Town of Sturbridge
Joshua Hyde Public Library
Sturbridge, MA

2017

HVAC Systems

Prepared For:

Town of Sturbridge
306 Main Street
Sturbridge, MA 01566

Prepared By:

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

July 27, 2017

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

GENERAL

The current HVAC system for the existing 8,300 square foot Town Library consists of two rooftop packaged gas heating/electric cooling units, two through wall heat pump units, roof exhaust fans and local controls.

The building was renovated in 1988 including a new HVAC system including electric heat/cool rooftop units; in 2002 the rooftop units were replace with new gas heating/electric cool rooftop units

EXISTING CONDITIONS

The building is provided with heated, ventilated by two rooftop packaged gas heating/electric cooling units, two through wall heat pump units, roof exhaust fans and

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

AREA	HVAC Unit	Make/Model	CFM	OA CFM	COOLING	HEATING
Basement	(2) PTAC	Gree/ ETAC2-15HC	-	-	14.2 MBH	11.7 MBH (Electric)
Intermediate Level	RTU-2	Carrier/ 48HJE008	3,000*	600*	90 MBH	147.6 MBH (Gas)
1ST Floor	RTU-1	Carrier/ 48HJF017	6,000*	460*	180 MBH	291 MBH (Gas)

*Original design data.

The Basement Level is provided with two packaged through the wall air conditioning units (PTAC) that provide heating and cooling to the adjacent activity spaces. There are also two enclosed storage rooms without any HVAC. The elevator machine room is provided with a inclined transfer duct to the elevator hoistway but no other HVAC provisions.

The entire Intermediate level including the two bathrooms is provided with heating, ventilating and air conditioning by RTU-2 and the roof mounted bathroom exhaust fan. The Intermediate Level occupied space consists of several different areas of different occupancy types and exterior wall exposure types. RTU-2 provides HVAC through a duct distribution system terminating into ceiling/wall air outlets and is controlled by a single wall mounted thermostat. The bathroom exhaust is through ceiling exhaust registers into the building exhaust duct distribution system terminating into the roof mounted exhaust fan. It does not appear that the crawlspace and utility room have been provided with any HVAC provisions as required by applicable codes.

The entire First Level including the two bathrooms is provided with heating, ventilating and air conditioning by RTU-1 and the roof mounted bathroom exhaust fan. The bathroom at the entry is provided with electric baseboard heat. The First Level occupied space consists of several different areas of different occupancy types, a large interior component with skylights, enclosed offices, balcony and exterior wall exposure types. RTU-1 provides HVAC through a duct distribution system terminating into ceiling/wall/floor air outlets and is controlled by a single wall mounted thermostat. The bathroom exhaust is through ceiling exhaust registers into the building exhaust duct distribution system terminating into the roof mounted exhaust fan.

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. Thermostat locations are not optimal increasing heating/cooling related issues.
3. Crawlspace, Storage, Utility and elevator machine room have not been provided with appropriate HVAC provisions.
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 less cooling capacity than required.

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

1. Capacity: The air conditioning capacity for each level is undersized for the areas that they serve; additional air conditioning capacity is required.

2. Zoning: The Intermediate Level and First Level are single, large heating and air conditioning zones that serve several different occupancies and exposures controlled by a single thermostat. Each zone at each level has differing heating and cooling requirements during the day as affected by the outside air temperature, location of the sun and occupancy that can't be adequately addressed by a single thermostat.

3. Thermostat Locations: Thermostat locations are not idea; the thermostats control the heating and air conditioning of the rooftop unit. In this situation, the only space that is truly satisfied is the area that the thermostat is located; all other areas are dependent on that location.

4. Rooftop Units: The issue with gas fired/electric cool rooftop units in this particular application is that they are only capable of providing conditioned supply air when the thermostat calls for either heating or cooling; otherwise, they are providing unconditioned air at the mixed air temperature (return/outdoor air) to each space until the thermostat calls for heating or cooling although spaces outside the thermostat area already do not feel satisfied. In other words, a particular space within the single HVAC zone may already feel cold in the winter and the supply

air from the rooftop unit feels cool or the air they may feel hot in the summer time and the supply air from the rooftop unit feels warm because the thermostat is satisfied.

5. Rooftop Units: The rooftop units are at the end of their anticipated life expectancy and will need to be replaced in the near future.

6. Exhaust/Ventilation: Provisions for exhaust and ventilation should be added to crawlspace, utility room and storage rooms in conformance with applicable codes.

7. Elevator Machine Room: The elevator machine room has strict space temperature limitations; if the machine room has noted high space temperatures, a small split system should be added to adequately maintain the space temperature within the room.

8. 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. Add supplemental cooling to the building through variable refrigerant systems with individual controls to provide additional cooling capacity and zoning to each of the building systems; the interior portion of the system could include either wall or ceiling mounted units interconnected to an exterior heat pump by interconnecting refrigerant piping system with applicable controls to provide heating/cooling to individual zones throughout the building. The rooftop units and through wall units could operate to provide the first level of heating/cooling to the building while the new variable refrigerant system could provide supplemental heating and cooling to the building and offering the additional benefit of adding zoning to the individual heating and cooling zones in the building.
2. Add controls for demand control ventilation and discharge air temperature control.
3. Provide additional exhaust/ventilation systems for crawlspace, utility room and storage rooms.
4. Provide split system air conditioning system for elevator machine room.
5. Balance existing system to calculated airflows for heating and cooling.
6. Commission systems for proper sequence of operation.

The estimated construction costs for Option 1 is **$ 119,226.00**.

Option 2 – Replace Existing System

1. Replace existing rooftop units and bathroom exhaust fan.
2. Add supplemental cooling to the building through variable refrigerant systems with individual controls to provide additional cooling capacity and zoning to each of the building systems; the interior portion of the system could include either wall or ceiling mounted units interconnected

to an exterior heat pump by interconnecting refrigerant piping system with applicable controls to provide heating/cooling to individual zones throughout the building. The rooftop units and through wall units could operate to provide the first level of heating/cooling to the building while the new variable refrigerant system could provide supplemental heating and cooling to the building and offering the additional benefit of adding zoning to the individual heating and cooling zones in the building.

3. Add building management system to remote monitor, adjust and control the entire building HVAC system.
4. Add controls for existing roof intake hoods.
5. Add controls for Lower Level Packaged Through Wall Terminal Units.
6. Add controls for demand control ventilation and discharge air temperature control.
7. Provide additional exhaust/ventilation systems for crawlspace, utility room and storage rooms.
8. Provide split system air conditioning system for elevator machine room.
9. Balance existing system to calculated airflows for heating and cooling.
10. Commission systems for proper sequence of operation.

The estimated construction costs for Option 1 is **$ 298,056.00**.

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
Hyde Public Library
Sturbridge, MA
Project Number: 17123.00

Sheet 1 of 1
Date 07.28.17

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							
Exhaust/Ventilation Systems	1	EA	750	750	500	500	1,250
Elevator Machine Room HVAC	1	EA	2,500	2,500	2,500	2,500	5,000
Variable Refrigerant System	8	Tons	2,000	16,000	2,500	20,000	36,000
Automatic Temperature Controls							
Central System	1	LS	5,000	5,000	12,500	12,500	17,500
Demand Control Ventilation	2	EA	1,000	2,000	3,000	6,000	8,000
Discharge Temperature Controls	2	EA	500	1,000	1,500	3,000	4,000
Commissioning	1	LS			2,500	2,500	2,500
Balancing	1	LS			2,500	2,500	2,500
26 00 00 - ELECTRICAL							
Power Wiring	1	LS	1,500	1,500	3,500	3,500	5,000
Subtotal				$ 28,750		$ 53,000	$ 94,250
15% Overhead & Profit							$ 14,138
Subtotal							$ 108,388
10% Contingency							$ 10,839
TOTAL							**$ 119,226**

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 2
Hyde Public Library
Sturbridge, MA
Project Number: 17123.00

Sheet 1 of 1
Date 07.28.17

Description	Qty	Units	Material Unit Cost	Material Total	Labor Unit Cost	Labor Total	Total
Option 2 - Replace Existing System							
00 10 00 - General Conditions							
General Conditions							30,000
23 00 00 - HVAC							
Demolition	1	LS			5,000	5,000	5,000
Rooftop Units	22.5	Tons	1,750	39,375	1,750	39,375	78,750
Replace Bathroom Exhaust Fan	1	EA	1,500	1,500	750	750	2,250
Exhaust/Ventilation Systems	1	EA	750	750	500	500	1,250
Elevator Machine Room HVAC	1	EA	2,500	2,500	2,500	2,500	5,000
Variable Refrigerant System	8	Tons	2,000	16,000	2,500	20,000	36,000
Automatic Temperature Controls							
Energy Managementl System	1	LS	7,500	7,500	17,500	17,500	25,000
Rooftop Unit Controls	2	EA	2,500	5,000	7,500	15,000	20,000
Micellaneous Controls (Fans, Dampers, etc.)	1	LS	4,000	4,000	8,000	8,000	12,000
Commissioning	1	LS			4,000	4,000	4,000
Balancing	1	LS			5,000	5,000	5,000
26 00 00 - ELECTRICAL							
Power Wiring	1	LS	3,000	3,000	9,000	9,000	12,000
Subtotal				$ 79,625		$ 126,625	$ 236,250
15% Overhead & Profit							$ 35,438
Subtotal							$ 271,688
10% Contingency							$ 27,169
					TOTAL		**$ 298,856**

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:**	**Sturbridge Public Library**
Trade Specification Section:	15500		
By:	**Checked By:**	**Project No.:**	**17123**

Date 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. Envelope Assumptions

Component	Value	
wall ht	11.25	ft
window ht	6.50	ft
ceiling ht	8.00	ft
lighting	2.00	W/ft2
activity lvl	255.00	BTU/hr
window shading	0.83	SC

Component	R-value	U-value	
wall	12.00	0.08	BTU/hr ft2 F
window	1.82	0.55	BTU/hr ft2 F
skylight	2.50	0.40	BTU/hr ft2 F
roof	18.00	0.06	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 OA

w/o treating OA

	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	b - maintenance/storage	12	1,519	2,434	70	-	2,717	3,688	70	124	-	30	611	1	80	66	56	55	59	108	4.53
2	b - activity space #1	54	10,219	15,417	473	-	6,210	10,816	473	320	-	34	249	3	79	66	56	55	63	84	10.3
3	b - activity space #2	94	9,792	16,128	453	-	10,648	17,787	453	550	-	32	409	6	80	67	56	55	57	94	17.7
4	b - storage	6	772	1,226	36	-	1,381	1,853	36	100	-	19	979	0	80	66	56	55	60	108	2.3
5	b - elevator mach. Rm.	4	839	1,252	39	-	940	1,289	39	67	-	19	642	0	79	66	56	55	64	94	1.57
6	b - stair #2	8	1,777	2,622	82	-	4,762	5,441	82	127	-	43	581	0	79	65	56	55	64	126	7.94
7	1 - atrium & wings	314	41,023	65,012	1,899	-	30,030	54,829	1,899	1,848	-	30	341	18	80	66	56	55	60	87	50
8	1 - utility room	19	2,425	3,842	112	-	0	1,464	112	309	-	5	965	0	80	66	56	55	60	72	0
9	1 - stair #1	9	708	1,225	33	-	2,747	3,380	33	142	-	24	1391	0	81	67	56	55	54	150	4.58
10	1 - janitor	1	278	412	13	-	382	493	13	21	-	23	612	0	79	66	56	55	64	100	0.64
11	1 - women's rm	18	1,461	2,542	68	-	1,523	2,858	68	134	-	21	633	2	81	67	56	55	54	93	2.54
12	1 - men's rm	18	1,440	2,514	67	-	1,463	2,796	67	134	-	21	640	2	81	67	56	55	53	92	2.44
13	1 - stair #2	7	3,649	5,117	169	-	4,301	5,152	169	123	-	42	288	0	78	65	56	55	67	96	7.17
14	2 - west	228	38,255	58,509	1,771	-	35,521	54,377	1,771	1,342	-	41	275	13	79	66	56	55	62	91	59.2
15	2 - east	325	49,505	76,698	2,292	-	59,386	85,772	2,292	1,914	-	45	299	19	79	66	56	55	61	96	99
16	2 - stair #2	7	4,876	6,759	226	-	6,548	7,522	226	123	-	61	218	0	78	65	56	55	68	99	10.9
17	2 - office #1	11	2,506	3,715	116	-	2,926	3,921	116	133	-	29	430	1	79	66	56	55	64	95	4.88
18	2 - office #2	14	4,335	6,243	201	-	3,349	4,695	201	163	-	29	313	1	79	65	56	55	66	87	5.58
19	2 - office #3	11	3,869	5,519	179	-	2,798	3,891	179	126	-	31	274	1	79	65	56	55	66	86	4.66
20	2 - office #4	11	3,973	5,679	184	-	2,922	4,070	184	134	-	30	283	1	79	65	56	55	66	87	4.87
21	3 - balcony	54	15,869	22,970	735	-	13,647	18,818	735	320	-	59	167	3	79	65	56	55	65	89	22.7
22	3 - storage	8	2,231	3,248	103	-	3,639	4,403	103	137	-	32	506	0	79	65	56	55	65	105	6.06
	Total	**1,235**	**201,321**	**309,083**	**9,320**	**-**	**197,840**	**299,314**	**9,320**	**8,391**	**-**	**36**	**326**	**36**	**-**	**-**	**-**	**-**	**-**	**-**	**330**

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:**	**Sturbridge Public Libra**	**Sheet**
Trade Specification Section:	15500		b - maintenance/storage	1 of 1
				Date
By:	**Checked By:**	**Project No.:**	**17123**	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		124	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	124		+		5	x	1					=	12.44	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	12	ft	x	11.25	ft	x	23	CLTD	x	0.06	Btu/hr ft2 F				=	179	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.06	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.06	Btu/hr ft2 F				=	0	Btu/hr
	W	14	ft	x	11.25	ft	x	41	CLTD	x	0.06	Btu/hr ft2 F				=	374	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.06	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.06	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.06	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	ft	x	26	CLTD	x	0.06	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	0	ft	x	4	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	6.50	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	0.06	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		124	ft2	x	0.90	W/ft2	x	3.412	Btuh/Watt							=	381	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	255	Btu/hr
Infiltration		124	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	133	Btu/hr
												RSH				=	1,321	Btu/hr
												Safety Factor (15%)				=	198	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**1,519**	**Btu/hr**
												Airflow (20F delta T)				=	**70**	**CFM**

III. Heating Load

Walls					281.25	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,430	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	0.06	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		20	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	119	Btu/hr
Infiltration		124	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	625	Btu/hr
												Heating				=	2,174	Btu/hr
												Safety Factor (25%)				=	543	Btu/hr
									(not treating air)			**MIN HEATING**				=	**2,717**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.87	Btu/lb	@	79.77	F DB	,	66.26	F WB	,	18	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	70	CFM	x	7.69	BTU/lb	x	4.5								=	2,434	Btu/hr
												Tons A/C				=	0.2	Tons
												H2O (10F delta T)				=	0	GPM
																=	611	ft2/Ton
	Mix Air T-In	59	F	@	18	% OA												
	Heat Air T-Out	108	F															
	Heating Cap	70	CFM	x	49	F	x	1.08								=	3,688	Btu/hr
												H2O (20F delta T)				=	0	GPM
																=	30	Btuh/ft2

