HEATING**				=	**2,616**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.73	Btu/lb	@	78.19	F DB	,	64.78	F WB	,	2	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	220	CFM	x	6.56	BTU/lb	x	4.5								=	6,495	Btu/hr
												Tons A/C				=	0.5	Tons
												H2O (10F delta T)				=	1	GPM
																=	129	ft2/Ton
	Mix Air T-In	69	F	@	2	% OA												
	Heat Air T-Out	83	F															
	Heating Cap	220	CFM	x	14	F	x	1.08								=	3,368	Btu/hr
												H2O (20F delta T)				=	0	GPM
																=	48	Btuh/ft2

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford** 101A TAX DROP	**Sheet** 1 of 1
Trade Specification Section: 15500		**Date**
By: **Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		35	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	35		+		5	x	0					=	2.1	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	7	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	248	Btu/hr
	E	7	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	207	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	2	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	784	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		2	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	75	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		35	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	131	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		35	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	40	Btu/hr

	RSH	=	1,486 Btu/hr
	Safety Factor (15%)	=	223 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**1,709 Btu/hr**
	Airflow (20F delta T)	=	**79 CFM**

III. Heating Load

Walls					157.17	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	737	Btu/hr
Glass					9.75	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	327	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		35	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	188	Btu/hr

	Heating	=	1,253 Btu/hr
	Safety Factor (25%)	=	313 Btu/hr
(not treating air)	**MIN HEATING**	=	**1,566 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.79	Btu/lb	@	78.27	F DB	,	64.85	F WB	,	3	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	79	CFM	x	6.61	BTU/lb	x	4.5								=	2,354	Btu/hr
												Tons A/C				=	0.2	Tons
												H2O (10F delta T)				=	0	GPM
																=	178	ft2/Ton
	Mix Air T-In	68	F	@	3	% OA												
	Heat Air T-Out	90	F															
	Heating Cap	79	CFM	x	22	F	x	1.08								=	1,875	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	101B MAIL DROP		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		24	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	24		+		5	x	0					=	1.44	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	7	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	257	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	7	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	277	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	2	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	914	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		2	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	88	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		24	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	90	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		24	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	27	Btu/hr
												RSH				=	1,654	Btu/hr
												Safety Factor (15%)				=	248	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**1,902**	**Btu/hr**
												Airflow (20F delta T)				=	**88**	**CFM**

III. Heating Load

Walls					160.59	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	754	Btu/hr
Glass					11.38	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	382	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		24	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	129	Btu/hr
												Heating				=	1,264	Btu/hr
												Safety Factor (25%)				=	316	Btu/hr
									(not treating air)			**MIN HEATING**				=	**1,580**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.71	Btu/lb	@	78.16	F DB	,	64.75	F WB	,	2	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	88	CFM	x	6.54	BTU/lb	x	4.5								=	2,591	Btu/hr
												Tons A/C				=	0.2	Tons
												H2O (10F delta T)				=	1	GPM
																=	111	ft2/Ton
	Mix Air T-In	69	F	@	2	% OA												
	Heat Air T-Out	89	F															
	Heating Cap	88	CFM	x	20	F	x	1.08								=	1,865	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 102 STAIR #1	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		79	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	79		+		5	x	0					=	4.74	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		79	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	135	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	135 Btu/hr
	Safety Factor (15%)	=	20 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**155 Btu/hr**
	Airflow (20F delta T)	=	**7 CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	0 Btu/hr
	Safety Factor (25%)	=	0 Btu/hr
(not treating air)	**MIN HEATING**	=	**0 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	34.58	Btu/lb	@	84.61	F DB	,	70.81	F WB	,	66	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	7	CFM	x	11.41	BTU/lb	x	4.5								=	368	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	2573	ft2/Ton
	Mix Air T-In	30	F	@	66	% OA												
	Heat Air T-Out	72	F															
	Heating Cap	7	CFM	x	42	F	x	1.08								=	328	Btu/hr

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HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 101 CORRIDOR	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		666	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	666		+		5	x	0					=	39.96	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	24	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	788	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	11	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	5,559	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		11	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	533	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		666	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	1,136	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		666	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	763	Btu/hr

RSH	=	8,780	Btu/hr
Safety Factor (15%)	=	1,317	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**10,097**	**Btu/hr**
Airflow (20F delta T)	=	**467**	**CFM**

III. Heating Load

Walls					222.80	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,045	Btu/hr
Glass					69.16	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	2,320	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		666	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	3,580	Btu/hr

Heating	=	6,946	Btu/hr
Safety Factor (25%)	=	1,737	Btu/hr
(not treating air) **MIN HEATING**	=	**8,683**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.20	Btu/lb	@	78.85	F DB	,	65.40	F WB	,	9	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	467	CFM	x	7.03	BTU/lb	x	4.5								=	14,787	Btu/hr
												Tons A/C				=	1.2	Tons
												H2O (10F delta T)				=	3	GPM
																=	540	ft2/Ton
	Mix Air T-In	65	F	@	9	% OA												
	Heat Air T-Out	89	F															
	Heating Cap	467	CFM	x	24	F	x	1.08								=	12,325	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	105 STAIR #2		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		114	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	114		+		5	x	0					=	6.84	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	9	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	184	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		114	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	194	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		114	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	131	Btu/hr

	RSH	=	509 Btu/hr
	Safety Factor (15%)	=	76 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**585** **Btu/hr**
	Airflow (20F delta T)	=	**27** **CFM**

III. Heating Load

Walls					103.92	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	488	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		3	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	1,025	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		114	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	613	Btu/hr

	Heating	=	2,125 Btu/hr
	Safety Factor (25%)	=	531 Btu/hr
(not treating air)	**MIN HEATING**	=	**2,657** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.42	Btu/lb	@	80.52	F DB	,	66.97	F WB	,	25	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	27	CFM	x	8.25	BTU/lb	x	4.5								=	1,006	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	1360	ft2/Ton
	Mix Air T-In	55	F	@	25	% OA												
	Heat Air T-Out	163	F															
	Heating Cap	27	CFM	x	108	F	x	1.08								=	3,166	Btu/hr

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HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford**	**Sheet**
Trade Specification Section:	15500	110 MACHINE ROOM	1 of 1
			Date
By: **Checked By:**		**Project No.:** **17076**	00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		41	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	41		+		5	x	0					=	2.46	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		41	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	280	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

RSH	=	280	Btu/hr
Safety Factor (15%)	=	42	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**322**	**Btu/hr**
Airflow (20F delta T)	=	**15**	**CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

Heating	=	0	Btu/hr
Safety Factor (25%)	=	0	Btu/hr
(not treating air) **MIN HEATING**	=	**0**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.78	Btu/lb	@	79.65	F DB	,	66.15	F WB	,	17	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	15	CFM	x	7.60	BTU/lb	x	4.5								=	510	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	965	ft2/Ton
	Mix Air T-In	60	F	@	17	% OA												
	Heat Air T-Out	72	F															
	Heating Cap	15	CFM	x	12	F	x	1.08								=	194	Btu/hr

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HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 107 PANTRY	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location		**Temps.**	**Summer**		**Winter**	
-		**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
		Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		113	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.18		x	113		+		7.5	x	8					=	79.665	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		113	ft2	x	1.20	W/ft2	x	3.412	Btuh/Watt							=	463	Btu/hr
People		8	People	x	255	Btu/hr	x	1	Diversity							=	2,017	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	2,480	Btu/hr
	Safety Factor (15%)	=	372	Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**2,852**	**Btu/hr**
	Airflow (20F delta T)	=	**132**	**CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	0	Btu/hr
	Safety Factor (25%)	=	0	Btu/hr
(not treating air)	**MIN HEATING**	=	**0**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	34.12	Btu/lb	@	84.03	F DB	,	70.27	F WB	,	60	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	132	CFM	x	10.95	BTU/lb	x	4.5								=	6,505	Btu/hr
												Tons A/C				=	0.5	Tons
												H2O (10F delta T)				=	1	GPM
																=	208	ft2/Ton
	Mix Air T-In	33	F	@	60	% OA												
	Heat Air T-Out	72	F															
	Heating Cap	132	CFM	x	39	F	x	1.08								=	5,533	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	109 A/V CLOSET		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		87	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	87		+		5	x	0					=	5.22	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		87	ft2	x	0.60	W/ft2	x	3.412	Btuh/Watt							=	178	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

RSH	=	178	Btu/hr
Safety Factor (15%)	=	27	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**205**	**Btu/hr**
Airflow (20F delta T)	=	**9**	**CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

