

**City of Portland, Maine - Building or Use Permit Application**

389 Congress Street, 04101 Tel: (207) 874-8703, Fax: (207) 874-8716

Permit No: 09-1029	Issue Date:	CBL: 046 D022001
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Location of Construction: 645 CONGRESS ST	Owner Name: BAYSIDE MAINE LLC	Owner Address: 477 CONGRESS ST STE 1012	Phone:
Business Name:	Contractor Name: P & P Plumbing Heating Gas	Contractor Address: 24 Caddie Lane Portland	Phone 2077973100
Lessee/Buyer's Name	Phone:	Permit Type: HVAC	Zone: B-3

Past Use: Commercial - Mixed Use	Proposed Use: Commercial - Mixed Use - Install MOD CON Boilers & York R.T.O	Permit Fee: \$5,160.00	Cost of Work: \$514,000.00	CEO District: 2
		FIRE DEPT: <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Denied * See Conditions	INSPECTION: Use Group: R2/M Type: HUAZ IMG-2003 Signature: JMB 10/29/09	

Proposed Project Description: Install MOD CON Boilers & York R.T.O	Signature:	Signature:
PEDESTRIAN ACTIVITIES DISTRICT (P.A.D.)		
Action: <input type="checkbox"/> Approved <input type="checkbox"/> Approved w/Conditions <input type="checkbox"/> Denied		
Signature: _____ Date: _____		

Permit Taken By: gg	Date Applied For: 09/24/2009	<b>Zoning Approval</b>
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<p>1. This permit application does not preclude the Applicant(s) from meeting applicable State and Federal Rules.</p> <p>2. Building permits do not include plumbing, septic or electrical work.</p> <p>3. Building permits are void if work is not started within six (6) months of the date of issuance. False information may invalidate a building permit and stop all work..</p>	<p><b>Special Zone or Reviews</b></p> <p><input type="checkbox"/> Shoreland</p> <p><input type="checkbox"/> Wetland</p> <p><input type="checkbox"/> Flood Zone</p> <p><input type="checkbox"/> Subdivision</p> <p><input type="checkbox"/> Site Plan</p> <p>Maj <input type="checkbox"/> Minor <input type="checkbox"/> MM <input type="checkbox"/></p> <p>Date: </p>	<p><b>Zoning Appeal</b></p> <p><input type="checkbox"/> Variance</p> <p><input type="checkbox"/> Miscellaneous</p> <p><input type="checkbox"/> Conditional Use</p> <p><input type="checkbox"/> Interpretation</p> <p><input type="checkbox"/> Approved</p> <p><input type="checkbox"/> Denied</p> <p>Date: _____</p>	<p><b>Historic Preservation</b></p> <p><input type="checkbox"/> Not in District or Landmark</p> <p><input type="checkbox"/> Does Not Require Review</p> <p><input type="checkbox"/> Requires Review</p> <p><input type="checkbox"/> Approved</p> <p><input type="checkbox"/> Approved w/Conditions</p> <p><input type="checkbox"/> Denied</p> <p>Date: </p> <p>Any exterior work requires a separate review &amp; approval</p>
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**CERTIFICATION**

I hereby certify that I am the owner of record of the named property, or that the proposed work is authorized by the owner of record and that I have been authorized by the owner to make this application as his authorized agent and I agree to conform to all applicable laws of this jurisdiction. In addition, if a permit for work described in the application is issued, I certify that the code official's authorized representative shall have the authority to enter all areas covered by such permit at any reasonable hour to enforce the provision of the code(s) applicable to such permit.

**PERMIT ISSUED**

SIGNATURE OF APPLICANT	ADDRESS	DATE	PHONE
		OCT 29 2009	
RESPONSIBLE PERSON IN CHARGE OF WORK, TITLE		DATE	PHONE
			City of Portland

**City of Portland, Maine - Building or Use Permit**

389 Congress Street, 04101 Tel: (207) 874-8703, Fax: (207) 874-8716

<b>Permit No:</b> 09-1029	<b>Date Applied For:</b> 09/24/2009	<b>CBL:</b> 046 D022001
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<b>Location of Construction:</b> 645 CONGRESS ST	<b>Owner Name:</b> BAYSIDE MAINE LLC	<b>Owner Address:</b> 477 CONGRESS ST STE 1012	<b>Phone:</b>
<b>Business Name:</b>	<b>Contractor Name:</b> P & P Plumbing Heating Gas	<b>Contractor Address:</b> 24 Caddie Lane Portland	<b>Phone</b> (207) 797-3100
<b>Lessee/Buyer's Name</b>	<b>Phone:</b>	<b>Permit Type:</b> HVAC	