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:**	**Sturbridge Public Libra** b - activity space #1
Trade Specification Section:	15500		
By:	**Checked By:**	**Project No.:**	**17123**

Sheet 1 of 1 **Date** 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		320	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.12		x	320		+		5	x	3					=	54.4	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	15	ft	x	11.25	ft	x	23	CLTD	x	0.33	Btu/hr ft2 F				=	1,281	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	18	ft	x	11.25	ft	x	31	CLTD	x	0.33	Btu/hr ft2 F				=	1,549	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	7	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	3,018	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		7	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	350	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	0.06	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		320	ft2	x	1.40	W/ft2	x	3.412	Btuh/Watt							=	1,529	Btu/hr
People		3	People	x	255	Btu/hr	x	1	Diversity							=	816	Btu/hr
Infiltration		320	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	344	Btu/hr
												RSH				=	8,886	Btu/hr
												Safety Factor (15%)				=	1,333	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**10,219**	**Btu/hr**
												Airflow (20F delta T)				=	**473**	**CFM**

III. Heating Load

Walls					320.13	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,627	Btu/hr
Glass					45.50	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	1,527	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	0.06	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		33	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	201	Btu/hr
Infiltration		320	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,613	Btu/hr
												Heating				=	4,968	Btu/hr
												Safety Factor (25%)				=	1,242	Btu/hr
									(not treating air)			**MIN HEATING**				=	**6,210**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.42	Btu/lb	@	79.15	F DB	,	65.68	F WB	,	11	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	473	CFM	x	7.24	BTU/lb	x	4.5								=	15,417	Btu/hr
												Tons A/C				=	1.3	Tons
												H2O (10F delta T)				=	3	GPM
																=	249	ft2/Ton
	Mix Air T-In	63	F	@	11	% OA												
	Heat Air T-Out	84	F															
	Heating Cap	473	CFM	x	21	F	x	1.08								=	10,816	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:**	**Sturbridge Public Libra** b - activity space #2
Trade Specification Section:	15500		
By:	**Checked By:**	**Project No.:**	**17123**

Sheet 1 of 1 **Date** 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		550	ft2																
	Method	Ra			A				Rp			P							
Ventilation	per Person	0.12		x	550		+		5	x	6					=	93.5	CFM	
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM	

II. Sensible Cooling Load

Walls	N	0	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	27	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	1,143	Btu/hr
	E	17	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	445	Btu/hr
	W	23	ft	x	11.25	ft	x	41	CLTD	x	0.06	Btu/hr ft2 F				=	623	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	4	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	1,509	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	0.06	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		550	ft2	x	1.40	W/ft2	x	3.412	Btuh/Watt							=	2,627	Btu/hr
People		6	People	x	255	Btu/hr	x	1	Diversity							=	1,403	Btu/hr
Infiltration		550	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	591	Btu/hr
												RSH				=	8,515	Btu/hr
												Safety Factor (15%)				=	1,277	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**9,792**	**Btu/hr**
												Airflow (20F delta T)				=	**453**	**CFM**

III. Heating Load

Walls					723.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	3,678	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	0.06	Btu/hr ft2 F							=	0	Btu/hr
Floor		0	ft2	x	61	F	x	0.03	Btu/hr ft2 F								0	Btu/hr
Slab		46	ft	x	61	F	x	0.10	Btu/hr ft2 F							=	281	Btu/hr
Infiltration		550	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	2,772	Btu/hr
												Heating				=	8,518	Btu/hr
												Safety Factor (25%)				=	2,130	Btu/hr
									(not treating air)			**MIN HEATING**				=	**10,648**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.08	Btu/lb	@	80.06	F DB	,	66.54	F WB	,	21	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	453	CFM	x	7.91	BTU/lb	x	4.5								=	16,128	Btu/hr
												Tons A/C				=	1.3	Tons
												H2O (10F delta T)				=	3	GPM
																=	409	ft2/Ton
	Mix Air T-In	57	F	@	21	% OA												
	Heat Air T-Out	94	F															
	Heating Cap	453	CFM	x	36	F	x	1.08								=	17,787	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:**	**Sturbridge Public Libra** b - storage
Trade Specification Section:	15500		
By:	**Checked By:**	**Project No.:**	**17123**

Sheet 1 of 1 **Date** 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		100	ft2																
	Method	Ra			A				Rp			P							
Ventilation	per Person	0.06		x	100		+		5	x	0						=	6	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr					=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	11	ft	x	11.25	ft	x	41	CLTD	x	0.06	Btu/hr ft2 F				=	291	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	6.50	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	0.06	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		100	ft2	x	0.80	W/ft2	x	3.412	Btuh/Watt							=	273	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		100	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	107	Btu/hr

	RSH	=	671	Btu/hr
	Safety Factor (15%)	=	101	Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**772**	**Btu/hr**
	Airflow (20F delta T)	=	**36**	**CFM**

III. Heating Load

Walls					118.13	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	600	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	0.06	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		100	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	504	Btu/hr

	Heating	=	1,104	Btu/hr
	Safety Factor (25%)	=	276	Btu/hr
(not treating air)	**MIN HEATING**	=	**1,381**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.80	Btu/lb	@	79.68	F DB	,	66.18	F WB	,	17	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	36	CFM	x	7.63	BTU/lb	x	4.5								=	1,226	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	979	ft2/Ton
	Mix Air T-In	60	F	@	17	% OA												
	Heat Air T-Out	108	F															
	Heating Cap	36	CFM	x	48	F	x	1.08								=	1,853	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:**	**Sturbridge Public Libra** b - elevator mach. Rm.
Trade Specification Section:	15500		
By:	**Checked By:**	**Project No.:**	**17123**

Sheet 1 of 1 **Date** 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		67	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	67		+		5	x	0					=	4.02	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	7	ft	x	11.25	ft	x	41	CLTD	x	0.06	Btu/hr ft2 F				=	201	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	6.50	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	0.06	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		67	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	457	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		67	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	72	Btu/hr

	RSH	=	730 Btu/hr
	Safety Factor (15%)	=	109 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**839 Btu/hr**
	Airflow (20F delta T)	=	**39 CFM**

III. Heating Load

Walls					81.56	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	415	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	0.06	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		67	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	338	Btu/hr

	Heating	=	752 Btu/hr
	Safety Factor (25%)	=	188 Btu/hr
(not treating air)	**MIN HEATING**	=	**940 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.33	Btu/lb	@	79.03	F DB	,	65.57	F WB	,	10	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	39	CFM	x	7.16	BTU/lb	x	4.5								=	1,252	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	642	ft2/Ton
	Mix Air T-In	64	F	@	10	% OA												
	Heat Air T-Out	94	F															
	Heating Cap	39	CFM	x	31	F	x	1.08								=	1,289	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:** **Sturbridge Public Libra**		**Sheet**
Trade Specification Section: 15500	b - stair #2		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17123**		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	0					=	7.62	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	9	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	194	Btu/hr
	S	9	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	388	Btu/hr
	E	20	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	567	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	6.50	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	0.06	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		127	ft2	x	0.60	W/ft2	x	3.412	Btuh/Watt							=	260	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		127	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	136	Btu/hr

	RSH	=	1,545 Btu/hr
	Safety Factor (15%)	=	232 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**1,777** **Btu/hr**
	Airflow (20F delta T)	=	**82** **CFM**

III. Heating Load

Walls					421.88	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	2,145	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	0.06	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		127	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	640	Btu/hr

	Heating	=	3,809 Btu/hr
	Safety Factor (25%)	=	952 Btu/hr
(not treating air)	**MIN HEATING**	=	**4,762** **Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.26	Btu/lb	@	78.93	F DB	,	65.47	F WB	,	9	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	82	CFM	x	7.08	BTU/lb	x	4.5								=	2,622	Btu/hr
												Tons A/C				=	0.2	Tons
												H2O (10F delta T)				=	1	GPM
																=	581	ft2/Ton
	Mix Air T-In	64	F	@	9	% OA												
	Heat Air T-Out	126	F															
	Heating Cap	82	CFM	x	61	F	x	1.08								=	5,441	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:**	**Sturbridge Public Libra** 1 - atrium & wings
Trade Specification Section:	15500		
By:	**Checked By:**	**Project No.:**	**17123**

Sheet 1 of 1 **Date** 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		1,848	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.12		x	1,848		+		5	x	18					=	314.16	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	27	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	441	Btu/hr
	S	46	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	1,733	Btu/hr
	E	34	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	736	Btu/hr
	W	34	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	1,307	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	11	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	2,175	Btu/hr
	S	11	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	5,486	Btu/hr
	E	15	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	6,468	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		36	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	1,802	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	0.06	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		1,848	ft2	x	1.40	W/ft2	x	3.412	Btuh/Watt							=	8,828	Btu/hr
People		18	People	x	255	Btu/hr	x	1	Diversity							=	4,712	Btu/hr
Infiltration		1,848	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,985	Btu/hr

	RSH	=	35,672 Btu/hr
	Safety Factor (15%)	=	5,351 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**41,023 Btu/hr**
	Airflow (20F delta T)	=	**1,899 CFM**

III. Heating Load

Walls					1349.44	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	6,860	Btu/hr
Glass					234.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	7,851	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	0.06	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		1,848	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	9,314	Btu/hr

	Heating	=	24,024 Btu/hr
	Safety Factor (25%)	=	6,006 Btu/hr
(not treating air)	**MIN HEATING**	=	**30,030 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	1,899	CFM	x	7.61	BTU/lb	x	4.5								=	65,012	Btu/hr
												Tons A/C				=	5.4	Tons
												H2O (10F delta T)				=	13	GPM
																=	341	ft2/Ton
	Mix Air T-In	60	F	@	17	% OA												
	Heat Air T-Out	87	F															
	Heating Cap	1,899	CFM	x	27	F	x	1.08								=	54,829	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:** Sturbridge Public Libra		**Sheet**
Trade Specification Section: 15500	1 - utility room		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17123		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	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	6.50	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	0.06	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		309	ft2	x	2.00	W/ft2	x	3.412	Btuh/Watt							=	2,109	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		0	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	0	Btu/hr

	RSH	=	2,109 Btu/hr
	Safety Factor (15%)	=	316 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**2,425 Btu/hr**
	Airflow (20F delta T)	=	**112 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	0.06	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	11.25	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	112	CFM	x	7.60	BTU/lb	x	4.5								=	3,842	Btu/hr
												Tons A/C				=	0.3	Tons
												H2O (10F delta T)				=	1	GPM
																=	965	ft2/Ton
	Mix Air T-In	60	F	@	17	% OA												
	Heat Air T-Out	72	F															
	Heating Cap	112	CFM	x	12	F	x	1.08								=	1,464	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:** **Sturbridge Public Libra**		**Sheet**
Trade Specification Section: 15500	1 - stair #1		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17123**		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		142	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	142		+		5	x	0					=	8.52	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	8	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	173	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	6.50	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	0.06	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		142	ft2	x	0.60	W/ft2	x	3.412	Btuh/Watt							=	291	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		142	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	153	Btu/hr

RSH	=	616	Btu/hr
Safety Factor (15%)	=	92	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**708**	**Btu/hr**
Airflow (20F delta T)	=	**33**	**CFM**

III. Heating Load

Walls					90.00	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	458	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	0.06	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		142	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	716	Btu/hr

Heating	=	2,198	Btu/hr
Safety Factor (25%)	=	549	Btu/hr
(not treating air) **MIN HEATING**	=	**2,747**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.48	Btu/lb	@	80.60	F DB	,	67.04	F WB	,	26	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	33	CFM	x	8.30	BTU/lb	x	4.5								=	1,225	Btu/hr
												Tons A/C				=	0.1	Tons
												H2O (10F delta T)				=	0	GPM
																=	1391	ft2/Ton
	Mix Air T-In	54	F	@	26	% OA												
	Heat Air T-Out	150	F															
	Heating Cap	33	CFM	x	95	F	x	1.08								=	3,380	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:**	**Sturbridge Public Libra**	**Sheet**
Trade Specification Section:	15500		1 - janitor	1 of 1
				Date
By:	**Checked By:**	**Project No.:**	**17123**	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	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	4	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	75	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	6.50	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	0.06	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	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	23	Btu/hr
												RSH				=	241	Btu/hr
												Safety Factor (15%)				=	36	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**278**	**Btu/hr**
												Airflow (20F delta T)				=	**13**	**CFM**

III. Heating Load

Walls					39.38	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	200	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	0.06	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	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	106	Btu/hr
												Heating				=	306	Btu/hr
												Safety Factor (25%)				=	76	Btu/hr
									(not treating air)			**MIN HEATING**				=	**382**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.29	Btu/lb	@	78.98	F DB	,	65.52	F WB	,	10	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	13	CFM	x	7.12	BTU/lb	x	4.5								=	412	Btu/hr
												Tons A/C				=	0.0	Tons
												H2O (10F delta T)				=	0	GPM
																=	612	ft2/Ton
	Mix Air T-In	64	F	@	10	% OA												
	Heat Air T-Out	100	F															
	Heating Cap	13	CFM	x	36	F	x	1.08								=	493	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:**	**Sturbridge Public Libra**	**Sheet**
Trade Specification Section:	15500		1 - women's rm	1 of 1
				Date
By:	**Checked By:**	**Project No.:**	**17123**	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		134	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	134		+		5	x	2					=	18.04	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	10	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	205	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	6.50	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	0.06	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		134	ft2	x	0.90	W/ft2	x	3.412	Btuh/Watt							=	411	Btu/hr
People		2	People	x	255	Btu/hr	x	1	Diversity							=	510	Btu/hr
Infiltration		134	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	144	Btu/hr

	RSH	=	1,270 Btu/hr
	Safety Factor (15%)	=	191 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**1,461 Btu/hr**
	Airflow (20F delta T)	=	**68 CFM**

III. Heating Load

Walls					106.88	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	543	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	0.06	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		134	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	675	Btu/hr

	Heating	=	1,219 Btu/hr
	Safety Factor (25%)	=	305 Btu/hr
(not treating air)	**MIN HEATING**	=	**1,523 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.53	Btu/lb	@	80.67	F DB	,	67.11	F WB	,	27	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	68	CFM	x	8.35	BTU/lb	x	4.5								=	2,542	Btu/hr
												Tons A/C				=	0.2	Tons
												H2O (10F delta T)				=	1	GPM
																=	633	ft2/Ton
	Mix Air T-In	54	F	@	27	% OA												
	Heat Air T-Out	93	F															
	Heating Cap	68	CFM	x	39	F	x	1.08								=	2,858	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:**	**Sturbridge Public Libra**	**Sheet**
Trade Specification Section:	15500		1 - men's rm	1 of 1
				Date
By:	**Checked By:**	**Project No.:**	**17123**	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		134	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	134		+		5	x	2					=	18.04	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	9	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	187	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	6.50	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	0.06	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		134	ft2	x	0.90	W/ft2	x	3.412	Btuh/Watt							=	411	Btu/hr
People		2	People	x	255	Btu/hr	x	1	Diversity							=	510	Btu/hr
Infiltration		134	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	144	Btu/hr