Heating	=	0	Btu/hr
Safety Factor (25%)	=	0	Btu/hr
(not treating air) **MIN HEATING**	=	**0**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	33.70	Btu/lb	@	83.50	F DB	,	69.77	F WB	,	55	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	9	CFM	x	10.53	BTU/lb	x	4.5								=	449	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	2324	ft2/Ton
	Mix Air T-In	36	F	@	55	% OA												
	Heat Air T-Out	72	F															
	Heating Cap	9	CFM	x	36	F	x	1.08								=	364	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	108 CHAIRS		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		73	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.12		x	73		+		5	x	0					=	8.76	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		73	ft2	x	0.60	W/ft2	x	3.412	Btuh/Watt							=	149	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	149 Btu/hr
	Safety Factor (15%)	=	22 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**172** **Btu/hr**
	Airflow (20F delta T)	=	**8** **CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	0 Btu/hr
	Safety Factor (25%)	=	0 Btu/hr
(not treating air)	**MIN HEATING**	=	**0** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	37.44	Btu/lb	@	88.00	F DB	,	74.00	F WB	,	100	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	8	CFM	x	14.26	BTU/lb	x	4.5								=	511	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	1715	ft2/Ton
	Mix Air T-In	9	F	@	100	% OA												
	Heat Air T-Out	72	F															
	Heating Cap	8	CFM	x	63	F	x	1.08								=	541	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	111 STAIR #3		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		115	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	115		+		5	x	0					=	6.9	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	9	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	184	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		115	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	196	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		115	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	132	Btu/hr

	RSH	=	512 Btu/hr
	Safety Factor (15%)	=	77 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**589** **Btu/hr**
	Airflow (20F delta T)	=	**27** **CFM**

III. Heating Load

Walls					103.92	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	488	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		3	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	1,025	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		115	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	618	Btu/hr

	Heating	=	2,131 Btu/hr
	Safety Factor (25%)	=	533 Btu/hr
(not treating air)	**MIN HEATING**	=	**2,663** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.43	Btu/lb	@	80.53	F DB	,	66.98	F WB	,	25	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	27	CFM	x	8.25	BTU/lb	x	4.5								=	1,012	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	1364	ft2/Ton
	Mix Air T-In	55	F	@	25	% OA												
	Heat Air T-Out	163	F															
	Heating Cap	27	CFM	x	108	F	x	1.08								=	3,177	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	112 COPY		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		41	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	41		+		5	x	0					=	2.46	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		41	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	280	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	280 Btu/hr
	Safety Factor (15%)	=	42 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**322** **Btu/hr**
	Airflow (20F delta T)	=	**15** **CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	0 Btu/hr
	Safety Factor (25%)	=	0 Btu/hr
(not treating air)	**MIN HEATING**	=	**0** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.78	Btu/lb	@	79.65	F DB	,	66.15	F WB	,	17	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	15	CFM	x	7.60	BTU/lb	x	4.5								=	510	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	965	ft2/Ton
	Mix Air T-In	60	F	@	17	% OA												
	Heat Air T-Out	72	F															
	Heating Cap	15	CFM	x	12	F	x	1.08								=	194	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	106 LARGE MTG. RM		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		842	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	842		+		5	x	42					=	261.02	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	13	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	149	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	18	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	515	Btu/hr
	W	18	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	681	Btu/hr
	NE	10	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	268	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	10	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	175	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	24	ft	x	3	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	2,295	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		24	ft	x	3.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	554	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		1,095	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	2,189	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		842	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	3,160	Btu/hr
People		42	People	x	255	Btu/hr	x	1	Diversity							=	10,736	Btu/hr
Infiltration		842	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	965	Btu/hr
												RSH				=	21,687	Btu/hr
												Safety Factor (15%)				=	3,253	Btu/hr
												Sensible(w/o treating air) **ERSH**				=	**24,940**	**Btu/hr**
												Airflow (20F delta T)				=	**1,155**	**CFM**

III. Heating Load

Walls					756.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	3,547	Btu/hr
Glass					72.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	2,416	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		6	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	2,050	Btu/hr
Roof		1,095	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	3,339	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		842	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	4,526	Btu/hr
												Heating				=	15,878	Btu/hr
												Safety Factor (25%)				=	3,969	Btu/hr
												(not treating air) **MIN HEATING**				=	**19,847**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.23	Btu/lb	@	80.26	F DB	,	66.73	F WB	,	23	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	1,155	CFM	x	8.05	BTU/lb	x	4.5								=	41,833	Btu/hr
												Tons A/C				=	3.5	Tons
												H2O (10F delta T)				=	8	GPM
																=	242	ft2/Ton
	Mix Air T-In	56	F	@	23	% OA												
	Heat Air T-Out	88	F															
	Heating Cap	1,155	CFM	x	32	F	x	1.08								=	39,537	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	114 CLERK WAITING		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		400	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	400		+		5	x	4					=	44	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	5	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	143	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		400	ft2	x	1.20	W/ft2	x	3.412	Btuh/Watt							=	1,638	Btu/hr
People		4	People	x	255	Btu/hr	x	1	Diversity							=	1,020	Btu/hr
Infiltration		400	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	458	Btu/hr

	RSH	=	3,259 Btu/hr
	Safety Factor (15%)	=	489 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**3,748 Btu/hr**
	Airflow (20F delta T)	=	**174 CFM**

III. Heating Load

Walls					60.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	282	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		400	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	2,150	Btu/hr

	Heating	=	2,432 Btu/hr
	Safety Factor (25%)	=	608 Btu/hr
(not treating air)	**MIN HEATING**	=	**3,040 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.43	Btu/lb	@	80.54	F DB	,	66.98	F WB	,	25	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	174	CFM	x	8.25	BTU/lb	x	4.5								=	6,446	Btu/hr
												Tons A/C				=	0.5	Tons
												H2O (10F delta T)				=	1	GPM
																=	745	ft2/Ton
	Mix Air T-In	55	F	@	25	% OA												
	Heat Air T-Out	88	F															
	Heating Cap	174	CFM	x	34	F	x	1.08								=	6,313	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 115 CONF. 1	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		138	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	138		+		5	x	7					=	42.78	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		138	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	518	Btu/hr
People		7	People	x	255	Btu/hr	x	1	Diversity							=	1,760	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

RSH	=	2,277	Btu/hr
Safety Factor (15%)	=	342	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**2,619**	**Btu/hr**
Airflow (20F delta T)	=	**121**	**CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

Heating	=	0	Btu/hr
Safety Factor (25%)	=	0	Btu/hr
(not treating air) **MIN HEATING**	=	**0**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	32.17	Btu/lb	@	81.53	F DB	,	67.92	F WB	,	35	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	121	CFM	x	9.00	BTU/lb	x	4.5								=	4,910	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	337	ft2/Ton
	Mix Air T-In	48	F	@	35	% OA												
	Heat Air T-Out	72	F															
	Heating Cap	121	CFM	x	24	F	x	1.08								=	3,080	Btu/hr

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HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 116 CUST./EQUIP STORAGE	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location		**Temps.**	**Summer**		**Winter**	
-		**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
		Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		274	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	274		+		5	x	0					=	16.44	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	21	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	406	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	3	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	76	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	4	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	725	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		4	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	175	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		274	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	467	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		274	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	314	Btu/hr

	RSH	=	2,163 Btu/hr
	Safety Factor (15%)	=	324 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**2,488 Btu/hr**
	Airflow (20F delta T)	=	**115 CFM**

III. Heating Load

Walls					261.17	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,225	Btu/hr
Glass					22.75	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	763	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		3	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	1,025	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		274	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,473	Btu/hr

	Heating	=	4,487 Btu/hr
	Safety Factor (25%)	=	1,122 Btu/hr
(not treating air)	**MIN HEATING**	=	**5,608 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.62	Btu/lb	@	79.43	F DB	,	65.94	F WB	,	14	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	115	CFM	x	7.44	BTU/lb	x	4.5								=	3,857	Btu/hr
												Tons A/C				=	0.3	Tons
												H2O (10F delta T)				=	1	GPM
																=	852	ft2/Ton
	Mix Air T-In	61	F	@	14	% OA												
	Heat Air T-Out	117	F															
	Heating Cap	115	CFM	x	56	F	x	1.08								=	6,940	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	117 MECHANICAL		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		217	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	217		+		5	x	0					=	13.02	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	13	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	441	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	3	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	845	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		3	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	125	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		217	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	1,481	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		217	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	249	Btu/hr
												RSH				=	3,140	Btu/hr
												Safety Factor (15%)				=	471	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**3,611**	**Btu/hr**
												Airflow (20F delta T)				=	**167**	**CFM**

III. Heating Load

Walls					139.75	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	656	Btu/hr
Glass					16.25	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	545	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		217	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,167	Btu/hr
												Heating				=	2,367	Btu/hr
												Safety Factor (25%)				=	592	Btu/hr
									(not treating air)			**MIN HEATING**				=	**2,959**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.15	Btu/lb	@	78.78	F DB	,	65.33	F WB	,	8	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	167	CFM	x	6.98	BTU/lb	x	4.5								=	5,248	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	496	ft2/Ton
	Mix Air T-In	65	F	@	8	% OA												
	Heat Air T-Out	88	F															
	Heating Cap	167	CFM	x	23	F	x	1.08								=	4,178	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	118 ELECTRICAL		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		52	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	52		+		5	x	0					=	3.12	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	11	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	234	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	7	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	255	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		52	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	355	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		52	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	60	Btu/hr
												RSH				=	903	Btu/hr
												Safety Factor (15%)				=	136	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**1,039**	**Btu/hr**
												Airflow (20F delta T)				=	**48**	**CFM**