<b>Proposed Use:</b> Commercial - Mixed Use - Install MOD CON Boilers & York R.T.O	<b>Proposed Project Description:</b> Install MOD CON Boilers & York R.T.O
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<b>Dept:</b> Zoning	<b>Status:</b> Approved	<b>Reviewer:</b> Marge Schmuckal	<b>Approval Date:</b> 09/25/2009
<b>Note:</b>	<b>Ok to Issue:</b> <input checked="" type="checkbox"/>		
<b>Dept:</b> Building	<b>Status:</b> Approved with Conditions	<b>Reviewer:</b> Jeanine Bourke	<b>Approval Date:</b>
<b>Note:</b>	<b>Ok to Issue:</b> <input type="checkbox"/>		
1) All penetrations through rated assemblies must be protected by an approved firestop system installed in accordance with ASTM 814 or UL 1479, per IBC 2003 Section 712.			
2) Installation shall comply with the 2003 International Mechanical Code Section 607 for smoke or fire dampers or combination F/S dampers including actuation and access panels.			
<b>Dept:</b> Fire	<b>Status:</b> Approved with Conditions	<b>Reviewer:</b> Capt Keith Gautreau	<b>Approval Date:</b> 10/13/2009
<b>Note:</b>	<b>Ok to Issue:</b> <input checked="" type="checkbox"/>		
1) Install shall comply with all manufacture's specifications.			
2) Install shall comply with NFPA 54. A compliance letter is required			

PERMIT ISSUED

OCT 29 2009

City of Portland



FILL IN AND SIGN WITH INK

PERMIT ISSUED

# APPLICATION FOR PERMIT HEATING OR POWER EQUIPMENT

OCT 29 2009

City of Portland

To the INSPECTOR OF BUILDINGS, PORTLAND, ME.

The undersigned hereby applies for a permit to install the following heating, cooking or power equipment in accordance with the Laws of Maine, the Building Code of the City of Portland, and the following specifications:

Location / CBL 645 CONGRESS STREET Use of Building RESIDENTIAL Date SEPT 23, 09  
Name and address of owner of appliance BAYSIDE MAINE LLC

Installer's name and address P&P Plumbing HEATING GAS  
24 CADDIS LANE, PORTLAND, ME 04103 Telephone 207-797-3100

**Location of appliance:**

- Basement
- Attic
- Floor
- Roof

**Type of Fuel:**

- Gas
- Oil
- Solid

Appliance Name: MOD CON Boilers YORK RTU.

U.L. Approved  Yes  No

Will appliance be installed in accordance with the manufacture's installation instructions?  Yes  No

IF NO Explain: \_\_\_\_\_

**The Type of License of Installer:**

- Master Plumber # M590008367
- Solid Fuel # \_\_\_\_\_
- Oil # \_\_\_\_\_
- Gas # PNT2534
- Other \_\_\_\_\_

**Type of Chimney:**

- Masonry Lined  
Factory built \_\_\_\_\_
- Metal  
Factory Built U.L. Listing # \_\_\_\_\_
- Direct Vent  
Type \_\_\_\_\_ UL# \_\_\_\_\_

**Type of Fuel Tank**

- Oil
- Gas

Size of Tank \_\_\_\_\_

Number of Tanks \_\_\_\_\_

Distance from Tank to Center of Flame \_\_\_\_\_ feet.