RSH	=	1,252	Btu/hr
Safety Factor (15%)	=	188	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**1,440**	**Btu/hr**
Airflow (20F delta T)	=	**67**	**CFM**

III. Heating Load

Walls					97.43	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	495	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	0.06	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		134	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	675	Btu/hr

Heating	=	1,171	Btu/hr
Safety Factor (25%)	=	293	Btu/hr
(not treating air) **MIN HEATING**	=	**1,463**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	31.56	Btu/lb	@	80.71	F DB	,	67.14	F WB	,	27	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	67	CFM	x	8.38	BTU/lb	x	4.5								=	2,514	Btu/hr
												Tons A/C				=	0.2	Tons
												H2O (10F delta T)				=	1	GPM
																=	640	ft2/Ton
	Mix Air T-In	53	F	@	27	% OA												
	Heat Air T-Out	92	F															
	Heating Cap	67	CFM	x	39	F	x	1.08								=	2,796	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:**	**Sturbridge Public Libra** 1 - stair #2
Trade Specification Section:	15500		
By:	**Checked By:**	**Project No.:**	**17123**

Sheet 1 of 1 **Date** 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		123	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	123		+		5	x	0					=	7.38	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	9	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	194	Btu/hr
	S	9	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	388	Btu/hr
	E	20	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	522	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	4	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	1,509	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	0.06	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		123	ft2	x	0.60	W/ft2	x	3.412	Btuh/Watt							=	252	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		123	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	132	Btu/hr

	RSH	=	3,173 Btu/hr
	Safety Factor (15%)	=	476 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**3,649 Btu/hr**
	Airflow (20F delta T)	=	**169 CFM**

III. Heating Load

Walls					404.75	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	2,057	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		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	0.06	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		123	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	620	Btu/hr

	Heating	=	3,441 Btu/hr
	Safety Factor (25%)	=	860 Btu/hr
(not treating air)	**MIN HEATING**	=	**4,301 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	29.91	Btu/lb	@	78.44	F DB	,	65.01	F WB	,	4	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	169	CFM	x	6.73	BTU/lb	x	4.5								=	5,117	Btu/hr
												Tons A/C				=	0.4	Tons
												H2O (10F delta T)				=	1	GPM
																=	288	ft2/Ton
	Mix Air T-In	67	F	@	4	% OA												
	Heat Air T-Out	96	F															
	Heating Cap	169	CFM	x	28	F	x	1.08								=	5,152	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:**	**Sturbridge Public Libra** 2 - west	**Sheet** 1 of 1
Trade Specification Section:	15500			**Date**
By:	**Checked By:**	**Project No.:**	**17123**	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		1,342	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.12		x	1,342		+		5	x	13					=	228.14	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	34	ft	x	16.50	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	916	Btu/hr
	S	34	ft	x	16.50	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	1,857	Btu/hr
	E	5	ft	x	16.50	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	192	Btu/hr
	W	42	ft	x	16.50	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	2,029	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	7	ft	x	16.50	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	189	Btu/hr
	SW	7	ft	x	16.50	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	259	Btu/hr
Glass	N	12	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	2,382	Btu/hr
	S	11	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	5,486	Btu/hr
	E	0	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	0	Btu/hr
	W	14	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	4,731	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		36	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	1,802	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		966	ft2	x	40.00	CLTD	x	0.06	Btu/hr ft2 F							=	2,147	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		1,342	ft2	x	1.40	W/ft2	x	3.412	Btuh/Watt							=	6,410	Btu/hr
People		13	People	x	255	Btu/hr	x	1	Diversity							=	3,422	Btu/hr
Infiltration		1,342	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,441	Btu/hr

	RSH	=	33,265 Btu/hr
	Safety Factor (15%)	=	4,990 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**38,255 Btu/hr**
	Airflow (20F delta T)	=	**1,771 CFM**

III. Heating Load

Walls					1869.75	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	9,505	Btu/hr
Glass					234.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	7,851	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		966	ft2	x	61	F	x	0.06	Btu/hr ft2 F							=	3,274	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		1,342	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	6,763	Btu/hr

	Heating	=	28,417 Btu/hr
	Safety Factor (25%)	=	7,104 Btu/hr
(not treating air)	**MIN HEATING**	=	**35,521 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	1,771	CFM	x	7.34	BTU/lb	x	4.5								=	58,509	Btu/hr
												Tons A/C				=	4.9	Tons
												H2O (10F delta T)				=	12	GPM
																=	275	ft2/Ton
	Mix Air T-In	62	F	@	13	% OA												
	Heat Air T-Out	91	F															
	Heating Cap	1,771	CFM	x	28	F	x	1.08								=	54,377	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:**	**Sturbridge Public Libra** 2 - east
Trade Specification Section:	15500		
By:	**Checked By:**	**Project No.:**	**17123**

Sheet 1 of 1

Date 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		1,914	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.12		x	1,914		+		5	x	19					=	325.38	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	46	ft	x	16.50	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	1,245	Btu/hr
	S	26	ft	x	16.50	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	1,383	Btu/hr
	E	34	ft	x	16.50	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	1,228	Btu/hr
	W	5	ft	x	16.50	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	254	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	18	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	3,625	Btu/hr
	S	11	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	5,486	Btu/hr
	E	14	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	6,036	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		42	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	2,102	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		2,818	ft2	x	40.00	CLTD	x	0.06	Btu/hr ft2 F							=	6,262	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		1,914	ft2	x	1.30	W/ft2	x	3.412	Btuh/Watt							=	8,490	Btu/hr
People		19	People	x	255	Btu/hr	x	1	Diversity							=	4,881	Btu/hr
Infiltration		1,914	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	2,056	Btu/hr
												RSH				=	43,048	Btu/hr
												Safety Factor (15%)				=	6,457	Btu/hr
												Sensible(w/o treating air) **ERSH**				=	**49,505**	**Btu/hr**
												Airflow (20F delta T)				=	**2,292**	**CFM**

III. Heating Load

Walls					1559.87	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	7,929	Btu/hr
Glass					273.00	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	9,159	Btu/hr
Skylight					460.00	ft2	x	61	F	x	0.40	Btu/hr ft2 F				=	11,224	Btu/hr
Door		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		2,818	ft2	x	61	F	x	0.06	Btu/hr ft2 F							=	9,550	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		1,914	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	9,646	Btu/hr
												Heating				=	47,509	Btu/hr
												Safety Factor (25%)				=	11,877	Btu/hr
												(not treating air) **MIN HEATING**				=	**59,386**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.61	Btu/lb	@	79.42	F DB	,	65.93	F WB	,	14	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	2,292	CFM	x	7.44	BTU/lb	x	4.5								=	76,698	Btu/hr
												Tons A/C				=	6.4	Tons
												H2O (10F delta T)				=	15	GPM
																=	299	ft2/Ton
	Mix Air T-In	61	F	@	14	% OA												
	Heat Air T-Out	96	F															
	Heating Cap	2,292	CFM	x	35	F	x	1.08								=	85,772	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:** Sturbridge Public Libra		**Sheet**
Trade Specification Section: 15500	2 - stair #2		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17123		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		123	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	123		+		5	x	0					=	7.38	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	9	ft	x	16.50	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	277	Btu/hr
	S	9	ft	x	16.50	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	553	Btu/hr
	E	20	ft	x	16.50	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	772	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	4	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	1,509	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		256	ft2	x	40.00	CLTD	x	0.06	Btu/hr ft2 F							=	569	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		123	ft2	x	0.60	W/ft2	x	3.412	Btuh/Watt							=	252	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		123	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	132	Btu/hr
												RSH				=	4,240	Btu/hr
												Safety Factor (15%)				=	636	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**4,876**	**Btu/hr**
												Airflow (20F delta T)				=	**226**	**CFM**

III. Heating Load

Walls					587.75	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	2,988	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		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		256	ft2	x	61	F	x	0.06	Btu/hr ft2 F							=	868	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		123	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	620	Btu/hr
												Heating				=	5,238	Btu/hr
												Safety Factor (25%)				=	1,310	Btu/hr
									(not treating air)			**MIN HEATING**				=	**6,548**	**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	226	CFM	x	6.65	BTU/lb	x	4.5								=	6,759	Btu/hr
												Tons A/C				=	0.6	Tons
												H2O (10F delta T)				=	1	GPM
																=	218	ft2/Ton
	Mix Air T-In	68	F	@	3	% OA												
	Heat Air T-Out	99	F															
	Heating Cap	226	CFM	x	31	F	x	1.08								=	7,522	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:** Sturbridge Public Libra		**Sheet**
Trade Specification Section: 15500	2 - office #1		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17123		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		133	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	133		+		5	x	1					=	11.305	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	10	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	172	Btu/hr
	S	0	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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		133	ft2	x	40.00	CLTD	x	0.06	Btu/hr ft2 F							=	296	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		133	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	499	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	170	Btu/hr
Infiltration		133	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	143	Btu/hr
												RSH				=	2,179	Btu/hr
												Safety Factor (15%)				=	327	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**2,506**	**Btu/hr**
												Airflow (20F delta T)				=	**116**	**CFM**

III. Heating Load

Walls					89.75	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	456	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		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		133	ft2	x	61	F	x	0.06	Btu/hr ft2 F							=	451	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		133	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	670	Btu/hr
												Heating				=	2,341	Btu/hr
												Safety Factor (25%)				=	585	Btu/hr
									(not treating air)			**MIN HEATING**				=	**2,926**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.29	Btu/lb	@	78.97	F DB	,	65.52	F WB	,	10	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	116	CFM	x	7.12	BTU/lb	x	4.5								=	3,715	Btu/hr
												Tons A/C				=	0.3	Tons
												H2O (10F delta T)				=	1	GPM
																=	430	ft2/Ton
	Mix Air T-In	64	F	@	10	% OA												
	Heat Air T-Out	95	F															
	Heating Cap	116	CFM	x	31	F	x	1.08								=	3,921	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:**	**Sturbridge Public Libra** 2 - office #2
Trade Specification Section:	15500		
By:	**Checked By:**	**Project No.:**	**17123**

Sheet 1 of 1

Date 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		163	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	163		+		5	x	1					=	13.855	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	12	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	409	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	4	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	1,829	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		163	ft2	x	40.00	CLTD	x	0.06	Btu/hr ft2 F							=	362	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		163	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	612	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	208	Btu/hr
Infiltration		163	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	175	Btu/hr

	RSH	=	3,770 Btu/hr
	Safety Factor (15%)	=	565 Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**4,335 Btu/hr**
	Airflow (20F delta T)	=	**201 CFM**

III. Heating Load

Walls					106.63	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	542	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		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		163	ft2	x	61	F	x	0.06	Btu/hr ft2 F							=	552	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		163	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	821	Btu/hr

	Heating	=	2,679 Btu/hr
	Safety Factor (25%)	=	670 Btu/hr
(not treating air)	**MIN HEATING**	=	**3,349 Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.09	Btu/lb	@	78.69	F DB	,	65.25	F WB	,	7	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	201	CFM	x	6.91	BTU/lb	x	4.5								=	6,243	Btu/hr
												Tons A/C				=	0.5	Tons
												H2O (10F delta T)				=	1	GPM
																=	313	ft2/Ton
	Mix Air T-In	66	F	@	7	% OA												
	Heat Air T-Out	87	F															
	Heating Cap	201	CFM	x	22	F	x	1.08								=	4,695	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:** Sturbridge Public Libra		**Sheet**
Trade Specification Section: 15500	2 - office #3		1 of 1
			Date
By: **Checked By:**	**Project No.:** 17123		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		126	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	126		+		5	x	1					=	10.71	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	9	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	312	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	4	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	1,829	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		126	ft2	x	40.00	CLTD	x	0.06	Btu/hr ft2 F							=	280	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		126	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	473	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	161	Btu/hr
Infiltration		126	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	135	Btu/hr

RSH	=	3,365	Btu/hr
Safety Factor (15%)	=	505	Btu/hr
Sensible(w/o treating air) **ERSH**	=	**3,869**	**Btu/hr**
Airflow (20F delta T)	=	**179**	**CFM**

III. Heating Load

Walls					81.31	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	413	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		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		126	ft2	x	61	F	x	0.06	Btu/hr ft2 F							=	427	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		126	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	635	Btu/hr

Heating	=	2,239	Btu/hr
Safety Factor (25%)	=	560	Btu/hr
(not treating air) **MIN HEATING**	=	**2,798**	**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	179	CFM	x	6.85	BTU/lb	x	4.5								=	5,519	Btu/hr
												Tons A/C				=	0.5	Tons
												H2O (10F delta T)				=	1	GPM
																=	274	ft2/Ton
	Mix Air T-In	66	F	@	6	% OA												
	Heat Air T-Out	86	F															
	Heating Cap	179	CFM	x	20	F	x	1.08								=	3,891	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:**	**Sturbridge Public Libra**
Trade Specification Section:	15500		2 - office #4
By:	**Checked By:**	**Project No.:**	**17123**

Sheet 1 of 1 **Date** 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		134	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.06		x	134		+		5	x	1					=	11.39	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	0	ft	x	11.25	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	S	10	ft	x	11.25	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	335	Btu/hr
	E	0	ft	x	11.25	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	0	ft	x	11.25	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NE	0	ft	x	11.25	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	11.25	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	11.25	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	11.25	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	4	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	1,829	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		134	ft2	x	40.00	CLTD	x	0.06	Btu/hr ft2 F							=	298	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		134	ft2	x	1.10	W/ft2	x	3.412	Btuh/Watt							=	503	Btu/hr
People		1	People	x	255	Btu/hr	x	1	Diversity							=	171	Btu/hr
Infiltration		134	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	144	Btu/hr
												RSH				=	3,455	Btu/hr
												Safety Factor (15%)				=	518	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**3,973**	**Btu/hr**
												Airflow (20F delta T)				=	**184**	**CFM**