III. Heating Load

Walls					213.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	999	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		52	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	280	Btu/hr
												Heating				=	1,279	Btu/hr
												Safety Factor (25%)				=	320	Btu/hr
									(not treating air)			**MIN HEATING**				=	**1,599**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.06	Btu/lb	@	78.65	F DB	,	65.21	F WB	,	6	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	48	CFM	x	6.88	BTU/lb	x	4.5								=	1,490	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	419	ft2/Ton
	Mix Air T-In	66	F	@	6	% OA												
	Heat Air T-Out	103	F															
	Heating Cap	48	CFM	x	37	F	x	1.08								=	1,908	Btu/hr

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HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 118A EMERG. ELEC.	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		21	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	21		+		5	x	0					=	1.26	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	5	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	153	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		21	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	143	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		21	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	24	Btu/hr
												RSH				=	320	Btu/hr
												Safety Factor (15%)				=	48	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**368**	**Btu/hr**
												Airflow (20F delta T)				=	**17**	**CFM**

III. Heating Load

Walls					63.96	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	300	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		21	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	113	Btu/hr
												Heating				=	413	Btu/hr
												Safety Factor (25%)				=	103	Btu/hr
									(not treating air)			**MIN HEATING**				=	**516**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.12	Btu/lb	@	78.74	F DB	,	65.30	F WB	,	7	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	17	CFM	x	6.95	BTU/lb	x	4.5								=	532	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	473	ft2/Ton
	Mix Air T-In	65	F	@	7	% OA												
	Heat Air T-Out	100	F															
	Heating Cap	17	CFM	x	35	F	x	1.08								=	636	Btu/hr

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HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 119 CLERK	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location		**Temps.**	**Summer**		**Winter**	
-		**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
		Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		408	ft2															
	Method	Ra			A				Rp			P						
Ventilation	per Person	0.06		x	408		+		5	x	2					=	34.68	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	32	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	1,083	Btu/hr
	E	23	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	588	Btu/hr
	W	9	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	341	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	12	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	6,270	Btu/hr
	E	5	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	2,156	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		17	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	851	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		408	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,531	Btu/hr
People		2	People	x	255	Btu/hr	x	1	Diversity							=	520	Btu/hr
Infiltration		408	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	467	Btu/hr
												RSH				=	13,807	Btu/hr
												Safety Factor (15%)				=	2,071	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**15,878**	**Btu/hr**
												Airflow (20F delta T)				=	**735**	**CFM**

III. Heating Load

Walls					660.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	3,099	Btu/hr
Glass					110.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	3,707	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		408	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	2,193	Btu/hr
												Heating				=	9,000	Btu/hr
												Safety Factor (25%)				=	2,250	Btu/hr
									(not treating air)			**MIN HEATING**				=	**11,250**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.93	Btu/lb	@	78.47	F DB	,	65.04	F WB	,	5	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	735	CFM	x	6.76	BTU/lb	x	4.5								=	22,350	Btu/hr
												Tons A/C				=	1.9	Tons
												H2O (10F delta T)				=	4	GPM
																=	219	ft2/Ton
	Mix Air T-In	67	F	@	5	% OA												
	Heat Air T-Out	86	F															
	Heating Cap	735	CFM	x	19	F	x	1.08								=	15,122	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	120 VAULT		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		162	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	162		+		5	x	0					=	9.72	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	13	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	501	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		162	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	276	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		162	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	186	Btu/hr

RSH	=	963	Btu/hr
Safety Factor (15%)	=	145	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**1,108**	**Btu/hr**
Airflow (20F delta T)	=	**51**	**CFM**

III. Heating Load

Walls					159.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	746	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		162	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	871	Btu/hr

Heating	=	1,617	Btu/hr
Safety Factor (25%)	=	404	Btu/hr
(not treating air) **MIN HEATING**	=	**2,021**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.96	Btu/lb	@	79.89	F DB	,	66.38	F WB	,	19	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	51	CFM	x	7.78	BTU/lb	x	4.5								=	1,796	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	1082	ft2/Ton
	Mix Air T-In	58	F	@	19	% OA												
	Heat Air T-Out	108	F															
	Heating Cap	51	CFM	x	50	F	x	1.08								=	2,772	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	121 WOMEN		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		144	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	144		+		5	x	3					=	23.64	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	10	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	439	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	11	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	376	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	3	ft	x	4	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	455	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		3	ft	x	3.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	67	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		144	ft2	x	0.90	W/ft2	x	3.412	Btuh/Watt							=	442	Btu/hr
People		3	People	x	255	Btu/hr	x	1	Diversity							=	765	Btu/hr
Infiltration		144	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	165	Btu/hr

	RSH	=	2,709 Btu/hr
	Safety Factor (15%)	=	406 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**3,115 Btu/hr**
	Airflow (20F delta T)	=	**144 CFM**

III. Heating Load

Walls					243.13	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,141	Btu/hr
Glass					8.75	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	294	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		144	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	774	Btu/hr

	Heating	=	2,209 Btu/hr
	Safety Factor (25%)	=	552 Btu/hr
(not treating air)	**MIN HEATING**	=	**2,761 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.77	Btu/lb	@	79.64	F DB	,	66.14	F WB	,	16	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	144	CFM	x	7.60	BTU/lb	x	4.5								=	4,930	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	351	ft2/Ton
	Mix Air T-In	60	F	@	16	% OA												
	Heat Air T-Out	90	F															
	Heating Cap	144	CFM	x	30	F	x	1.08								=	4,630	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	122 JAN		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		27	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	27		+		5	x	0					=	1.62	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		27	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	46	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	46 Btu/hr
	Safety Factor (15%)	=	7 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**53** **Btu/hr**
	Airflow (20F delta T)	=	**2** **CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	0 Btu/hr
	Safety Factor (25%)	=	0 Btu/hr
(not treating air)	**MIN HEATING**	=	**0** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	34.58	Btu/lb	@	84.61	F DB	,	70.81	F WB	,	66	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	2	CFM	x	11.41	BTU/lb	x	4.5								=	126	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	2573	ft2/Ton
	Mix Air T-In	30	F	@	66	% OA												
	Heat Air T-Out	72	F															
	Heating Cap	2	CFM	x	42	F	x	1.08								=	112	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	123 MEN		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		145	ft2															
	Method	Ra			A				Rp			P						
Ventilation	per Person	0.06		x	145		+		5	x	3					=	23.7	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	10	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	219	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	11	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	379	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	3	ft	x	4	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	455	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		3	ft	x	3.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	67	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		145	ft2	x	0.90	W/ft2	x	3.412	Btuh/Watt							=	445	Btu/hr
People		3	People	x	255	Btu/hr	x	1	Diversity							=	765	Btu/hr
Infiltration		145	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	166	Btu/hr

RSH	=	2,497	Btu/hr
Safety Factor (15%)	=	375	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**2,872**	**Btu/hr**
Airflow (20F delta T)	=	**133**	**CFM**

III. Heating Load

Walls					244.21	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,146	Btu/hr
Glass					8.75	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	294	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		145	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	779	Btu/hr

Heating	=	2,219	Btu/hr
Safety Factor (25%)	=	555	Btu/hr
(not treating air) **MIN HEATING**	=	**2,774**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.88	Btu/lb	@	79.78	F DB	,	66.28	F WB	,	18	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	133	CFM	x	7.70	BTU/lb	x	4.5								=	4,607	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	378	ft2/Ton
	Mix Air T-In	59	F	@	18	% OA												
	Heat Air T-Out	91	F															
	Heating Cap	133	CFM	x	32	F	x	1.08								=	4,622	Btu/hr

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BLW ENGINEERS, INC.

311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	OPEN LIBRARY AREA		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		1,497	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.12		x	1,497		+		5	x	15					=	254.49	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	42	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	835	Btu/hr
	S	10	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	435	Btu/hr
	E	46	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	1,263	Btu/hr
	W	3	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	104	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	7	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	1,116	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	5	ft	x	4	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	1,161	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		12	ft	x	4.38	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	404	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		1,497	ft2	x	1.70	W/ft2	x	3.412	Btuh/Watt							=	8,683	Btu/hr
People		15	People	x	255	Btu/hr	x	1	Diversity							=	3,817	Btu/hr
Infiltration		1,497	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,715	Btu/hr
												RSH				=	19,533	Btu/hr
												Safety Factor (15%)				=	2,930	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**22,463**	**Btu/hr**
												Airflow (20F delta T)				=	**1,040**	**CFM**

III. Heating Load

Walls					1157.46	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	5,431	Btu/hr
Glass					52.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	1,761	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		1,497	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	8,048	Btu/hr
												Heating				=	15,240	Btu/hr
												Safety Factor (25%)				=	3,810	Btu/hr
									(not treating air)			**MIN HEATING**				=	**19,050**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.36	Btu/lb	@	80.45	F DB	,	66.90	F WB	,	24	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	1,040	CFM	x	8.19	BTU/lb	x	4.5								=	38,324	Btu/hr
												Tons A/C				=	3.2	Tons
												H2O (10F delta T)				=	8	GPM
																=	469	ft2/Ton
	Mix Air T-In	55	F	@	24	% OA												
	Heat Air T-Out	89	F															
	Heating Cap	1,040	CFM	x	34	F	x	1.08								=	38,062	Btu/hr

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BLW ENGINEERS, INC.