Cost of Work: \$ 514,000

Permit Fee: \$ 5,160

Dept. of Building Inspections  
City of Portland Maine  
NARRAN  
SEP 24 2009

RECEIVED

Approved

Fire: \_\_\_\_\_  
Ele.: \_\_\_\_\_  
Bldg.: \_\_\_\_\_

Approved with Conditions

- See attached letter or requirement

Signature of Installer [Signature] / P&P Plumbing HEATING GAS Inspector's Signature \_\_\_\_\_ Date Approved \_\_\_\_\_

White - Inspection Yellow - File Pink - Applicant's Gold - Assessor's Copy



# Small Sunline

ZJ - 13 SEER Single Pkg. R-410A AC

Date: 8/20/2009 Page: 3

Order No:

Project Name: 645 congress

Model #: ZJ048N06U1AAA1

Quantity: 1 Tag #:

System: ZJ048N06U1AAA1

### Cooling Performance

Total capacity	49.0 MBH
Sensible capacity	36.2 MBH
Refrigerant type	R410A
Seasonal Efficiency (at ARI)	13.00 SEER
Efficiency (at ARI)	11.00 EER
Ambient DB temp.	95 °F
Entering DB temp.	80 °F
Entering WB temp.	67 °F
Leaving DB temp.	59.1 °F
Leaving WB temp.	57.4 °F
Power input (w/o blower)	3.60 kW
Sound power	80 dB(A)

### Heating Performance

Entering DB temp.	60 °F
Heating output capacity (Max)	59 MBH
Heating input capacity (Max)	75 MBH
Leaving DB temp.	94.1 °F
Air temp. rise	34.1 °F
AFUE	80.9 %
SSE	81.6 %
Stages	1

### Supply Air Blower Performance

Supply air	1600 CFM
Ext. static pressure	0.6 IWG
Unit static resistance	0.11 IWG
Blower speed	1030 RPM
Duct location	Bottom
Motor rating	1.50 HP
Actual required BHP	0.83 HP
Power input	0.78 kW
Elevation	0 ft.
Drive type	BELT

### Electrical Data

Power supply	230-1-60
Min circuit ampacity	36.30 Amps
Max over-current protection	45 Amps

### Dimensions & Weight

Hgt	33 in.	Len	83 in.	With	45 in.
Weight with factory installed options	690 lbs.				

### Clearances

Right	24 in.	Front	32 in.	Back	36 in.
Top	72 in.	Bottom	0 in.	Left	36 in.



Made in USA



### 4 Ton

- YORK Sunline units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

### STANDARD FEATURES

- Unit Cabinet Constructed of Powder Painted Steel, Certified At 1000 Hours Salt Spray Test (ASTM B-117 Standards).
- Scroll Compressor
- Through-the-Curb and Through-The-Base electrical and gas connections
- Ships with 1" throwaway filter, designed to accept 2" filters
- Either supply and/or return can be field converted from vertical to horizontal configuration without cutting panels.
- Full perimeter base rails with built in rigging capabilities.
- Liquid line filter-driers
- Single point power connection

### Standard Unit Controller: (Simplicity® Control Board)

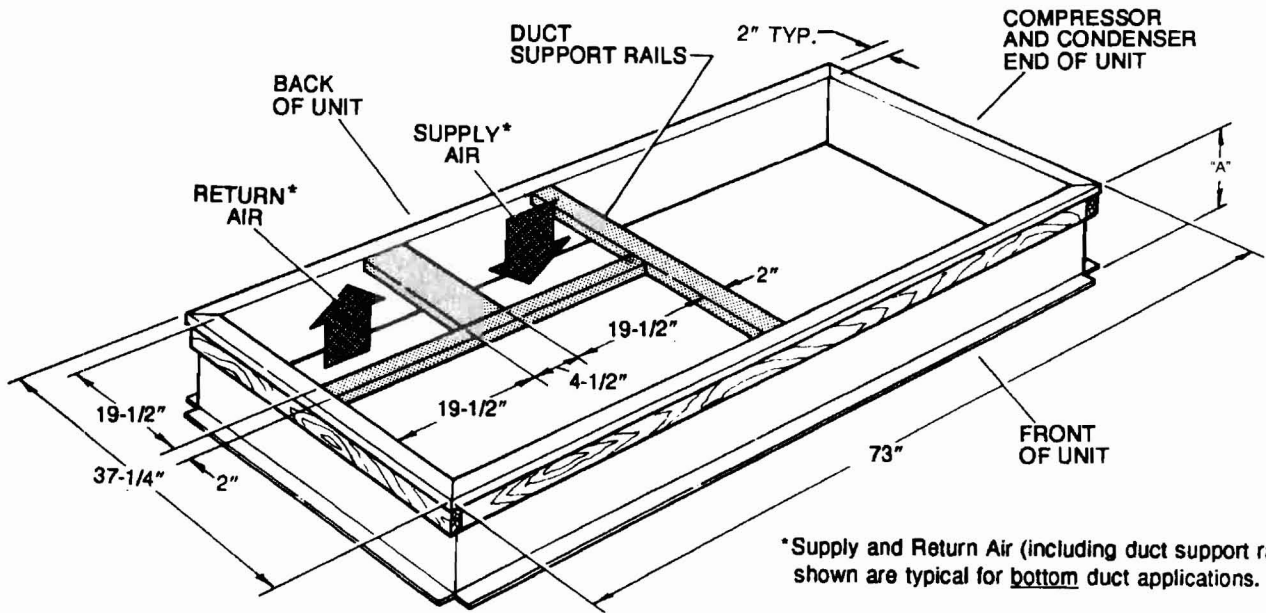
- An integrated low-ambient control, anti-short cycle protection, lead-lag, fan on and fan off delays, low voltage protection, on-board diagnostic and fault code display.
- Safety Monitoring - Monitors the high and low-pressure switches, the freezestats, the gas valve, if applicable, and the temperature limit switch on gas and electric heat units. The unit control board will alarm on ignition failures, safety lockouts and repeated limit switch trips.