III. Heating Load

Walls					87.50	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	445	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		0	ft	x	7.00	ft	x	61	F	x	0.80	Btu/hr ft2 F				=	0	Btu/hr
Roof		134	ft2	x	61	F	x	0.06	Btu/hr ft2 F							=	454	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		134	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	675	Btu/hr
												Heating				=	2,338	Btu/hr
												Safety Factor (25%)				=	584	Btu/hr
									(not treating air)			**MIN HEATING**				=	**2,922**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.04	Btu/lb	@	78.62	F DB	,	65.18	F WB	,	6	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	184	CFM	x	6.86	BTU/lb	x	4.5								=	5,679	Btu/hr
												Tons A/C				=	0.5	Tons
												H2O (10F delta T)				=	1	GPM
																=	283	ft2/Ton
	Mix Air T-In	66	F	@	6	% OA												
	Heat Air T-Out	87	F															
	Heating Cap	184	CFM	x	20	F	x	1.08								=	4,070	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:**	**Sturbridge Public Libra**	**Sheet**
Trade Specification Section:	15500		3 - balcony	1 of 1
				Date
By:	**Checked By:**	**Project No.:**	**17123**	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		320	ft2															
	Method	Ra			A				Rp		P							
Ventilation	per Person	0.12		x	320		+		5	x	3					=	54.4	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	27	ft	x	8.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	279	Btu/hr
	S	0	ft	x	8.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	E	18	ft	x	8.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	254	Btu/hr
	W	17	ft	x	8.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	314	Btu/hr
	NE	0	ft	x	8.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	8.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	8.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	8.00	ft	x	26	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
Glass	N	11	ft	x	7	ft	x	48	SHG	x	0.83	SC	x	0.80	CLF	=	2,175	Btu/hr
	S	0	ft	x	7	ft	x	149	SHG	x	0.83	SC	x	0.65	CLF	=	0	Btu/hr
	E	7	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.37	CLF	=	3,018	Btu/hr
	W	7	ft	x	7	ft	x	216	SHG	x	0.83	SC	x	0.29	CLF	=	2,366	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		25	ft	x	6.50	ft	x	14	CLTD	x	0.55	Btu/hr ft2 F				=	1,226	Btu/hr
Skylight		0	ft	x	1.00	ft	x	40	CLTD	x	0.40	Btu/hr ft2 F				=	0	Btu/hr
Roof		665	ft2	x	40.00	CLTD	x	0.06	Btu/hr ft2 F							=	1,478	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		320	ft2	x	1.40	W/ft2	x	3.412	Btuh/Watt							=	1,529	Btu/hr
People		3	People	x	255	Btu/hr	x	1	Diversity							=	816	Btu/hr
Infiltration		320	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	344	Btu/hr
												RSH				=	13,799	Btu/hr
												Safety Factor (15%)				=	2,070	Btu/hr
									Sensible(w/o treating air)			**ERSH**				=	**15,869**	**Btu/hr**
												Airflow (20F delta T)				=	**735**	**CFM**

III. Heating Load

Walls					336.09	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,708	Btu/hr
Glass					159.25	ft2	x	61	F	x	0.55	Btu/hr ft2 F				=	5,343	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		665	ft2	x	61	F	x	0.06	Btu/hr ft2 F							=	2,254	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		320	ft2	x	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	1,613	Btu/hr
												Heating				=	10,918	Btu/hr
												Safety Factor (25%)				=	2,729	Btu/hr
									(not treating air)			**MIN HEATING**				=	**13,647**	**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	735	CFM	x	6.95	BTU/lb	x	4.5								=	22,970	Btu/hr
												Tons A/C				=	1.9	Tons
												H2O (10F delta T)				=	5	GPM
																=	167	ft2/Ton
	Mix Air T-In	65	F	@	7	% OA												
	Heat Air T-Out	89	F															
	Heating Cap	735	CFM	x	24	F	x	1.08								=	18,818	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:** **Sturbridge Public Libra**		**Sheet**
Trade Specification Section: 15500	3 - storage		1 of 1
			Date
By: **Checked By:**	**Project No.:** **17123**		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	0					=	8.22	CFM
	per ACH	2.00	ACH	x	0	ft2	x	8.00	ft	/	60	min/hr				=	0	CFM

II. Sensible Cooling Load

Walls	N	7	ft	x	8.00	ft	x	23	CLTD	x	0.08	Btu/hr ft2 F				=	104	Btu/hr
	S	7	ft	x	8.00	ft	x	46	CLTD	x	0.08	Btu/hr ft2 F				=	209	Btu/hr
	E	0	ft	x	8.00	ft	x	31	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	W	20	ft	x	8.00	ft	x	41	CLTD	x	0.08	Btu/hr ft2 F				=	538	Btu/hr
	NE	0	ft	x	8.00	ft	x	29	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SE	0	ft	x	8.00	ft	x	37	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	NW	0	ft	x	8.00	ft	x	19	CLTD	x	0.08	Btu/hr ft2 F				=	0	Btu/hr
	SW	0	ft	x	8.00	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	6.50	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		256	ft2	x	40.00	CLTD	x	0.06	Btu/hr ft2 F							=	569	Btu/hr
Floor		0	ft2	x	4.00	CLTD	x	0.03	Btu/hr ft2 F								0	Btu/hr
Lighting/Power		137	ft2	x	0.80	W/ft2	x	3.412	Btuh/Watt							=	374	Btu/hr
People		0	People	x	255	Btu/hr	x	1	Diversity							=	0	Btu/hr
Infiltration		137	ft2	x	11.25	ft	x	13	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	147	Btu/hr

	RSH	=	1,940	Btu/hr
	Safety Factor (15%)	=	291	Btu/hr
Sensible(w/o treating air)	**ERSH**	=	**2,231**	**Btu/hr**
	Airflow (20F delta T)	=	**103**	**CFM**

III. Heating Load

Walls					266.13	ft2	x	61	F	x	0.08	Btu/hr ft2 F				=	1,353	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		256	ft2	x	61	F	x	0.06	Btu/hr ft2 F							=	868	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	11.25	ft	x	61	F	x	1.08	x 0.4 ACH	x	0.017	min/hr	=	690	Btu/hr

	Heating	=	2,911	Btu/hr
	Safety Factor (25%)	=	728	Btu/hr
(not treating air)	**MIN HEATING**	=	**3,639**	**Btu/hr**

IV. Furnace Specifications

AHU	Enthalpy-In	30.16	Btu/lb	@	78.80	F DB	,	65.35	F WB	,	8	% OA						
	Enthalpy-Out	23.17	Btu/lb	@	56.00	F DB	,	55.0	F WB									
	Cooling Cap	103	CFM	x	6.99	BTU/lb	x	4.5								=	3,248	Btu/hr
												Tons A/C				=	0.3	Tons
												H2O (10F delta T)				=	1	GPM
																=	506	ft2/Ton
	Mix Air T-In	65	F	@	8	% OA												
	Heat Air T-Out	105	F															
	Heating Cap	103	CFM	x	39	F	x	1.08								=	4,403	Btu/hr

REPLACEMENT ROOFTOP UNITS

SUBMITTAL

Project

Sturbridge Public Library

Date

Wednesday, July 26, 2017

Unit Report For RTU-1

Project: Sturbridge Public Library
Prepared By:

07/26/2017
11:41AM

Unit Parameters

Unit Model: **48TCFE16ACA6-0F2C0**
Unit Size: **16 (15 Tons)**
Volts-Phase-Hertz: **460-3-60**
Heating Type: **Gas**
Duct Cfg: **Vertical Supply / Vertical Return**
High Heat
Round Tube Plate Fin Coils

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **9' 7.875"**
Unit Width: **5' 3.375"**
Unit Height: **4' 9.375"**
*** Total Operating Weight: **1718** lb

*** Weights and Dimensions are approximate. Weight does not include unit packaging. Approximate dimensions are provided primarily for shipping purposes. For exact dimensions and weights, refer to appropriate product data catalog.

Lines and Filters

Gas Line Size: **3/4**
Condensate Drain Line Size: **3/4**
Return Air Filter Type: **Throwaway**
Return Air Filter Quantity: **6**
Return Air Filter Size: **18 x 24 x 2**

Unit Configuration

High Static Option with High Efficiency Motor (Belt Drive)
Al/Cu - Al/Cu
Base Electromechanical Controls
Enthalpy Economizer w/ Barometric Relief
Powered Convenience Outlet
Non-Fused Disconnect
Standard Packaging
Humidi-MiZer™ Adaptive Dehumidification System

Warranty Information

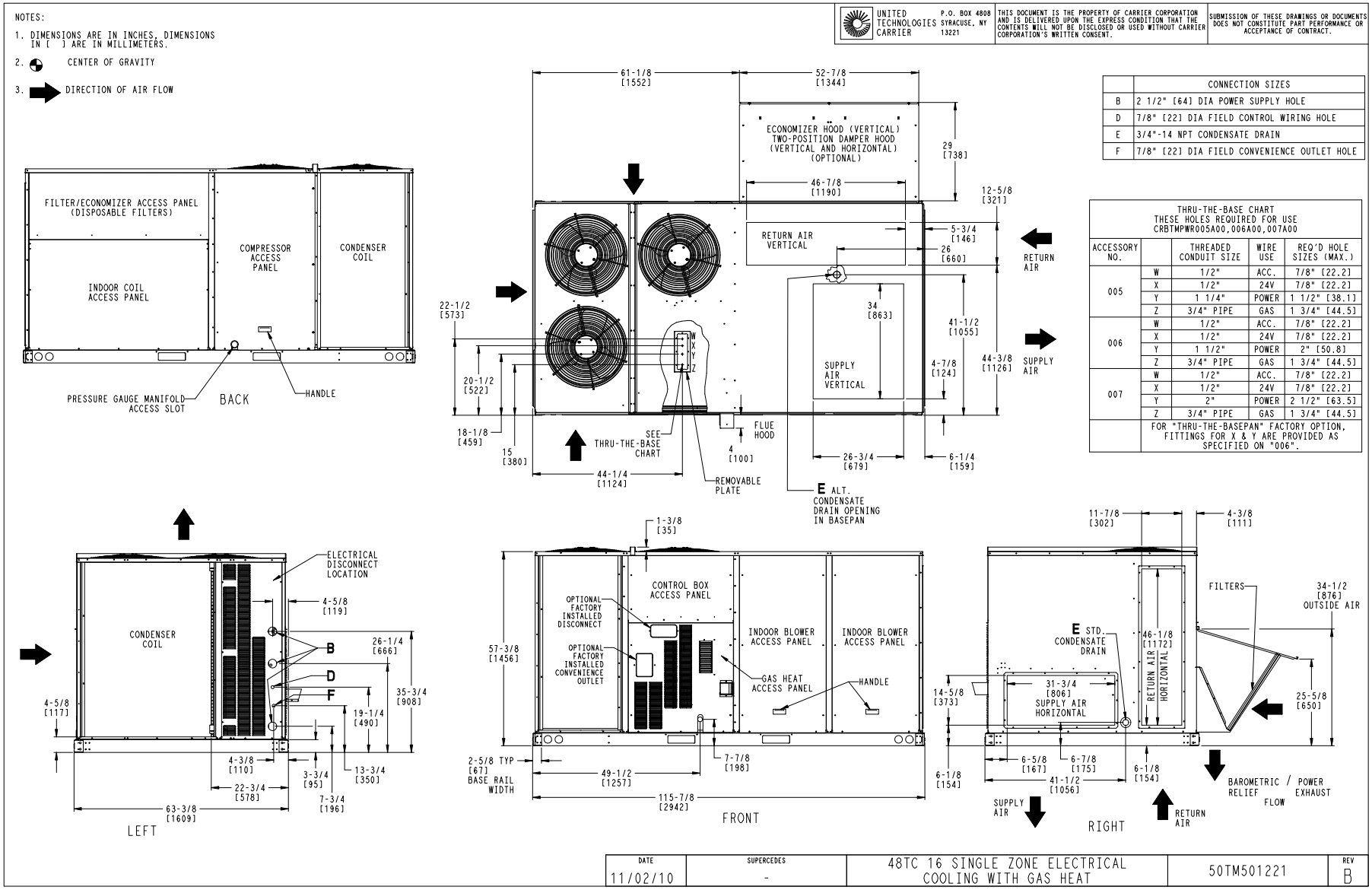
1-Year parts(std.)
5-Year compressor parts(std.)
10-Year heat exchanger - Aluminized(std.)

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

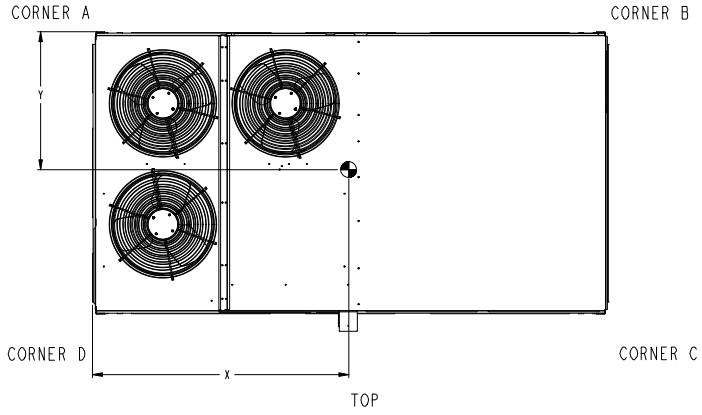
Ordering Information

Part Number	Description	Quantity
48TCFE16ACA6-0F2C0	Rooftop Unit	1
	Base Unit	
	High Static Option with High Efficiency Motor (Belt Drive)	
	Powered Convenience Outlet	
	Std leak Enty Econo IV with baro relief and W7212 control	
	Non-Fused Disconnect	