311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	125 TAX COLLECTOR		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		468	ft2																
	Method	Ra			A				Rp			P							
Ventilation	per Person	0.06		x	468		+		5	x	2					=	39.78	CFM	
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM	

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	21	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	754	Btu/hr
	E	6	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	172	Btu/hr
	W	23	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	777	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	6	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	3,135	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	5	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	1,690	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		11	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	551	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		468	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,756	Btu/hr
People		2	People	x	255	Btu/hr	x	1	Diversity							=	597	Btu/hr
Infiltration		468	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	536	Btu/hr
												RSH				=	9,967	Btu/hr
												Safety Factor (15%)				=	1,495	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**11,463**	**Btu/hr**
												Airflow (20F delta T)				=	**531**	**CFM**

III. Heating Load

Walls					531.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	2,494	Btu/hr
Glass					71.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	2,399	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		468	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	2,516	Btu/hr
												Heating				=	7,409	Btu/hr
												Safety Factor (25%)				=	1,852	Btu/hr
									(not treating air)			**MIN HEATING**				=	**9,261**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.13	Btu/lb	@	78.75	F DB	,	65.30	F WB	,	7	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	531	CFM	x	6.95	BTU/lb	x	4.5								=	16,608	Btu/hr
												Tons A/C				=	1.4	Tons
												H2O (10F delta T)				=	3	GPM
																=	338	ft2/Ton
	Mix Air T-In	65	F	@	7	% OA												
	Heat Air T-Out	88	F															
	Heating Cap	531	CFM	x	23	F	x	1.08								=	13,028	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	126 COLLECTOR OFFICE		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		121	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	121		+		5	x	1					=	10.285	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	11	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	410	Btu/hr
	E	17	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	472	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	3	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	1,306	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	7	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	7	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		3	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	125	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		121	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	454	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	154	Btu/hr
Infiltration		121	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	139	Btu/hr

RSH	=	3,060	Btu/hr
Safety Factor (15%)	=	459	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**3,519**	**Btu/hr**
Airflow (20F delta T)	=	**163**	**CFM**

III. Heating Load

Walls					313.75	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,472	Btu/hr
Glass					16.25	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	545	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		121	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	650	Btu/hr

Heating	=	2,668	Btu/hr
Safety Factor (25%)	=	667	Btu/hr
(not treating air) **MIN HEATING**	=	**3,335**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.05	Btu/lb	@	78.63	F DB	,	65.19	F WB	,	6	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	163	CFM	x	6.87	BTU/lb	x	4.5								=	5,037	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	288	ft2/Ton
	Mix Air T-In	66	F	@	6	% OA												
	Heat Air T-Out	91	F															
	Heating Cap	163	CFM	x	25	F	x	1.08								=	4,364	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	201 CORRIDOR		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		546	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	546		+		5	x	0					=	32.76	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	24	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	842	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	10	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	4,019	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		10	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	385	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		770	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	1,540	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		546	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	931	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		546	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	626	Btu/hr
												RSH				=	8,343	Btu/hr
												Safety Factor (15%)				=	1,252	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**9,595**	**Btu/hr**
												Airflow (20F delta T)				=	**444**	**CFM**

III. Heating Load

Walls					238.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,117	Btu/hr
Glass					50.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	1,678	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		770	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	2,349	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		546	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	2,935	Btu/hr
												Heating				=	8,078	Btu/hr
												Safety Factor (25%)				=	2,019	Btu/hr
									(not treating air)			**MIN HEATING**				=	**10,097**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.12	Btu/lb	@	78.74	F DB	,	65.29	F WB	,	7	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	444	CFM	x	6.95	BTU/lb	x	4.5								=	13,884	Btu/hr
												Tons A/C				=	1.2	Tons
												H2O (10F delta T)				=	3	GPM
																=	472	ft2/Ton
	Mix Air T-In	66	F	@	7	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	444	CFM	x	28	F	x	1.08								=	13,215	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 202 CO	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location		**Temps.**	**Summer**		**Winter**	
-		**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
		Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		309	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	309		+		5	x	0					=	18.54	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	25	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	669	Btu/hr
	E	15	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	352	Btu/hr
	W	15	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	466	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	14	ft	x	8	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	8,440	Btu/hr
	E	4	ft	x	8	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	1,741	Btu/hr
	W	4	ft	x	8	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	1,365	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		21	ft	x	7.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	1,213	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		530	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	1,060	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		309	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,160	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		309	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	354	Btu/hr
												RSH				=	16,820	Btu/hr
												Safety Factor (15%)				=	2,523	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**19,343**	**Btu/hr**
												Airflow (20F delta T)				=	**896**	**CFM**

III. Heating Load

Walls					484.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	2,273	Btu/hr
Glass					157.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	5,284	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		530	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,617	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		309	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,661	Btu/hr
												Heating				=	10,835	Btu/hr
												Safety Factor (25%)				=	2,709	Btu/hr
									(not treating air)			**MIN HEATING**				=	**13,544**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.74	Btu/lb	@	78.21	F DB	,	64.79	F WB	,	2	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	896	CFM	x	6.57	BTU/lb	x	4.5								=	26,472	Btu/hr
												Tons A/C				=	2.2	Tons
												H2O (10F delta T)				=	5	GPM
																=	140	ft2/Ton
	Mix Air T-In	69	F	@	2	% OA												
	Heat Air T-Out	86	F															
	Heating Cap	896	CFM	x	17	F	x	1.08								=	16,700	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	203 JAN		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		30	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	30		+		5	x	0					=	1.8	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		44	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	87	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		30	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	51	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	138 Btu/hr
	Safety Factor (15%)	=	21 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**159 Btu/hr**
	Airflow (20F delta T)	=	**7 CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		44	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	133	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	133 Btu/hr
	Safety Factor (25%)	=	33 Btu/hr
(not treating air)	**MIN HEATING**	=	**166 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.36	Btu/lb	@	80.45	F DB	,	66.90	F WB	,	24	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	7	CFM	x	8.19	BTU/lb	x	4.5								=	271	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	1328	ft2/Ton
	Mix Air T-In	55	F	@	24	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	7	CFM	x	38	F	x	1.08								=	300	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	204 MEN		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		44	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	44		+		5	x	1					=	7.64	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		60	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	120	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		44	ft2	x	0.90	W/ft2	x	3.412	Btuh/Watt							=	135	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	255	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	510 Btu/hr
	Safety Factor (15%)	=	77 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**587 Btu/hr**
	Airflow (20F delta T)	=	**27 CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		60	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	183	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	183 Btu/hr
	Safety Factor (25%)	=	46 Btu/hr
(not treating air)	**MIN HEATING**	=	**229 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.64	Btu/lb	@	80.81	F DB	,	67.24	F WB	,	28	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	27	CFM	x	8.46	BTU/lb	x	4.5								=	1,034	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	511	ft2/Ton
	Mix Air T-In	53	F	@	28	% OA												
	Heat Air T-Out	80	F															
	Heating Cap	27	CFM	x	27	F	x	1.08								=	791	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	206 STAIR #5		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		90	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	90		+		5	x	0					=	5.4	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		130	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	260	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		90	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	154	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	414 Btu/hr
	Safety Factor (15%)	=	62 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**476** **Btu/hr**
	Airflow (20F delta T)	=	**22** **CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		130	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	397	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	397 Btu/hr
	Safety Factor (25%)	=	99 Btu/hr
(not treating air)	**MIN HEATING**	=	**496** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.37	Btu/lb	@	80.45	F DB	,	66.91	F WB	,	25	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	22	CFM	x	8.19	BTU/lb	x	4.5								=	812	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	1330	ft2/Ton
	Mix Air T-In	55	F	@	25	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	22	CFM	x	38	F	x	1.08								=	899	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	207 DEAD FILE STORAGE		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		85	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	85		+		5	x	0					=	5.1	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	9	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	198	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		123	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	247	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		85	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	145	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		85	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	97	Btu/hr

	RSH	=	687	Btu/hr
	Safety Factor (15%)	=	103	Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**790**	**Btu/hr**
	Airflow (20F delta T)	=	**37**	**CFM**

III. Heating Load

Walls					111.96	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	525	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		123	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	376	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		85	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	457	Btu/hr