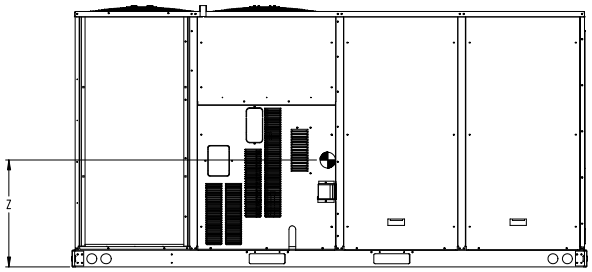

NOTES:
1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW
UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221
THIS DOCUMENT IS THE PROPERTY OF CARRIER CORPORATION AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORPORATION'S WRITTEN CONSENT.
SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.
FILTER/ECONOMIZER ACCESS PANEL (DISPOSABLE FILTERS)
INDOOR COIL ACCESS PANEL
COMPRESSOR ACCESS PANEL
CONDENSER COIL
PRESSURE GAUGE MANIFOLD ACCESS SLOT
BACK
HANDLE
61-1/8 [1552]
52-7/8 [1344]
ECONOMIZER HOOD (VERTICAL) TWO-POSITION DAMPER HOOD (VERTICAL AND HORIZONTAL) (OPTIONAL)
29 [738]
46-7/8 [1190]
12-5/8 [321]
RETURN AIR VERTICAL
5-3/4 [146]
26 [660]
RETURN AIR
22-1/2 [573]
34 [863]
41-1/2 [1055]
SUPPLY AIR VERTICAL
4-7/8 [124]
44-3/8 [1126]
SUPPLY AIR
20-1/2 [522]
18-1/8 [459]
15 [380]
SEE THRU-THE-BASE CHART
FLUE HOOD
4 [100]
26-3/4 [679]
6-1/4 [159]
44-1/4 [1124]
REMOVABLE PLATE
E ALT. CONDENSATE DRAIN OPENING IN BASEPAN
W
X
Y
Z
CONNECTION SIZES
B 2 1/2" [64] DIA POWER SUPPLY HOLE
D 7/8" [22] DIA FIELD CONTROL WIRING HOLE
E 3/4"-14 NPT CONDENSATE DRAIN
F 7/8" [22] DIA FIELD CONVENIENCE OUTLET HOLE
THRU-THE-BASE CHART
THESE HOLES REQUIRED FOR USE CRBTMPWR005A00,006A00,007A00
ACCESSORY NO. | | THREADED CONDUIT SIZE | WIRE USE | REQ'D HOLE SIZES (MAX.)
005 | W | 1/2" | ACC. | 7/8" [22.2]
005 | X | 1/2" | 24V | 7/8" [22.2]
005 | Y | 1 1/4" | POWER | 1 1/2" [38.1]
005 | Z | 3/4" PIPE | GAS | 1 3/4" [44.5]
006 | W | 1/2" | ACC. | 7/8" [22.2]
006 | X | 1/2" | 24V | 7/8" [22.2]
006 | Y | 1 1/2" | POWER | 2" [50.8]
006 | Z | 3/4" PIPE | GAS | 1 3/4" [44.5]
007 | W | 1/2" | ACC. | 7/8" [22.2]
007 | X | 1/2" | 24V | 7/8" [22.2]
007 | Y | 2" | POWER | 2 1/2" [63.5]
007 | Z | 3/4" PIPE | GAS | 1 3/4" [44.5]
FOR "THRU-THE-BASEPAN" FACTORY OPTION, FITTINGS FOR X & Y ARE PROVIDED AS SPECIFIED ON "006".
CONDENSER COIL
ELECTRICAL DISCONNECT LOCATION
4-5/8 [119]
B
D
F
26-1/4 [666]
35-3/4 [908]
4-5/8 [117]
19-1/4 [490]
4-3/8 [110]
3-3/4 [95]
13-3/4 [350]
22-3/4 [578]
7-3/4 [196]
63-3/8 [1609]
LEFT
1-3/8 [35]
CONTROL BOX ACCESS PANEL
OPTIONAL FACTORY INSTALLED DISCONNECT
OPTIONAL FACTORY INSTALLED CONVENIENCE OUTLET
INDOOR BLOWER ACCESS PANEL
INDOOR BLOWER ACCESS PANEL
57-3/8 [1456]
GAS HEAT ACCESS PANEL
HANDLE
2-5/8 TYP [67] BASE RAIL WIDTH
7-7/8 [198]
49-1/2 [1257]
115-7/8 [2942]
FRONT
11-7/8 [302]
4-3/8 [111]
FILTERS
34-1/2 [876] OUTSIDE AIR
E STD. CONDENSATE DRAIN
46-1/8 [1172] RETURN AIR HORIZONTAL
31-3/4 [806] SUPPLY AIR HORIZONTAL
14-5/8 [373]
25-5/8 [650]
6-5/8 [167]
6-7/8 [175]
41-1/2 [1056]
6-1/8 [154]
6-1/8 [154]
BAROMETRIC / POWER RELIEF FLOW
EXHAUST
SUPPLY AIR
RETURN AIR
RIGHT
DATE 11/02/10
SUPERCEDES -
48TC 16 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT
50TM501221
REV B

UNIT	STD UNIT WEIGHT		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48TC 16	1380	627	295	134	276	126	342	156	421	191	64 1/4 [1630]	35 [890]	21 1/8 [537]

STANDARD UNIT WEIGHT IS WITH LOW HEAT & WITHOUT PACKAGING.
FOR OPTIONS & ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



TOP

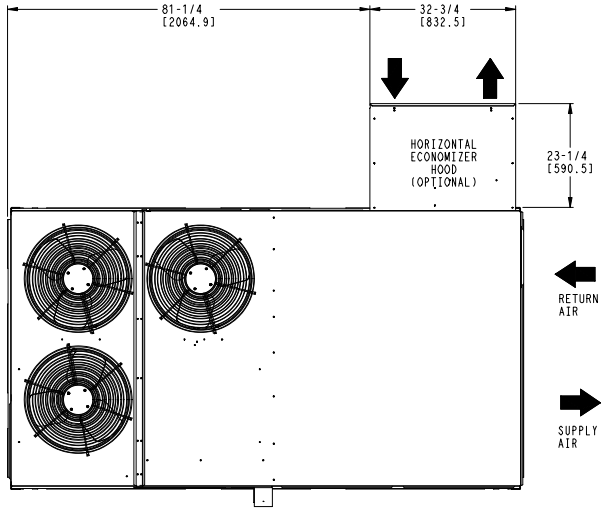


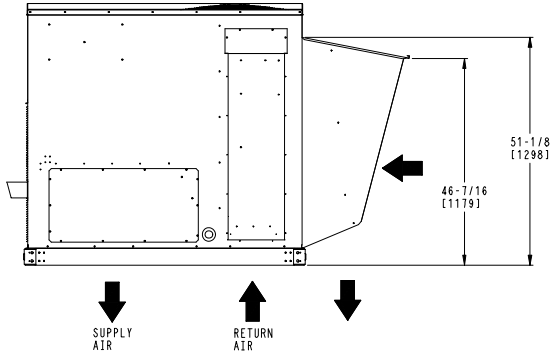
FRONT

UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221

THIS DOCUMENT IS THE PROPERTY OF CARRIER CORPORATION AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORPORATION'S WRITTEN CONSENT.

SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.





HORIZONTAL ECONOMIZER

DATE	SUPERCEDES			REV
06/15/11	-	48TC 16 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	50TM501221	C

Cambridgeport

SUBMITTAL

Part Number
2010096

SUBMITTED TO _____

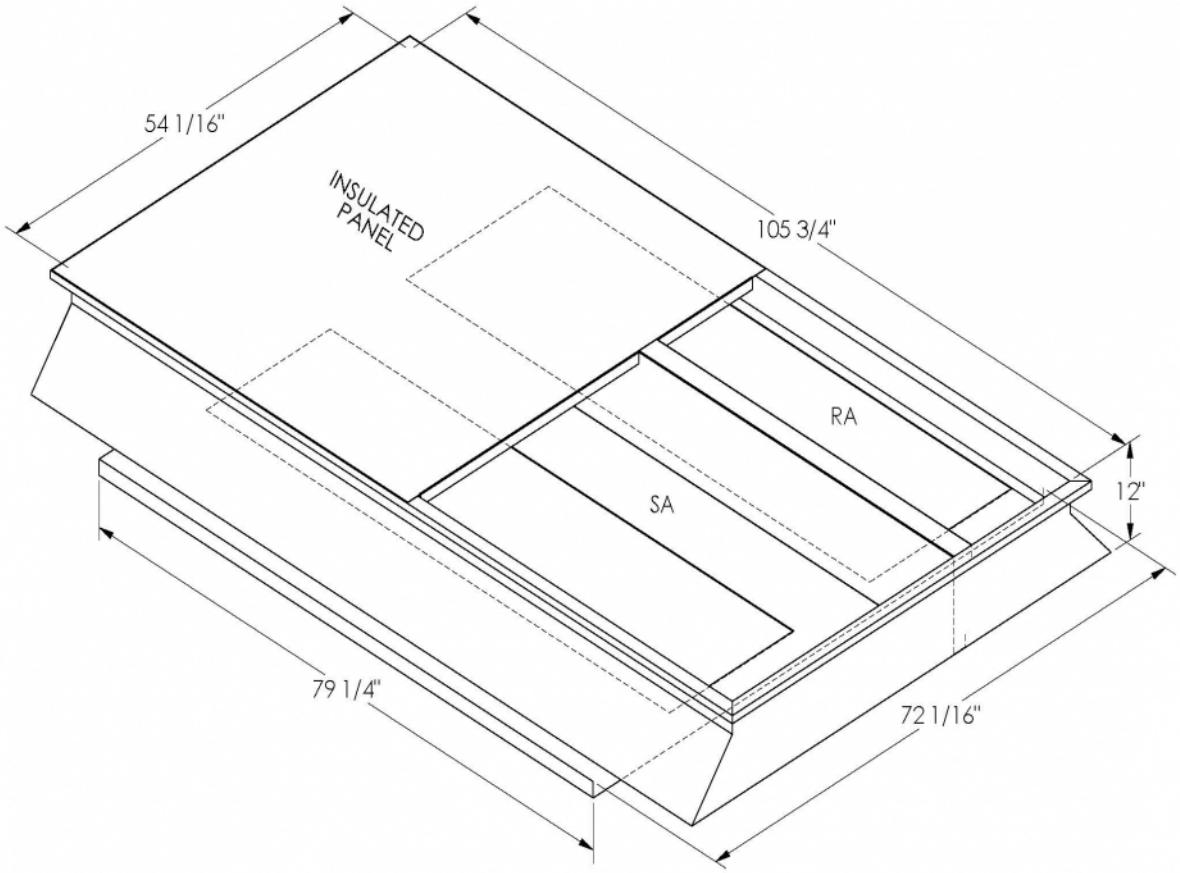
COMPANY _____

JOB NAME _____

EQUIPMENT _____

SIGNATURE _____

DATE _____



FEATURES

ONE PIECE WELDED CONSTRUCTION

FACTORY INSTALLED SUPPLY TRANSITIONS

FULLY INSULATED

DESIGNED FOR EVEN WEIGHT DISTRIBUTION

FABRICATED OF HEAVY GAUGE G90 GALVANIZED STEEL

ALL WELDS SPRAYED WITH GALVANIZING COMPOUND

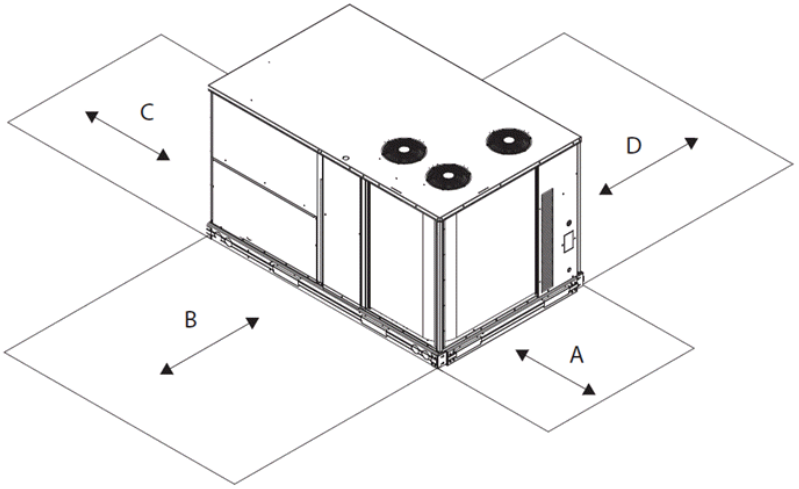
GASKET PROVIDED FOR UNIT TO ADAPTER SEALING

Existing Unit *48HJF017 (CARRIER)*
New Unit *48TCFD16 (CARRIER)*

CAMBRIDGEPORT STRONGLY RECOMMENDS CONFIRMING THE DIMENSIONS ON THIS SUBMITTAL

CURB ADAPTERS ARE BASED ON UNIT MANUFACTURERS STANDARD CURB DIMENSIONS.
CAMBRIDGEPORT CANNOT BE RESPONSIBLE FOR ANY DEVIATIONS FROM FACTORY DIMENSIONS OR INCORRECT MODEL NUMBERS.

Service Clearance



C1057B

LOCATION	DIMENSION	CONDITION
A	48-in (1219 mm)	• Unit disconnect is mounted on panel
	18-in (457 mm)	• No disconnect, convenience outlet option • Recommended service clearance
	12-in (305 mm)	• Minimum clearance
B	42-in (1067 mm)	• Surface behind servicer is grounded (e.g., metal, masonry wall)
	36-in (914 mm)	• Surface behind servicer is electrically non-conductive (e.g., wood, fiberglass)
	Special	• Check for sources of flue products within 10-ft of unit fresh air intake hood
C	36-in (914 mm)	• Side condensate drain is used
	18-in (457 mm)	• Minimum clearance
D	48-in (1219 mm)	• No flue discharge accessory installed, surface is combustible material
	42-in (1067 mm)	• Surface behind servicer is grounded (e.g., metal, masonry wall, another unit)
	36-in (914 mm)	• Surface behind servicer is electrically non-conductive (e.g., wood, fiberglass)
	Special	• Check for adjacent units or building fresh air intakes within 10-ft of this unit's flue outlet

NOTE: Unit not designed to have overhead obstruction. Contact Application Engineering for guidance on any application planning overhead obstruction or vertical clearances.

Chassis 5

Part Number:48TCFE16ACA6-0F2C0

ARI EER:	**10.80**	
IEER (Max Cooling at Normal Cooling Design Mode):	**11.7**	

Base Unit Dimensions

Unit Length:	**115.9**	in
Unit Width:	**63.4**	in
Unit Height:	**57.4**	in

Operating Weight

Base Unit Weight:	**1380**	lb
High Heat:	**50**	lb
Two Stage Compressor Models with Al/Cu condenser Coils and Humidimizer:	**90**	lb
High Static Option with High Efficiency Motor (Belt Drive):	**45**	lb
Enthalpy Economizer w/ Barometric Relief:	**103**	lb
Powered Convenience Outlet:	**35**	lb
Non-Fused Disconnect:	**15**	lb
Total Operating Weight:	**1718**	lb

Unit

Unit Voltage-Phase-Hertz:	**460-3-60**	
Air Discharge:	**Vertical**	
Fan Drive Type:	**Belt**	
Actual Airflow:	**6000**	CFM
Site Altitude:	**0**	ft

Cooling Performance

Condenser Entering Air DB:	**95.0**	F
Evaporator Entering Air DB:	**80.0**	F
Evaporator Entering Air WB:	**67.0**	F
Entering Air Enthalpy:	**31.44**	BTU/lb
Evaporator Leaving Air DB:	**59.0**	F
Evaporator Leaving Air WB:	**57.4**	F
Evaporator Leaving Air Enthalpy:	**24.62**	BTU/lb
Gross Cooling Capacity:	**184.10**	MBH
Gross Sensible Capacity:	**136.00**	MBH
Compressor Power Input:	**13.84**	kW
Coil Bypass Factor:	**0.610**	

Heating Performance

Heating Airflow:	**6000**	CFM
Entering Air Temp:	**70.0**	F
Leaving Air Temp:	**113.2**	F
Gas Heating Input Capacity:	**280.0 / 350.0**	MBH
Gas Heating Output Capacity:	**224.0 / 280.0**	MBH
Temperature Rise:	**43.2**	F
Thermal Efficiency (%):	**80.0**	

Supply Fan

External Static Pressure:	**1.00**	in wg
Options / Accessories Static Pressure		
Humidi-MiZer Dehumidification System:	**0.11**	in wg
Economizer:	**0.05**	in wg
Total Application Static (ESP + Unit Opts/Acc.):	**1.16**	in wg
Fan RPM:	**832**	
Fan Power:	**3.86**	BHP
NOTE:	**Selected IFM RPM Range: 776 - 955**	

Electrical Data

Voltage Range: **414 - 506**
Compressor #1 RLA: **12.2**
Compressor #1 LRA: **100**
Compressor #2 RLA: **12.8**
Compressor #2 LRA: **100**
Indoor Fan Motor Type: **High Eff. High**
Indoor Fan Motor FLA: **10.2**
Combustion Fan Motor FLA (ea): **0.25**
Power Supply MCA: **43**
Power Supply MOCP (Fuse or HACR): **50**
Disconnect Size FLA: **46**
Disconnect Size LRA: **254**
Electrical Convenience Outlet FLA (based on unit line voltage): **2.2**
Outdoor Fan [Qty / FLA (ea)]: **3 / 0.8**
NOTE: Convenience outlet must be field connected to the line/load side of the unit disconnect per local code.