	Heating	=	1,358	Btu/hr
	Safety Factor (25%)	=	340	Btu/hr
(not treating air)	**MIN HEATING**	=	**1,698**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.59	Btu/lb	@	79.39	F DB	,	65.91	F WB	,	14	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	37	CFM	x	7.42	BTU/lb	x	4.5								=	1,221	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	835	ft2/Ton
	Mix Air T-In	61	F	@	14	% OA												
	Heat Air T-Out	115	F															
	Heating Cap	37	CFM	x	53	F	x	1.08								=	2,113	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	208 SMALL MTG. ROOM		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		414	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	414		+		5	x	21					=	128.34	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	30	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	637	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		600	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	1,201	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		414	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,554	Btu/hr
People		21	People	x	255	Btu/hr	x	1	Diversity							=	5,279	Btu/hr
Infiltration		414	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	474	Btu/hr
												RSH				=	9,144	Btu/hr
												Safety Factor (15%)				=	1,372	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**10,516**	**Btu/hr**
												Airflow (20F delta T)				=	**487**	**CFM**

III. Heating Load

Walls					360.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,689	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		600	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,831	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		414	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	2,226	Btu/hr
												Heating				=	5,746	Btu/hr
												Safety Factor (25%)				=	1,436	Btu/hr
									(not treating air)			**MIN HEATING**				=	**7,182**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.50	Btu/lb	@	80.64	F DB	,	67.08	F WB	,	26	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	487	CFM	x	8.33	BTU/lb	x	4.5								=	18,248	Btu/hr
												Tons A/C				=	1.5	Tons
												H2O (10F delta T)				=	4	GPM
																=	272	ft2/Ton
	Mix Air T-In	54	F	@	26	% OA												
	Heat Air T-Out	86	F															
	Heating Cap	487	CFM	x	32	F	x	1.08								=	16,689	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	208.1 MECH. CLOSET		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		47	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	47		+		5	x	0					=	2.82	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		68	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	136	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		47	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	321	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	457 Btu/hr
	Safety Factor (15%)	=	69 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**526 Btu/hr**
	Airflow (20F delta T)	=	**24 CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		68	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	208	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	208 Btu/hr
	Safety Factor (25%)	=	52 Btu/hr
(not treating air)	**MIN HEATING**	=	**260 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.42	Btu/lb	@	79.16	F DB	,	65.69	F WB	,	12	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	24	CFM	x	7.25	BTU/lb	x	4.5								=	794	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	711	ft2/Ton
	Mix Air T-In	63	F	@	12	% OA												
	Heat Air T-Out	82	F															
	Heating Cap	24	CFM	x	19	F	x	1.08								=	498	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	209 WOMEN		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location		Temps.	Summer		Winter	
-		**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
		Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		50	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	50		+		5	x	1					=	8	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		73	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	145	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		50	ft2	x	0.90	W/ft2	x	3.412	Btuh/Watt							=	154	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	255	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

RSH	=	554	Btu/hr
Safety Factor (15%)	=	83	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**637**	**Btu/hr**
Airflow (20F delta T)	=	**29**	**CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		73	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	221	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

Heating	=	221	Btu/hr
Safety Factor (25%)	=	55	Btu/hr
(not treating air) **MIN HEATING**	=	**276**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.56	Btu/lb	@	80.71	F DB	,	67.15	F WB	,	27	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	29	CFM	x	8.39	BTU/lb	x	4.5								=	1,112	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	539	ft2/Ton
	Mix Air T-In	53	F	@	27	% OA												
	Heat Air T-Out	81	F															
	Heating Cap	29	CFM	x	27	F	x	1.08								=	867	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford** 210 STAIR #1		**Sheet** 1 of 1
Trade Specification Section: 15500			**Date**
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		116	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	116		+		5	x	0					=	6.96	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		168	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	336	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		116	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	198	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		116	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	133	Btu/hr

	RSH	=	667 Btu/hr
	Safety Factor (15%)	=	100 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**767** **Btu/hr**
	Airflow (20F delta T)	=	**36** **CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		168	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	513	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		116	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	624	Btu/hr

	Heating	=	1,137 Btu/hr
	Safety Factor (25%)	=	284 Btu/hr
(not treating air)	**MIN HEATING**	=	**1,421** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.00	Btu/lb	@	79.96	F DB	,	66.44	F WB	,	20	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	36	CFM	x	7.83	BTU/lb	x	4.5								=	1,252	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	1112	ft2/Ton
	Mix Air T-In	58	F	@	20	% OA												
	Heat Air T-Out	109	F															
	Heating Cap	36	CFM	x	51	F	x	1.08								=	1,956	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	212 DEAD FILE STORAGE		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		85	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	85		+		5	x	0					=	5.1	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	9	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	200	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		123	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	247	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		85	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	145	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		85	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	97	Btu/hr

	RSH	=	688	Btu/hr
	Safety Factor (15%)	=	103	Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**792**	**Btu/hr**
	Airflow (20F delta T)	=	**37**	**CFM**

III. Heating Load

Walls					112.80	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	529	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		123	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	376	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		85	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	457	Btu/hr

	Heating	=	1,362	Btu/hr
	Safety Factor (25%)	=	341	Btu/hr
(not treating air)	**MIN HEATING**	=	**1,703**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.59	Btu/lb	@	79.39	F DB	,	65.91	F WB	,	14	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	37	CFM	x	7.42	BTU/lb	x	4.5								=	1,223	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	834	ft2/Ton
	Mix Air T-In	62	F	@	14	% OA												
	Heat Air T-Out	115	F															
	Heating Cap	37	CFM	x	53	F	x	1.08								=	2,118	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	213 STAIR #3		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		94	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	94		+		5	x	0					=	5.64	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		136	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	273	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		94	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	160	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	433 Btu/hr
	Safety Factor (15%)	=	65 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**498** **Btu/hr**
	Airflow (20F delta T)	=	**23** **CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		136	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	416	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	416 Btu/hr
	Safety Factor (25%)	=	104 Btu/hr
(not treating air)	**MIN HEATING**	=	**520** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.36	Btu/lb	@	80.45	F DB	,	66.90	F WB	,	24	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	23	CFM	x	8.19	BTU/lb	x	4.5								=	849	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	1328	ft2/Ton
	Mix Air T-In	55	F	@	24	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	23	CFM	x	38	F	x	1.08								=	941	Btu/hr

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BLW ENGINEERS, INC.

311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	214 ADMIN WAITING		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		373	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	373		+		5	x	4					=	41.03	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	5	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	189	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		541	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	1,082	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		373	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,400	Btu/hr
People		4	People	x	255	Btu/hr	x	1	Diversity							=	951	Btu/hr
Infiltration		373	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	427	Btu/hr
												RSH				=	4,049	Btu/hr
												Safety Factor (15%)				=	607	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**4,657**	**Btu/hr**
												Airflow (20F delta T)				=	**216**	**CFM**

III. Heating Load

Walls					60.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	282	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		541	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,650	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		373	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	2,005	Btu/hr
												Heating				=	3,936	Btu/hr
												Safety Factor (25%)				=	984	Btu/hr
									(not treating air)			**MIN HEATING**				=	**4,920**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.96	Btu/lb	@	79.90	F DB	,	66.39	F WB	,	19	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	216	CFM	x	7.79	BTU/lb	x	4.5								=	7,556	Btu/hr
												Tons A/C				=	0.6	Tons
												H2O (10F delta T)				=	2	GPM
																=	592	ft2/Ton
	Mix Air T-In	58	F	@	19	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	216	CFM	x	35	F	x	1.08								=	8,089	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	215 FINANCE OFFICE		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		341	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	341		+		5	x	2					=	28.985	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	10	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	146	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	9	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	239	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	8	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	1,195	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	3	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	829	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		10	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	385	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		494	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	989	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		341	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,280	Btu/hr
People		2	People	x	255	Btu/hr	x	1	Diversity							=	435	Btu/hr
Infiltration		341	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	391	Btu/hr
												RSH				=	5,889	Btu/hr
												Safety Factor (15%)				=	883	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**6,772**	**Btu/hr**
												Airflow (20F delta T)				=	**314**	**CFM**

III. Heating Load

Walls					182.80	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	858	Btu/hr
Glass					50.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	1,678	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		494	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,508	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		341	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,833	Btu/hr
												Heating				=	5,876	Btu/hr
												Safety Factor (25%)				=	1,469	Btu/hr
									(not treating air)			**MIN HEATING**				=	**7,346**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.25	Btu/lb	@	78.92	F DB	,	65.47	F WB	,	9	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	314	CFM	x	7.08	BTU/lb	x	4.5								=	9,988	Btu/hr
												Tons A/C				=	0.8	Tons
												H2O (10F delta T)				=	2	GPM
																=	410	ft2/Ton
	Mix Air T-In	64	F	@	9	% OA												
	Heat Air T-Out	94	F															
	Heating Cap	314	CFM	x	29	F	x	1.08								=	9,932	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	216 ACCOUNTANT		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		139	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	139		+		5	x	1					=	13.34	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	11	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	211	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	3	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	104	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	3	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	398	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		3	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	96	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		202	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	403	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		139	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	522	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	255	Btu/hr
Infiltration		139	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	159	Btu/hr

RSH	=	2,149	Btu/hr
Safety Factor (15%)	=	322	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**2,472**	**Btu/hr**
Airflow (20F delta T)	=	**114**	**CFM**

III. Heating Load

Walls					152.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	716	Btu/hr
Glass					12.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	419	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		202	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	615	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		139	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	747	Btu/hr

Heating	=	2,497	Btu/hr
Safety Factor (25%)	=	624	Btu/hr
(not treating air) **MIN HEATING**	=	**3,121**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.43	Btu/lb	@	79.17	F DB	,	65.70	F WB	,	12	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	114	CFM	x	7.25	BTU/lb	x	4.5								=	3,735	Btu/hr
												Tons A/C				=	0.3	Tons
												H2O (10F delta T)				=	1	GPM
																=	447	ft2/Ton
	Mix Air T-In	63	F	@	12	% OA												
	Heat Air T-Out	97	F															
	Heating Cap	114	CFM	x	34	F	x	1.08								=	4,247	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	217 FINANCE DIRECTOR		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		137	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	137		+		5	x	1					=	13.22	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	11	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	211	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	16	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	421	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	3	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	398	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	3	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	829	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		5	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	193	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		199	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	397	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		137	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	514	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	255	Btu/hr
Infiltration		137	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	157	Btu/hr

	RSH	=	3,376 Btu/hr
	Safety Factor (15%)	=	506 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**3,882 Btu/hr**
	Airflow (20F delta T)	=	**180 CFM**

III. Heating Load

Walls					296.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,389	Btu/hr
Glass					25.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	839	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		199	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	606	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		137	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	736	Btu/hr

	Heating	=	3,570 Btu/hr
	Safety Factor (25%)	=	893 Btu/hr
(not treating air)	**MIN HEATING**	=	**4,463 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.12	Btu/lb	@	78.74	F DB	,	65.29	F WB	,	7	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	180	CFM	x	6.94	BTU/lb	x	4.5								=	5,617	Btu/hr
												Tons A/C				=	0.5	Tons
												H2O (10F delta T)				=	1	GPM
																=	293	ft2/Ton
	Mix Air T-In	66	F	@	7	% OA												
	Heat Air T-Out	95	F															
	Heating Cap	180	CFM	x	29	F	x	1.08								=	5,722	Btu/hr

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HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 218 MAIL/COPY	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		182	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	182		+		5	x	2					=	20.92	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	10	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	219	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	11	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	248	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	5	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	1,658	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		5	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	193	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		264	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	528	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		182	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	1,242	Btu/hr
People		2	People	x	255	Btu/hr	x	1	Diversity							=	510	Btu/hr
Infiltration		182	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	209	Btu/hr
												RSH				=	4,806	Btu/hr
												Safety Factor (15%)				=	721	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**5,527**	**Btu/hr**
												Airflow (20F delta T)				=	**256**	**CFM**

III. Heating Load

Walls					227.60	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,068	Btu/hr
Glass					25.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	839	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		264	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	805	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		182	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	978	Btu/hr
												Heating				=	3,690	Btu/hr
												Safety Factor (25%)				=	923	Btu/hr
									(not treating air)			**MIN HEATING**				=	**4,613**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.18	Btu/lb	@	78.82	F DB	,	65.37	F WB	,	8	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	256	CFM	x	7.00	BTU/lb	x	4.5								=	8,063	Btu/hr
												Tons A/C				=	0.7	Tons
												H2O (10F delta T)				=	2	GPM
																=	271	ft2/Ton
	Mix Air T-In	65	F	@	8	% OA												
	Heat Air T-Out	89	F															
	Heating Cap	256	CFM	x	24	F	x	1.08								=	6,543	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	219 DEAD FILE STORAGE		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		89	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	89		+		5	x	0					=	5.34	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		129	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	258	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		89	ft2	x	0.50	W/ft2	x	3.412	Btuh/Watt							=	152	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	410 Btu/hr
	Safety Factor (15%)	=	61 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**471 Btu/hr**
	Airflow (20F delta T)	=	**22 CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		129	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	394	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	394 Btu/hr
	Safety Factor (25%)	=	98 Btu/hr
(not treating air)	**MIN HEATING**	=	**492 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.36	Btu/lb	@	80.45	F DB	,	66.90	F WB	,	24	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	22	CFM	x	8.19	BTU/lb	x	4.5								=	804	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	1328	ft2/Ton
	Mix Air T-In	55	F	@	24	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	22	CFM	x	38	F	x	1.08								=	891	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	220 SELECTMEN		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		285	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	285		+		5	x	1					=	24.225	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	16	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	547	Btu/hr
	E	20	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	513	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	8	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	3,014	Btu/hr
	E	5	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	1,658	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		13	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	481	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		413	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	827	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		285	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,070	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	363	Btu/hr
Infiltration		285	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	327	Btu/hr
												RSH				=	8,799	Btu/hr
												Safety Factor (15%)				=	1,320	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**10,119**	**Btu/hr**
												Airflow (20F delta T)				=	**468**	**CFM**

III. Heating Load

Walls					369.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,734	Btu/hr
Glass					62.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	2,097	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		413	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,260	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		285	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,532	Btu/hr
												Heating				=	6,623	Btu/hr
												Safety Factor (25%)				=	1,656	Btu/hr
									(not treating air)			**MIN HEATING**				=	**8,279**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.96	Btu/lb	@	78.52	F DB	,	65.09	F WB	,	5	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	468	CFM	x	6.79	BTU/lb	x	4.5								=	14,312	Btu/hr
												Tons A/C				=	1.2	Tons
												H2O (10F delta T)				=	3	GPM
																=	239	ft2/Ton
	Mix Air T-In	67	F	@	5	% OA												
	Heat Air T-Out	88	F															
	Heating Cap	468	CFM	x	22	F	x	1.08								=	10,887	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500		221 ASSISTANT ADMINISTRATOR	1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.		Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88	74	9 °F	

I. Outdoor Air Requirement

Area		183	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	183		+		5	x	1					=	15.555	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	10	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	425	Btu/hr
	E	10	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	236	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	5	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	1,658	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		5	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	193	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		265	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	531	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		183	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	687	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	233	Btu/hr
Infiltration		183	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	210	Btu/hr

	RSH	=	4,172 Btu/hr
	Safety Factor (15%)	=	626 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**4,798 Btu/hr**
	Airflow (20F delta T)	=	**222 CFM**

III. Heating Load

Walls					218.96	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,027	Btu/hr
Glass					25.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	839	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		265	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	809	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		183	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	984	Btu/hr

	Heating	=	3,659 Btu/hr
	Safety Factor (25%)	=	915 Btu/hr
(not treating air)	**MIN HEATING**	=	**4,574 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.09	Btu/lb	@	78.70	F DB	,	65.26	F WB	,	7	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	222	CFM	x	6.92	BTU/lb	x	4.5								=	6,916	Btu/hr
												Tons A/C				=	0.6	Tons
												H2O (10F delta T)				=	1	GPM
																=	318	ft2/Ton
	Mix Air T-In	66	F	@	7	% OA												
	Heat Air T-Out	91	F															
	Heating Cap	222	CFM	x	25	F	x	1.08								=	6,079	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	222 TOWN ADMINISTRATOR		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		288	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	288		+		5	x	1					=	24.48	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	17	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	579	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	21	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	716	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	8	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	3,014	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	5	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	1,300	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		13	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	481	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		418	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	835	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		288	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,081	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	367	Btu/hr
Infiltration		288	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	330	Btu/hr
												RSH				=	8,703	Btu/hr
												Safety Factor (15%)				=	1,305	Btu/hr
												Sensible(w/o treating air) **ERSH**				=	**10,009**	**Btu/hr**
												Airflow (20F delta T)				=	**463**	**CFM**

III. Heating Load

Walls					390.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,832	Btu/hr
Glass					62.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	2,097	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		418	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,274	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		288	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,548	Btu/hr
												Heating				=	6,751	Btu/hr
												Safety Factor (25%)				=	1,688	Btu/hr
												(not treating air) **MIN HEATING**				=	**8,439**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.97	Btu/lb	@	78.53	F DB	,	65.10	F WB	,	5	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	463	CFM	x	6.80	BTU/lb	x	4.5								=	14,172	Btu/hr
												Tons A/C				=	1.2	Tons
												H2O (10F delta T)				=	3	GPM
																=	244	ft2/Ton
	Mix Air T-In	67	F	@	5	% OA												
	Heat Air T-Out	89	F															
	Heating Cap	463	CFM	x	22	F	x	1.08								=	11,053	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	223 REGULATORY WAITING		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		354	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	354		+		5	x	4					=	38.94	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	5	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	143	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		513	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	1,027	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		354	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,329	Btu/hr
People		4	People	x	255	Btu/hr	x	1	Diversity							=	903	Btu/hr
Infiltration		354	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	406	Btu/hr