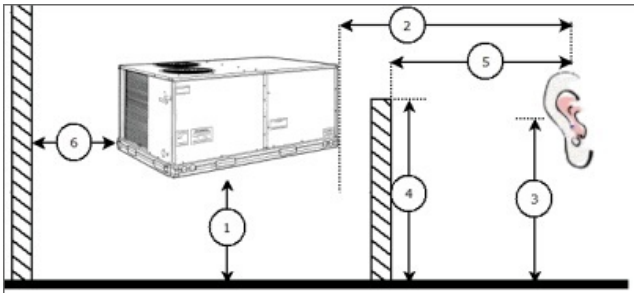
Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

Acoustics

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	96.9	93.4	87.0
125 Hz	97.4	88.3	85.2
250 Hz	83.5	69.3	84.6
500 Hz	79.4	68.8	84.9
1000 Hz	74.8	67.3	82.2
2000 Hz	70.3	64.1	78.4
4000 Hz	76.3	65.2	75.3
8000 Hz	76.0	61.8	72.9
A-Weighted	85.4	76.1	87.0

Advanced Acoustics



Advanced Accoustics Parameters

1. Unit height above ground: **30.0** ft
2. Horizontal distance from unit to receiver: **50.0** ft
3. Receiver height above ground: **5.7** ft
4. Height of obstruction: **0.0** ft
5. Horizontal distance from obstruction to receiver: **0.0** ft
6. Horizontal distance from unit to obstruction: **0.0** ft

Detailed Acoustics Information

Performance Summary For RTU-1

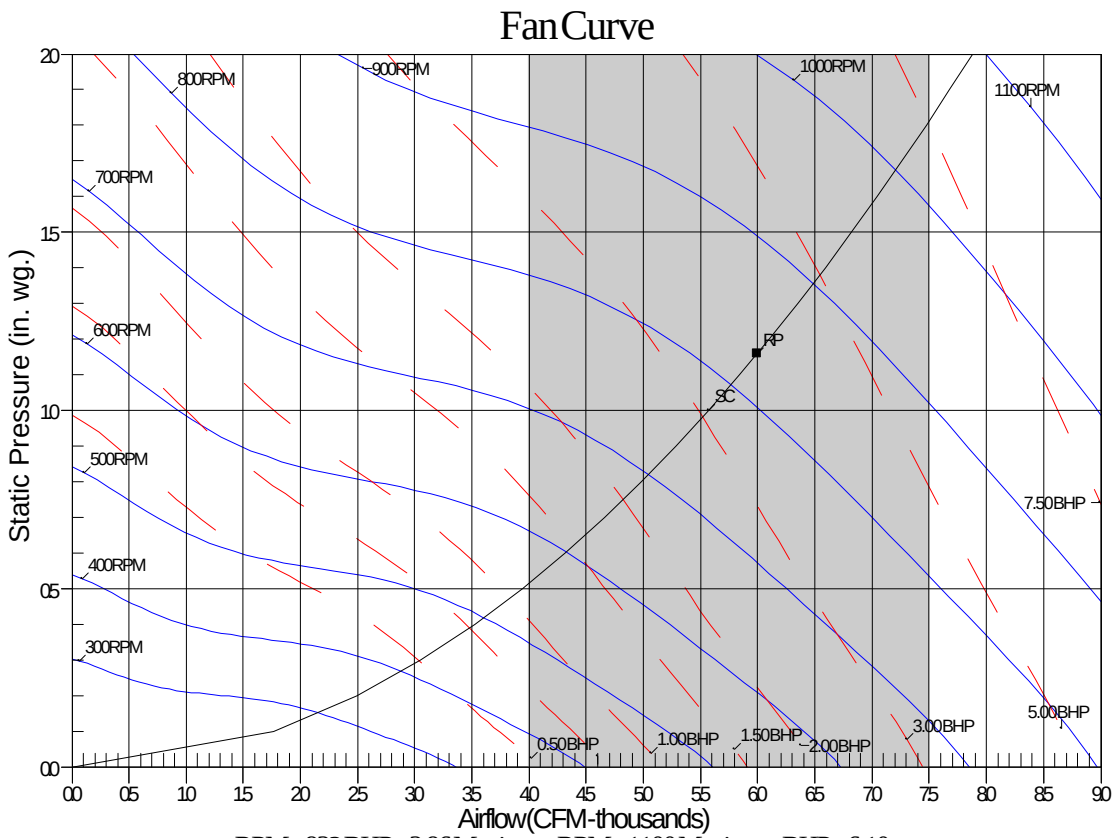
Project: Sturbridge Public Library
Prepared By:

07/26/2017
11:41AM

Octave Band Center Freq. Hz	63	125	250	500	1k	2k	4k	8k	Overall
A	87.0	85.2	84.6	84.9	82.2	78.4	75.3	72.9	92.4 Lw
B	60.8	69.1	76.0	81.7	82.2	79.6	76.3	71.8	87.1 LwA
C	54.6	52.8	52.2	52.5	49.8	46.0	42.9	40.5	60.0 Lp
D	28.4	36.7	43.6	49.3	49.8	47.2	43.9	39.4	54.7 LpA

Legend
A Sound Power Levels at Unit's Acoustic Center, Lw
B A-Weighted Sound Power Levels at Unit's Acoustic Center, LwA
C Sound Pressure Levels at Specific Distance from Unit, Lp
D A-Weighted Sound Pressure Levels at Specific Distance from Unit, LpA

Calculation methods used in this program are patterned after the ASHRAE Guide; other ASHRAE Publications and the AHRI Acoustical Standards. While a very significant effort has been made to insure the technical accuracy of this program, it is assumed that the user is knowledgeable in the art of system sound estimation and is aware of the tolerances involved in real world acoustical estimation. This program makes certain assumptions as to the dominant sound sources and sound paths which may not always be appropriate to the real system being estimated. Because of this, no assurances can be offered that this software will always generate an accurate sound prediction from user supplied input data. If in doubt about the estimation of expected sound levels in a space, an Acoustical Engineer or a person with sound prediction expertise should be consulted.



RPM=832 BHP=3.86 Maximum RPM=1100 Maximum BHP=6.10
Note: Please contact application engineering for selections outside the shaded region.
SC-System Curve RP-Rated Point

Unit Report For RTU-2

Project: Sturbridge Public Library
Prepared By:

07/26/2017
11:41AM

Unit Parameters

Unit Model: **48TCFE08A2A6-0F2C0**
Unit Size: **08 (7.5 Tons)**
Volts-Phase-Hertz: **460-3-60**
Heating Type: **Gas**
Duct Cfg: **Vertical Supply / Vertical Return**
High Heat
Round Tube Plate Fin Coils

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **7' 4.125"**
Unit Width: **4' 11.5"**
Unit Height: **3' 5.25"**
*** Total Operating Weight: **1083** lb

*** Weights and Dimensions are approximate. Weight does not include unit packaging. Approximate dimensions are provided primarily for shipping purposes. For exact dimensions and weights, refer to appropriate product data catalog.

Lines and Filters

Gas Line Size: **3/4**
Condensate Drain Line Size: **3/4**
Return Air Filter Type: **Throwaway**
Return Air Filter Quantity: **4**
Return Air Filter Size: **16 x 20 x 2**

Unit Configuration

Medium Static Option (Belt Drive)
Al/Cu - Al/Cu
Base Electromechanical Controls
Enthalpy Economizer w/ Barometric Relief
Powered Convenience Outlet
Non-Fused Disconnect
Standard Packaging
Humidi-MiZer™ Adaptive Dehumidification System

Warranty Information

1-Year parts(std.)
5-Year compressor parts(std.)
10-Year heat exchanger - Aluminized(std.)

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

Ordering Information

Part Number	Description	Quantity
48TCFE08A2A6-0F2C0	Rooftop Unit	1
	Base Unit	
	Medium Static Option (Belt Drive)	
	Powered Convenience Outlet	
	Std leak Enty Econo IV with baro relief and W7212 control	
	Non-Fused Disconnect	

NOTES:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW

UNIT	OUTDOOR COIL TYPE	J	K	H
48TC-A08	RTPF	41 1/4 [1048]	33 [658]	15 7/8 [403]
48TC-A09	RTPF	49 3/8 [1253]	37 1/4 [946]	27 7/8 [708]
48TC-A12	RTPF	49 3/8 [1253]	37 1/4 [946]	15 7/8 [403]
48TC-D08	RTPF	41 1/4 [1048]	33 [658]	15 7/8 [403]
48TC-D09	RTPF	49 3/8 [1253]	37 1/4 [946]	15 7/8 [403]
48TC-D12	RTPF	49 3/8 [1253]	37 1/4 [946]	15 7/8 [403]
48TC-D08	MCHX	41 1/4 [1048]	33 [658]	23 [584.2]
48TC-D12	MCHX	49 3/8 [1253]	37 1/4 [946]	11 [279.4]

RTPF - ROUND TUBE, PLATE FIN (COPPER/ALUM)
MCHX - NOVATION (ALUM/ALUM)

UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221

THIS DOCUMENT IS THE PROPERTY OF CARRIER CORPORATION AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORPORATION'S WRITTEN CONSENT.

SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

	CONNECTION SIZES
A	1 3/8" [35] DIA FIELD POWER SUPPLY HOLE
B	2 1/2" [64] DIA POWER SUPPLY KNOCKOUT
C	1 3/4" [51] DIA GAUGE ACCESS PLUG
D	7/8" [22] DIA FIELD CONTROL WIRING HOLE
E	3/4"-14 NPT CONDENSATE DRAIN
F	1/2"-14 NPT GAS CONNECTION 3/4"-14 NPT GAS CONNECTION
G	2 " [51] DIA POWER SUPPLY KNOCK-OUT

THRU-THE-BASE CHART (FIELD INST)

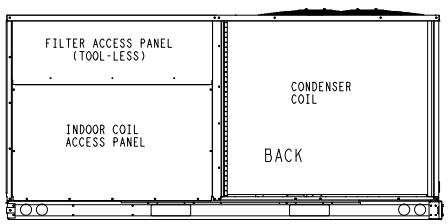
THESE HOLES REQUIRED FOR USE WITH ACCY KITS:
CRBTMPWR002A01: GAS THRU CURB
CRBTMPWR004A01: GAS THRU BASEPAN

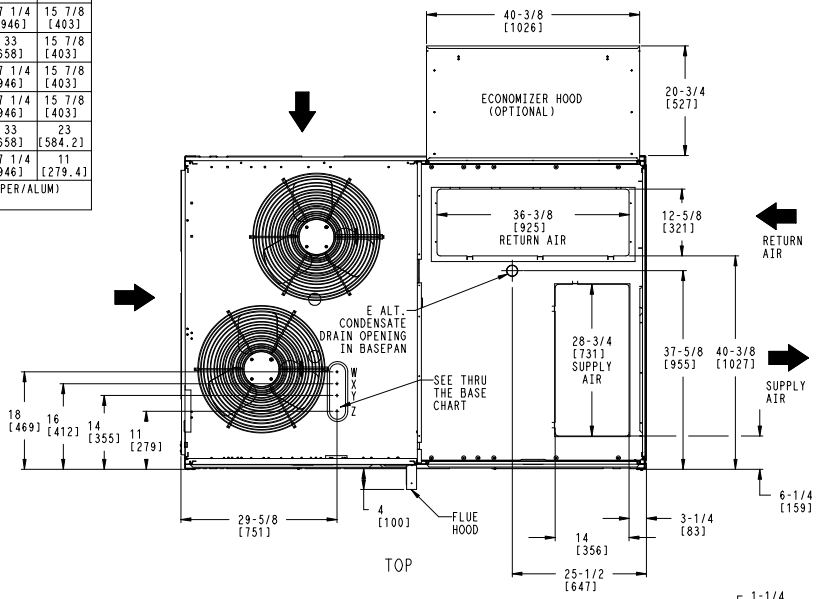
	THREADED CONDUIT SIZE	WIRE USE	REQ'D HOLE SIZES (MAX.)
W	1/2"	ACC.	7/8" [22.2]
X	1/2"	24V	7/8" [22.2]
Y	1 1/4" (002,004)	POWER	1 3/4" [44.4]
Z *	(004) 3/4" FPT	GAS	1 3/4" [44.4]
*	(002) PROVIDES 3/4" FPT THRU CURB FLANGE & FITTING. HOLE SIZE: 2" [50.8]		

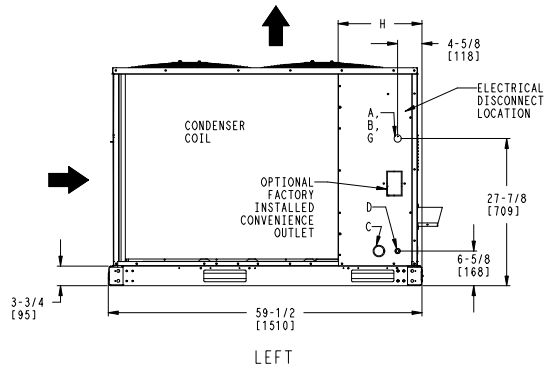
THRU-THE-BASE CHART (FIOP)

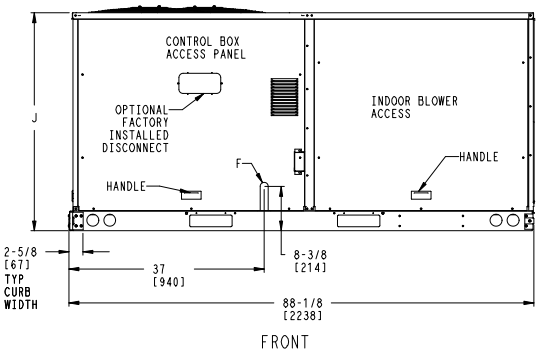
FOR "THRU-THE-BASEPAN" FACTORY OPTION, FITTINGS FOR ONLY X, Y, & Z ARE PROVIDED. **

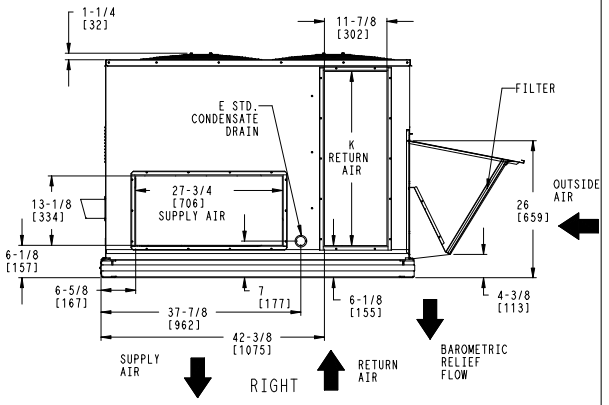
**	FOR BELOW LISTED MODELS, A FIELD SUPPLIED 1/2" ADAPTER IS REQUIRED BETWEEN BASE PAN FITTING AND GAS VALVE: 48HCD,S*08