RSH	=	3,807	Btu/hr
Safety Factor (15%)	=	571	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**4,378**	**Btu/hr**
Airflow (20F delta T)	=	**203**	**CFM**

III. Heating Load

Walls					60.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	282	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		513	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,566	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		354	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,903	Btu/hr

Heating	=	3,750	Btu/hr
Safety Factor (25%)	=	938	Btu/hr
(not treating air) **MIN HEATING**	=	**4,688**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.98	Btu/lb	@	79.92	F DB	,	66.41	F WB	,	19	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	203	CFM	x	7.80	BTU/lb	x	4.5								=	7,115	Btu/hr
												Tons A/C				=	0.6	Tons
												H2O (10F delta T)				=	1	GPM
																=	597	ft2/Ton
	Mix Air T-In	58	F	@	19	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	203	CFM	x	35	F	x	1.08								=	7,691	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	224 INSPECTIONAL DEPT.		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		280	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	280		+		5	x	1					=	23.8	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	16	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	547	Btu/hr
	E	21	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	541	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	8	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	3,014	Btu/hr
	E	5	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	1,658	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		13	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	481	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		406	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	812	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		280	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,051	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	357	Btu/hr
Infiltration		280	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	321	Btu/hr
												RSH				=	8,783	Btu/hr
												Safety Factor (15%)				=	1,317	Btu/hr
												Sensible(w/o treating air) **ERSH**				=	**10,100**	**Btu/hr**
												Airflow (20F delta T)				=	**468**	**CFM**

III. Heating Load

Walls					381.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,790	Btu/hr
Glass					62.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	2,097	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		406	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,238	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		280	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,505	Btu/hr
												Heating				=	6,631	Btu/hr
												Safety Factor (25%)				=	1,658	Btu/hr
												(not treating air) **MIN HEATING**				=	**8,288**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.96	Btu/lb	@	78.51	F DB	,	65.08	F WB	,	5	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	468	CFM	x	6.78	BTU/lb	x	4.5								=	14,273	Btu/hr
												Tons A/C				=	1.2	Tons
												H2O (10F delta T)				=	3	GPM
																=	235	ft2/Ton
	Mix Air T-In	67	F	@	5	% OA												
	Heat Air T-Out	88	F															
	Heating Cap	468	CFM	x	22	F	x	1.08								=	10,866	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	225 BUILDING INSPECTOR		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 74	9 °F	

I. Outdoor Air Requirement

Area		128	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	128		+		5	x	1					=	10.88	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	16	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	547	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	10	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	349	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	8	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	3,014	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	3	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	650	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		10	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	385	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		186	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	371	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		128	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	480	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	163	Btu/hr
Infiltration		128	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	147	Btu/hr
												RSH				=	6,106	Btu/hr
												Safety Factor (15%)				=	916	Btu/hr
												Sensible(w/o treating air) **ERSH**				=	**7,022**	**Btu/hr**
												Airflow (20F delta T)				=	**325**	**CFM**

III. Heating Load

Walls					265.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,243	Btu/hr
Glass					50.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	1,678	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		186	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	566	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		128	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	688	Btu/hr
												Heating				=	4,175	Btu/hr
												Safety Factor (25%)				=	1,044	Btu/hr
												(not treating air) **MIN HEATING**				=	**5,219**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.83	Btu/lb	@	78.33	F DB	,	64.91	F WB	,	3	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	325	CFM	x	6.66	BTU/lb	x	4.5								=	9,742	Btu/hr
												Tons A/C				=	0.8	Tons
												H2O (10F delta T)				=	2	GPM
																=	158	ft2/Ton
	Mix Air T-In	68	F	@	3	% OA												
	Heat Air T-Out	87	F															
	Heating Cap	325	CFM	x	19	F	x	1.08								=	6,638	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 226 ZBA	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location		**Temps.**	**Summer**		**Winter**	
-		**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
		Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		156	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	156		+		5	x	1					=	13.26	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	10	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	330	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	3	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	650	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		3	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	96	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		226	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	452	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		156	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	585	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	199	Btu/hr
Infiltration		156	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	179	Btu/hr
												RSH				=	2,491	Btu/hr
												Safety Factor (15%)				=	374	Btu/hr
												Sensible(w/o treating air) **ERSH**				=	**2,865**	**Btu/hr**
												Airflow (20F delta T)				=	**133**	**CFM**

III. Heating Load

Walls					104.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	490	Btu/hr
Glass					12.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	419	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		226	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	690	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		156	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	839	Btu/hr
												Heating				=	2,438	Btu/hr
												Safety Factor (25%)				=	610	Btu/hr
												(not treating air) **MIN HEATING**				=	**3,048**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.31	Btu/lb	@	79.00	F DB	,	65.54	F WB	,	10	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	133	CFM	x	7.13	BTU/lb	x	4.5								=	4,258	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	440	ft2/Ton
	Mix Air T-In	64	F	@	10	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	133	CFM	x	29	F	x	1.08								=	4,208	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	227 HEALTH		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		248	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	248		+		5	x	1					=	21.08	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	10	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	437	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	10	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	292	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	5	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	1,300	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		5	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	193	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		360	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	719	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		248	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	931	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	316	Btu/hr
Infiltration		248	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	284	Btu/hr
												RSH				=	4,472	Btu/hr
												Safety Factor (15%)				=	671	Btu/hr
												Sensible(w/o treating air) **ERSH**				=	**5,143**	**Btu/hr**
												Airflow (20F delta T)				=	**238**	**CFM**

III. Heating Load

Walls					216.32	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,015	Btu/hr
Glass					25.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	839	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		360	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,097	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		248	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,333	Btu/hr
												Heating				=	4,284	Btu/hr
												Safety Factor (25%)				=	1,071	Btu/hr
												(not treating air) **MIN HEATING**				=	**5,355**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.23	Btu/lb	@	78.89	F DB	,	65.43	F WB	,	9	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	238	CFM	x	7.05	BTU/lb	x	4.5								=	7,556	Btu/hr
												Tons A/C				=	0.6	Tons
												H2O (10F delta T)				=	2	GPM
																=	394	ft2/Ton
	Mix Air T-In	65	F	@	9	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	238	CFM	x	28	F	x	1.08								=	7,258	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	228 HEALTH DIRECTOR		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		127	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	127		+		5	x	1					=	10.795	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	10	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	219	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	12	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	356	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	5	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	1,300	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		5	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	193	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		184	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	368	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		127	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	477	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	162	Btu/hr
Infiltration		127	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	145	Btu/hr
												RSH				=	3,220	Btu/hr
												Safety Factor (15%)				=	483	Btu/hr
												Sensible(w/o treating air)				=	**3,703**	**Btu/hr**
												Airflow (20F delta T)				=	**171**	**CFM**

III. Heating Load

Walls					236.96	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,112	Btu/hr
Glass					25.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	839	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		184	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	562	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		127	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	683	Btu/hr
												Heating				=	3,195	Btu/hr
												Safety Factor (25%)				=	799	Btu/hr
												(not treating air) **MIN HEATING**				=	**3,994**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.04	Btu/lb	@	78.63	F DB	,	65.19	F WB	,	6	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	171	CFM	x	6.87	BTU/lb	x	4.5								=	5,300	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	288	ft2/Ton
	Mix Air T-In	66	F	@	6	% OA												
	Heat Air T-Out	94	F															
	Heating Cap	171	CFM	x	27	F	x	1.08								=	5,075	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	229 CONS COM/PLANNING		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		354	ft2															
	Method	Ra			A				Rp			P						
Ventilation	per Person	0.06		x	354		+		5	x	2					=	30.09	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	12	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	415	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	3	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	650	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		3	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	96	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		513	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	1,027	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		354	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	1,329	Btu/hr
People		2	People	x	255	Btu/hr	x	1	Diversity							=	451	Btu/hr
Infiltration		354	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	406	Btu/hr
												RSH				=	4,373	Btu/hr
												Safety Factor (15%)				=	656	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**5,029**	**Btu/hr**
												Airflow (20F delta T)				=	**233**	**CFM**

III. Heating Load

Walls					131.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	617	Btu/hr
Glass					12.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	419	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		513	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	1,566	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		354	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,903	Btu/hr
												Heating				=	4,505	Btu/hr
												Safety Factor (25%)				=	1,126	Btu/hr
									(not treating air)			**MIN HEATING**				=	**5,631**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.52	Btu/lb	@	79.29	F DB	,	65.81	F WB	,	13	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	233	CFM	x	7.34	BTU/lb	x	4.5								=	7,695	Btu/hr
												Tons A/C				=	0.6	Tons
												H2O (10F delta T)				=	2	GPM
																=	552	ft2/Ton
	Mix Air T-In	62	F	@	13	% OA												
	Heat Air T-Out	94	F															
	Heating Cap	233	CFM	x	32	F	x	1.08								=	8,116	Btu/hr