SHEET	DATE	SUPERCEDES			REV
1 OF 2	03-08-10	11-24-08	48TC 08-12 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	48TM500985	F

UNIT	OUTDOOR COIL TYPE	STD. UNIT WEIGHT ***		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
		LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48TC-A08	RTPF	780	354	178	81	158	72	209	95	236	107	41 1/2 [1054]	33 7/8 [860]	20 1/2 [521]
48TC-A09	RTPF	920	418	212	96	183	83	243	110	282	128	40 7/8 [1038]	34 [864]	23 1/8 [587]
48TC-A12	RTPF	930	422	216	98	196	89	247	112	272	123.5	42 [1067]	33 1/8 [841]	24 1/4 [616]
48TC-D08	RTPF	835	379	164	74.5	170	77.2	255	115.8	246	111.7	44 7/8 [1140]	35 5/8 [905]	19 3/8 [492]
48TC-D09	RTPF	930	422	228	103.5	187	85	232	105.3	283	128.5	39 3/4 [1010]	32 7/8 [835]	18 5/8 [473]
48TC-D12	RTPF	940	427	231	104.9	189	85.8	234	106.2	286	129.8	39 3/4 [1010]	33 [838]	18 1/2 [470]
48TC-D08	MCHX	805	365.5	160	72.6	153	69.5	240	109	260	118	43 [1092]	36 3/8 [924]	20 3/8 [517.7]
48TC-D12	MCHX	895	406.3	185	84	176	79.9	260	118	274	124.4	42 7/8 [1089]	35 1/2 [902]	22 7/8 [581]

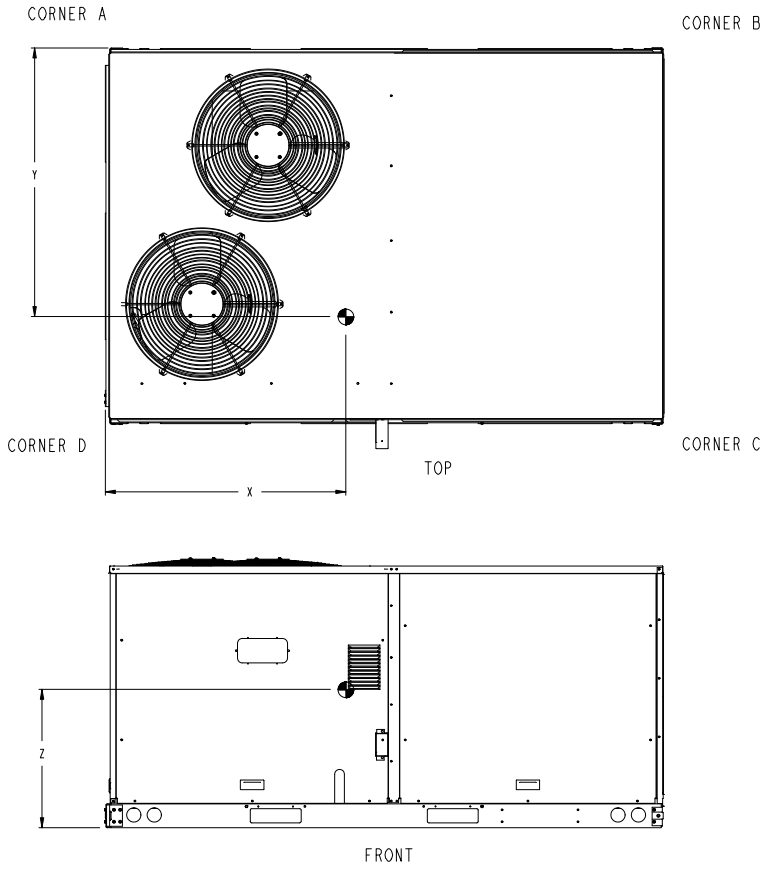
RTPF - ROUND TUBE, PLATE FIN (COPPER/ALUM)
MCHX - NOVATION (ALUM/ALUM)

UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221

THIS DOCUMENT IS THE PROPERTY OF CARRIER CORPORATION AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORPORATION'S WRITTEN CONSENT.

SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

*** STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



SHEET	DATE	SUPERCEDES			REV
2 OF 2	03-08-10	11-24-08	48TC 08-12 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	48TM500985	F

NOTES:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW

UNIT	OUTDOOR COIL TYPE	J	K	H
48TC-A08	RTPF	41 1/4 [1048]	33 [658]	15 7/8 [403]
48TC-A09	RTPF	49 3/8 [1253]	37 1/4 [946]	27 7/8 [708]
48TC-A12	RTPF	49 3/8 [1253]	37 1/4 [946]	15 7/8 [403]
48TC-D08	RTPF	41 1/4 [1048]	33 [658]	15 7/8 [403]
48TC-D09	RTPF	49 3/8 [1253]	37 1/4 [946]	15 7/8 [403]
48TC-D12	RTPF	49 3/8 [1253]	37 1/4 [946]	15 7/8 [403]
48TC-D08	MCHX	41 1/4 [1048]	33 [658]	23 [584.2]
48TC-D12	MCHX	49 3/8 [1253]	37 1/4 [946]	11 [279.4]

RTPF - ROUND TUBE, PLATE FIN (COPPER/ALUM)
MCHX - NOVATION (ALUM/ALUM)

UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221

THIS DOCUMENT IS THE PROPERTY OF CARRIER CORPORATION AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORPORATION'S WRITTEN CONSENT.

SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

	CONNECTION SIZES
A	1 3/8" [35] DIA FIELD POWER SUPPLY HOLE
B	2 1/2" [64] DIA POWER SUPPLY KNOCKOUT
C	1 3/4" [51] DIA GAUGE ACCESS PLUG
D	7/8" [22] DIA FIELD CONTROL WIRING HOLE
E	3/4"-14 NPT CONDENSATE DRAIN
F	1/2"-14 NPT GAS CONNECTION 3/4"-14 NPT GAS CONNECTION
G	2 " [51] DIA POWER SUPPLY KNOCK-OUT

THRU-THE-BASE CHART (FIELD INST)

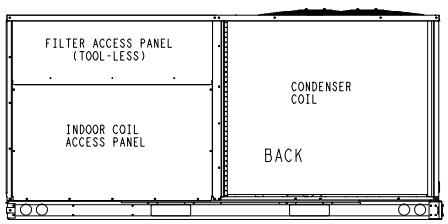
THESE HOLES REQUIRED FOR USE WITH ACCY KITS:
CRBTMPWR002A01: GAS THRU CURB
CRBTMPWR004A01: GAS THRU BASEPAN

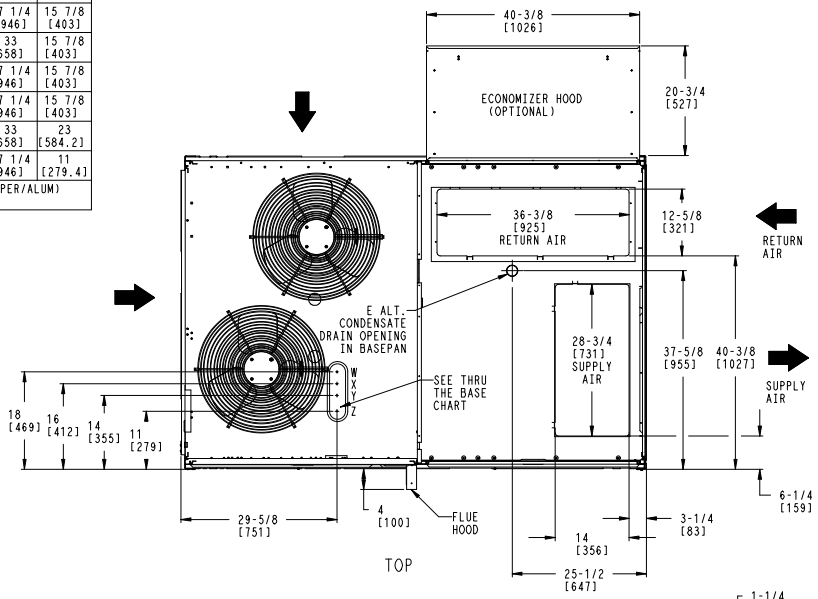
	THREADED CONDUIT SIZE	WIRE USE	REQ'D HOLE SIZES (MAX.)
W	1/2"	ACC.	7/8" [22.2]
X	1/2"	24V	7/8" [22.2]
Y	1 1/4" (002,004)	POWER	1 3/4" [44.4]
Z *	(004) 3/4" FPT	GAS	1 3/4" [44.4]
*	(002) PROVIDES 3/4" FPT THRU CURB FLANGE & FITTING. HOLE SIZE: 2" [50.8]		

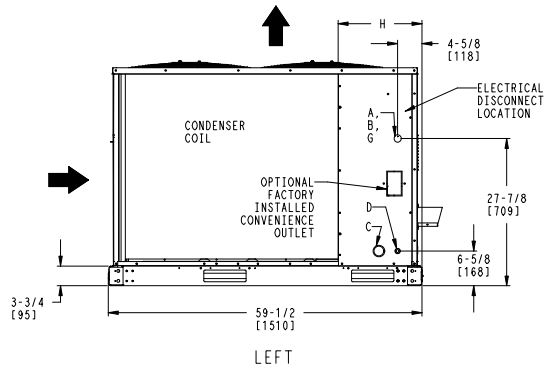
THRU-THE-BASE CHART (FIOP)

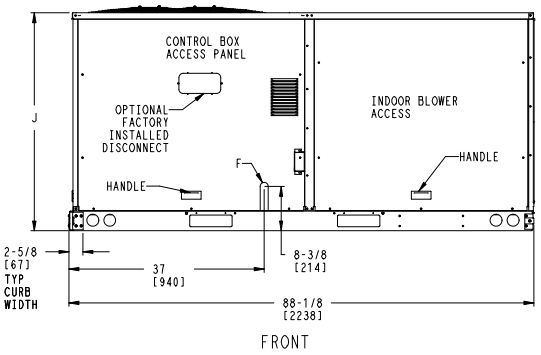
FOR "THRU-THE-BASEPAN" FACTORY OPTION, FITTINGS FOR ONLY X, Y, & Z ARE PROVIDED. **

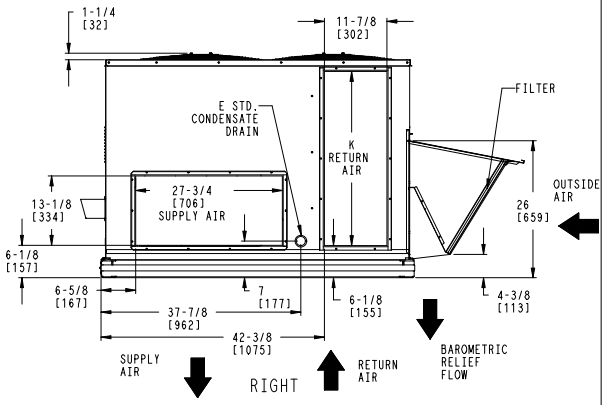
**	FOR BELOW LISTED MODELS, A FIELD SUPPLIED 1/2" ADAPTER IS REQUIRED BETWEEN BASE PAN FITTING AND GAS VALVE: 48HCD,S*08











SHEET	DATE	SUPERCEDES			REV
1 OF 2	03-08-10	11-24-08	48TC 08-12 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	48TM500985	F

UNIT	OUTDOOR COIL TYPE	STD. UNIT WEIGHT ***		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
		LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48TC-A08	RTPF	780	354	178	81	158	72	209	95	236	107	41 1/2 [1054]	33 7/8 [860]	20 1/2 [521]
48TC-A09	RTPF	920	418	212	96	183	83	243	110	282	128	40 7/8 [1038]	34 [864]	23 1/8 [587]
48TC-A12	RTPF	930	422	216	98	196	89	247	112	272	123.5	42 [1067]	33 1/8 [841]	24 1/4 [616]
48TC-D08	RTPF	835	379	164	74.5	170	77.2	255	115.8	246	111.7	44 7/8 [1140]	35 5/8 [905]	19 3/8 [492]
48TC-D09	RTPF	930	422	228	103.5	187	85	232	105.3	283	128.5	39 3/4 [1010]	32 7/8 [835]	18 5/8 [473]
48TC-D12	RTPF	940	427	231	104.9	189	85.8	234	106.2	286	129.8	39 3/4 [1010]	33 [838]	18 1/2 [470]
48TC-D08	MCHX	805	365.5	160	72.6	153	69.5	240	109	260	118	43 [1092]	36 3/8 [924]	20 3/8 [517.7]
48TC-D12	MCHX	895	406.3	185	84	176	79.9	260	118	274	124.4	42 7/8 [1089]	35 1/2 [902]	22 7/8 [581]

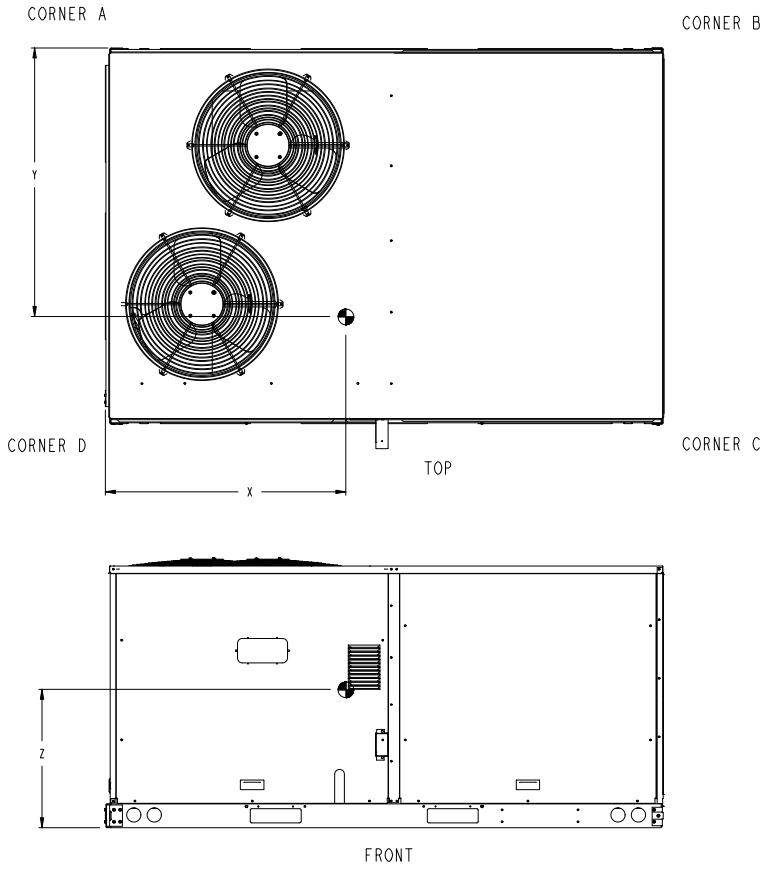
RTPF - ROUND TUBE, PLATE FIN (COPPER/ALUM)
MCHX - NOVATION (ALUM/ALUM)

UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221

THIS DOCUMENT IS THE PROPERTY OF CARRIER CORPORATION AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORPORATION'S WRITTEN CONSENT.

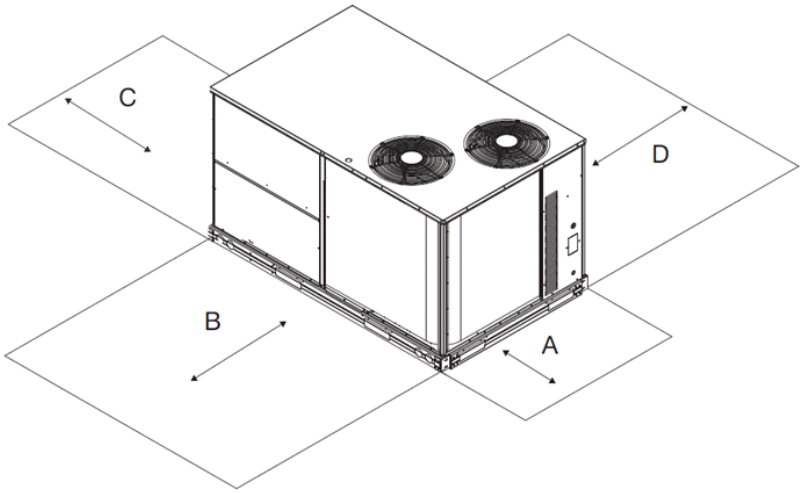
SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

*** STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



SHEET	DATE	SUPERCEDES			REV
2 OF 2	03-08-10	11-24-08	48TC 08-12 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	48TM500985	F

Service Clearance



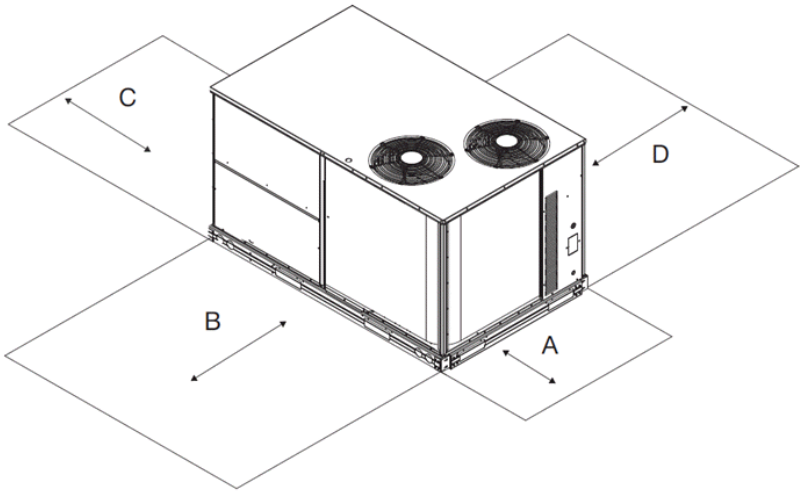
C11247

LOCATION	DIMENSION	CONDITION
A	48-in (1219 mm)	• Unit disconnect is mounted on panel
	36-in (914 mm)	• If dimension-B is 12-in (305 mm)
	18-in (457 mm)	• No disconnect, convenience outlet option • Recommended service clearance (use electric screwdriver)
	12-in (305 mm)	• Minimum clearance (use manual ratchet screwdriver)
B	36-in (914 mm)	• Unit has economizer
	12-in (305 mm)	• If dimension-A is 36-in (914 mm)
	Special	• Check for sources of flue products within 10-ft of unit fresh air intake hood
C	36-in (914 mm)	• Side condensate drain is used
	18-in (457 mm)	• Minimum clearance
D	48-in (1219 mm)	• No flue discharge accessory installed, surface is combustible material
	42-in (1067 mm)	• Surface behind servicer is grounded (e.g., metal, masonry wall, another unit)
	36-in (914 mm)	• Surface behind servicer is electrically non-conductive (e.g., wood, fiberglass)
	Special	• Check for adjacent units or building fresh air intakes within 10-ft of this unit's flue outlet

NOTE: Unit not designed to have overhead obstruction. Contact Application Engineering for guidance on any application planning overhead obstruction or vertical clearances.

Chassis 3-4a

Service Clearance



C11247

LOCATION	DIMENSION	CONDITION
A	48-in (1219 mm)	• Unit disconnect is mounted on panel
	36-in (914 mm)	• If dimension-B is 12-in (305 mm)
	18-in (457 mm)	• No disconnect, convenience outlet option • Recommended service clearance (use electric screwdriver)
	12-in (305 mm)	• Minimum clearance (use manual ratchet screwdriver)
B	36-in (914 mm)	• Unit has economizer
	12-in (305 mm)	• If dimension-A is 36-in (914 mm)
	Special	• Check for sources of flue products within 10-ft of unit fresh air intake hood
C	36-in (914 mm)	• Side condensate drain is used
	18-in (457 mm)	• Minimum clearance
D	48-in (1219 mm)	• No flue discharge accessory installed, surface is combustible material
	42-in (1067 mm)	• Surface behind servicer is grounded (e.g., metal, masonry wall, another unit)
	36-in (914 mm)	• Surface behind servicer is electrically non-conductive (e.g., wood, fiberglass)
	Special	• Check for adjacent units or building fresh air intakes within 10-ft of this unit's flue outlet

NOTE: Unit not designed to have overhead obstruction. Contact Application Engineering for guidance on any application planning overhead obstruction or vertical clearances.

Chassis 3-4a

Part Number:48TCFE08A2A6-0F2C0

ARI EER:	**11.00**	
IEER (Max Cooling at Normal Cooling Design Mode):	**11.7**	

Base Unit Dimensions

Unit Length:	**88.1**	in
Unit Width:	**59.5**	in
Unit Height:	**41.3**	in

Operating Weight

Base Unit Weight:	**835**	lb
High Heat:	**29**	lb
Two Stage Compressor Models with Al/Cu condenser Coils and Humidimizer:	**80**	lb
Medium Static Option (Belt Drive):	**15**	lb
Enthalpy Economizer w/ Barometric Relief:	**74**	lb
Powered Convenience Outlet:	**35**	lb
Non-Fused Disconnect:	**15**	lb
Total Operating Weight:	**1083**	lb

Unit

Unit Voltage-Phase-Hertz:	**460-3-60**	
Air Discharge:	**Vertical**	
Fan Drive Type:	**Belt**	
Actual Airflow:	**3000**	CFM
Site Altitude:	**0**	ft

Cooling Performance

Condenser Entering Air DB:	**95.0**	F
Evaporator Entering Air DB:	**80.0**	F
Evaporator Entering Air WB:	**67.0**	F
Entering Air Enthalpy:	**31.44**	BTU/lb
Evaporator Leaving Air DB:	**59.8**	F
Evaporator Leaving Air WB:	**57.8**	F
Evaporator Leaving Air Enthalpy:	**24.90**	BTU/lb
Gross Cooling Capacity:	**88.30**	MBH
Gross Sensible Capacity:	**65.30**	MBH
Compressor Power Input:	**6.12**	kW
Coil Bypass Factor:	**0.070**	

Heating Performance

Heating Airflow:	**3000**	CFM
Entering Air Temp:	**70.0**	F
Leaving Air Temp:	**126.8**	F
Gas Heating Input Capacity:	**180.0 / 224.0**	MBH
Gas Heating Output Capacity:	**147.0 / 184.0**	MBH
Temperature Rise:	**56.8**	F
Thermal Efficiency (%):	**82.0**	

Supply Fan

External Static Pressure:	**1.00**	in wg
Options / Accessories Static Pressure		
Humidi-MiZer Dehumidification System:	**0.18**	in wg
Economizer:	**0.11**	in wg
Total Application Static (ESP + Unit Opts/Acc.):	**1.29**	in wg
Fan RPM:	**941**	
Fan Power:	**2.78**	BHP
NOTE:	**Selected IFM RPM Range: 733 - 949**	

Electrical Data

Voltage Range: **414 - 506**
Compressor #1 RLA: **6.1**
Compressor #1 LRA: **41**
Compressor #2 RLA: **6.1**
Compressor #2 LRA: **41**
Indoor Fan Motor Type: **MED**
Indoor Fan Motor FLA: **4.2**
Combustion Fan Motor FLA (ea): **0.25**
Power Supply MCA: **22**
Power Supply MOCP (Fuse or HACR): **25**
Disconnect Size FLA: **23**
Disconnect Size LRA: **124**
Electrical Convenience Outlet FLA (based on unit line voltage): **2.2**
Outdoor Fan [Qty / FLA (ea)]: **2 / 0.8**
NOTE: Convenience outlet must be field connected to the line/load side of the unit disconnect per local code.

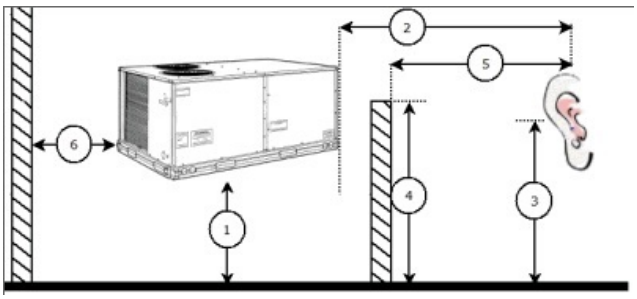
Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

Acoustics

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	99.7	97.1	85.8
125 Hz	92.8	88.8	84.3
250 Hz	81.0	78.3	80.5
500 Hz	73.0	69.2	78.7
1000 Hz	70.8	66.8	76.4
2000 Hz	69.9	61.8	72.7
4000 Hz	70.7	61.6	68.3
8000 Hz	75.0	60.6	65.1
A-Weighted	82.0	77.3	82.0

Advanced Acoustics



Advanced Accoustics Parameters

1. Unit height above ground: **30.0** ft
2. Horizontal distance from unit to receiver: **50.0** ft
3. Receiver height above ground: **5.7** ft
4. Height of obstruction: **0.0** ft
5. Horizontal distance from obstruction to receiver: **0.0** ft
6. Horizontal distance from unit to obstruction: **0.0** ft

Detailed Acoustics Information

Performance Summary For RTU-2

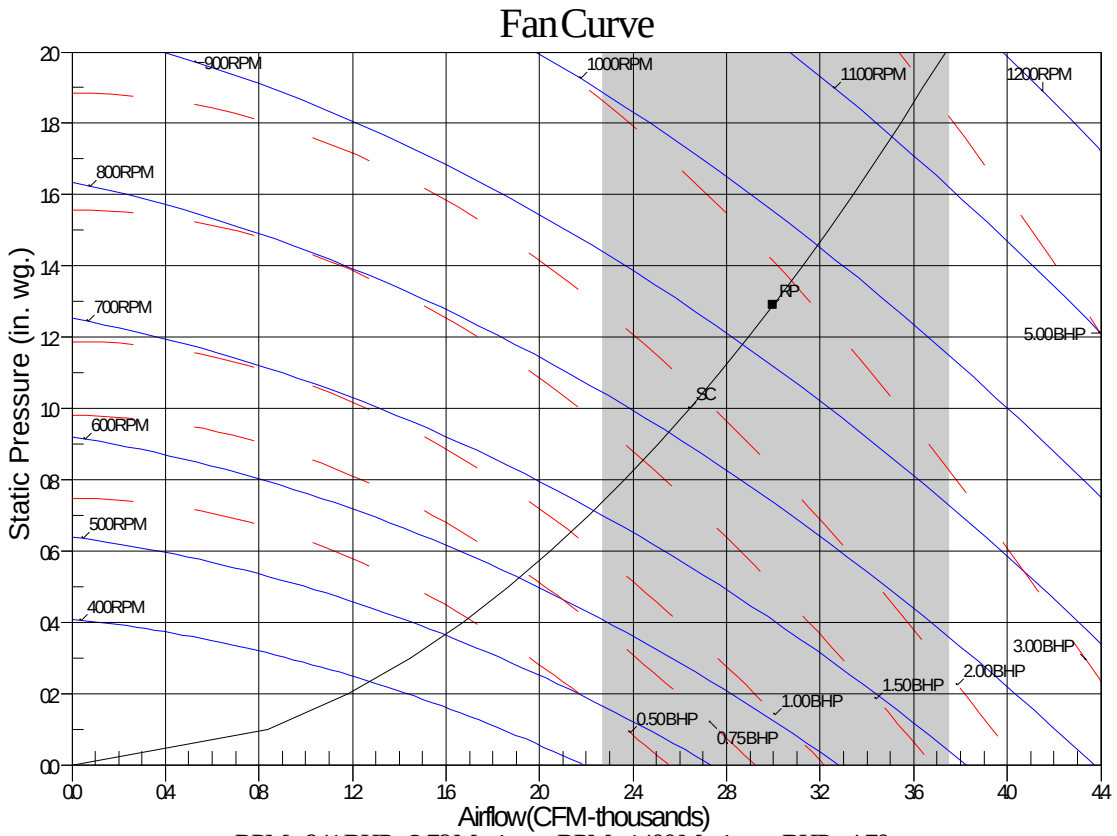
Project: Sturbridge Public Library
Prepared By:

07/26/2017
11:41AM

Octave Band Center Freq. Hz	63	125	250	500	1k	2k	4k	8k	Overall
A	85.8	84.3	80.5	78.7	76.4	72.7	68.3	65.1	89.6 Lw
B	59.6	68.2	71.9	75.5	76.4	73.9	69.3	64.0	81.4 LwA
C	53.4	51.9	48.1	46.3	44.0	40.3	35.9	32.7	57.2 Lp
D	27.2	35.8	39.5	43.1	44.0	41.5	36.9	31.6	49.0 LpA

Legend
A Sound Power Levels at Unit's Acoustic Center, Lw
B A-Weighted Sound Power Levels at Unit's Acoustic Center, LwA
C Sound Pressure Levels at Specific Distance from Unit, Lp
D A-Weighted Sound Pressure Levels at Specific Distance from Unit, LpA

Calculation methods used in this program are patterned after the ASHRAE Guide; other ASHRAE Publications and the AHRI Acoustical Standards. While a very significant effort has been made to insure the technical accuracy of this program, it is assumed that the user is knowledgeable in the art of system sound estimation and is aware of the tolerances involved in real world acoustical estimation. This program makes certain assumptions as to the dominant sound sources and sound paths which may not always be appropriate to the real system being estimated. Because of this, no assurances can be offered that this software will always generate an accurate sound prediction from user supplied input data. If in doubt about the estimation of expected sound levels in a space, an Acoustical Engineer or a person with sound prediction expertise should be consulted.



RPM=941 BHP=2.78 Maximum RPM=1400 Maximum BHP=4.70
Note: Please contact application engineering for selections outside the shaded region.
SC-System Curve RP-Rated Point