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HVAC Calculations

Project phase:	Preliminary	**Project:** **Boxford** 230 CONSERVATION DIRECTOR	**Sheet** 1 of 1
Trade Specification Section:	15500		**Date**
By:	**Checked By:**	**Project No.:** **17076**	00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb)	75 / 63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb)	88 / 74	9 °F	

I. Outdoor Air Requirement

Area		109	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	109		+		5	x	1					=	9.265	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	11	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	207	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	13	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	465	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	3	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	398	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	3	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	650	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		5	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	193	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		158	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	316	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		109	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	409	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	139	Btu/hr
Infiltration		109	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	125	Btu/hr
												RSH				=	2,902	Btu/hr
												Safety Factor (15%)				=	435	Btu/hr
												Sensible(w/o treating air) **ERSH**				=	**3,337**	**Btu/hr**
												Airflow (20F delta T)				=	**155**	**CFM**

III. Heating Load

Walls					264.56	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,241	Btu/hr
Glass					25.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	839	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		158	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	482	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		109	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	586	Btu/hr
												Heating				=	3,148	Btu/hr
												Safety Factor (25%)				=	787	Btu/hr
												(not treating air) **MIN HEATING**				=	**3,935**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.02	Btu/lb	@	78.60	F DB	,	65.16	F WB	,	6	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	155	CFM	x	6.85	BTU/lb	x	4.5								=	4,761	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	275	ft2/Ton
	Mix Air T-In	66	F	@	6	% OA												
	Heat Air T-Out	96	F															
	Heating Cap	155	CFM	x	29	F	x	1.08								=	4,879	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500		231 CONSERVATION ASSISTANT	1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		118	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	118		+		5	x	1					=	10.03	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	10	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	153	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	8	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	1,195	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		8	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	289	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		171	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	342	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		118	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	443	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	150	Btu/hr
Infiltration		118	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	135	Btu/hr
												RSH				=	2,708	Btu/hr
												Safety Factor (15%)				=	406	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**3,114**	**Btu/hr**
												Airflow (20F delta T)				=	**144**	**CFM**

III. Heating Load

Walls					86.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	406	Btu/hr
Glass					37.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	1,258	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		171	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	522	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		118	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	634	Btu/hr
												Heating				=	2,820	Btu/hr
												Safety Factor (25%)				=	705	Btu/hr
									(not treating air)			**MIN HEATING**				=	**3,525**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.09	Btu/lb	@	78.70	F DB	,	65.25	F WB	,	7	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	144	CFM	x	6.92	BTU/lb	x	4.5								=	4,487	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	316	ft2/Ton
	Mix Air T-In	66	F	@	7	% OA												
	Heat Air T-Out	95	F															
	Heating Cap	144	CFM	x	29	F	x	1.08								=	4,497	Btu/hr

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311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** **Boxford**		**Sheet**
Trade Specification Section: 15500	232 PLANNER		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17076**		00.00.00

Design Conditions:

Location	**Temps.**	**Summer**		**Winter**	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		110	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	110		+		5	x	1					=	9.35	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	11	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	206	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	3	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	76	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	3	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	398	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		3	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	96	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		160	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	319	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		110	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	751	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	140	Btu/hr
Infiltration		110	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	126	Btu/hr

	RSH	=	2,113 Btu/hr
	Safety Factor (15%)	=	317 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**2,430** **Btu/hr**
	Airflow (20F delta T)	=	**112** **CFM**

III. Heating Load

Walls					148.42	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	696	Btu/hr
Glass					12.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	419	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		160	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	486	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		110	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	591	Btu/hr

	Heating	=	2,194 Btu/hr
	Safety Factor (25%)	=	548 Btu/hr
(not treating air)	**MIN HEATING**	=	**2,742** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.19	Btu/lb	@	78.83	F DB	,	65.38	F WB	,	8	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	112	CFM	x	7.01	BTU/lb	x	4.5								=	3,550	Btu/hr
												Tons A/C				=	0.3	Tons
												H2O (10F delta T)				=	1	GPM
																=	372	ft2/Ton
	Mix Air T-In	65	F	@	8	% OA												
	Heat Air T-Out	95	F															
	Heating Cap	112	CFM	x	30	F	x	1.08								=	3,601	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	~		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		0	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	0		+		5	x	0					=	0	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		0	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	0	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	0 Btu/hr
	Safety Factor (15%)	=	0 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**0 Btu/hr**
	Airflow (20F delta T)	=	**0 CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	0 Btu/hr
	Safety Factor (25%)	=	0 Btu/hr
(not treating air)	**MIN HEATING**	=	**0 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	0.00	Btu/lb	@	0.00	F DB	,	0.00	F WB	,	100	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	0	CFM	x	-23.17	BTU/lb	x	4.5								=	0	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	0	ft2/Ton
	Mix Air T-In	9	F	@	100	% OA												
	Heat Air T-Out	#DIV/0!	F															
	Heating Cap	0	CFM	x	#DIV/0!	F	x	1.08								=	#DIV/0!	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	~		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		0	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	0		+		5	x	0					=	0	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		0	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	0	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	0 Btu/hr
	Safety Factor (15%)	=	0 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**0 Btu/hr**
	Airflow (20F delta T)	=	**0 CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	0 Btu/hr
	Safety Factor (25%)	=	0 Btu/hr
(not treating air)	**MIN HEATING**	=	**0 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	0.00	Btu/lb	@	0.00	F DB	,	0.00	F WB	,	100	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	0	CFM	x	-23.17	BTU/lb	x	4.5								=	0	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	0	ft2/Ton
	Mix Air T-In	9	F	@	100	% OA												
	Heat Air T-Out	#DIV/0!	F															
	Heating Cap	0	CFM	x	#DIV/0!	F	x	1.08								=	#DIV/0!	Btu/hr

BLW

BLW ENGINEERS, INC.

311 Great Road, PO Box 1551 Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	~		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		0	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	0		+		5	x	0					=	0	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		0	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	0	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	0 Btu/hr
	Safety Factor (15%)	=	0 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**0 Btu/hr**
	Airflow (20F delta T)	=	**0 CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	0 Btu/hr
	Safety Factor (25%)	=	0 Btu/hr
(not treating air)	**MIN HEATING**	=	**0 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	0.00	Btu/lb	@	0.00	F DB	,	0.00	F WB	,	100	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	0	CFM	x	-23.17	BTU/lb	x	4.5								=	0	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	0	ft2/Ton
	Mix Air T-In	9	F	@	100	% OA												
	Heat Air T-Out	#DIV/0!	F															
	Heating Cap	0	CFM	x	#DIV/0!	F	x	1.08								=	#DIV/0!	Btu/hr

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HVAC Calculations

Project phase: Preliminary	**Project:** Boxford		**Sheet**
Trade Specification Section: 15500	~		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17076		00.00.00

Design Conditions:

Location	Temps.	Summer		Winter	
-	**Indoor**	(°F-Db/°F-Wb) 75	63	70 °F	IMC 2012, IECC 2012
	Outdoor	(°F-Db/°F-Wb) 88	74	9 °F	

I. Outdoor Air Requirement

Area		0	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	0		+		5	x	0					=	0	CFM
	per ACH	2.00	ACH	x	0	ft2	x	12.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	12.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	12.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	12.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	12.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	12.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	12.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	12.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	12.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	5	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	0	Btu/hr
	S	0	ft	x	5	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	0	ft	x	5	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	0	Btu/hr
	NE	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.30	CLF	=	0	Btu/hr
	SE	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.40	CLF	=	0	Btu/hr
	NW	0	ft	x	5	ft	x	172	SHG	x	0.83	SC	x	0.21	CLF	=	0	Btu/hr
	SW	0	ft	x	5	ft	x	161	SHG	x	0.83	SC	x	0.44	CLF	=	0	Btu/hr
Glass		0	ft	x	5.00	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	40.00	CLTD	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		0	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	0	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	0 Btu/hr
	Safety Factor (15%)	=	0 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**0 Btu/hr**
	Airflow (20F delta T)	=	**0 CFM**

III. Heating Load

Walls					0.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass					0.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	0	Btu/hr
Skylight					0.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		0	ft2	x	61	F	x	0.05	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		0	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	0	Btu/hr
Infiltration		0	ft2	x	12.00	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	Heating	=	0 Btu/hr
	Safety Factor (25%)	=	0 Btu/hr
(not treating air)	**MIN HEATING**	=	**0 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	0.00	Btu/lb	@	0.00	F DB	,	0.00	F WB	,	100	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	0	CFM	x	-23.17	BTU/lb	x	4.5								=	0	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	0	ft2/Ton
	Mix Air T-In	9	F	@	100	% OA												
	Heat Air T-Out	#DIV/0!	F															
	Heating Cap	0	CFM	x	#DIV/0!	F	x	1.08								=	#DIV/0!	Btu/hr