### WARRANTY

- One (1) Year Limited Warranty on the Complete Unit.
- Five (5) Year Warranty - Compressors and Electric Heater Elements.
- Ten (10) Year Warranty - Aluminized and Stainless Steel Tubular Heat Exchangers.

JOB NAME \_\_\_\_\_ 645 CONGRESS ST LOCATION \_\_\_\_\_  
 PURCHASER \_\_\_\_\_ ORDER NO. \_\_\_\_\_  
 ENGINEER \_\_\_\_\_  
 SUBMITTED TO \_\_\_\_\_ FOR: Reference Approval Construction  
 SUBMITTED BY \_\_\_\_\_ DATE \_\_\_\_\_

UNIT DESIGNATION: Schedule No. \_\_\_\_\_ MODEL NO. \_\_\_\_\_



\*Supply and Return Air (including duct support rails) shown are typical for bottom duct applications.

For location of horizontal duct applications (on back of unit), refer to Unit Dimension details.

DUCT SIZE:  
 Supply Air = 19" x 19"  
 Return Air = 19" x 19"

MODEL	DIMENSION "A"
1RC0465	8"
1RC0434	14"

- NOTE:
1. Roof curb is built to NRCA standards.
  2. Roof curb is constructed of 18 gauge G90 steel.
  3. Unit duct supports are provided.
  4. Full perimeter 4 wood nailer.
  5. Curbs are shipped unassembled.
  6. Corner hinge pins are used for assembly.

Suggested roof opening; 43 1/2" long x 33 1/4" wide.

Refer to price pages for other details.

Subject to change without notice. Printed in the U. S. A.

**ROOF CURB**  
**MODELS: 1RC0434 AND 1RC0465**  
 (FOR SUNLINE SERIES 3 THRU 6 TON SINGLE PACKAGE ROOFTOP MODELS)

FORM 530.22-SD10Y (297)  
 Supersedes: Nothing



## Hot Water Performance Data

## Steam Performance Data

Model No.	Output BTU/HR*	GPM	Final Air °F	Prsr. Drop FT./H <sub>2</sub> O	Motor HP	RPM	Nominal CFM	Outlet FPM	Nom. Amps @ 115VAC†	Sound Rating
HB-108A	8,030	.80	91	.80	16 Watt	1550	245	250	.80	II
	6,800		90			1350	210	215	.80	I
HB-118A	18,400	1.9	94	2.2	16 Watt	1550	500	500	.80	II
	15,650		96			1350	420	420	.80	I
HB-125A	24,800	2.5	102	2.2	25 Watt	1550	580	590	1.2	II
	21,230		106			1350	460	450	1.2	I
HB-136A	35,900	3.6	99	3.0	1/20	1000	850	550	1.4	II
	32,300		100			900	750	480	1.4	I
HB-18	13,050	1.3	95	.005	16 Watt	1550	395	395	.80	II
	11,725		99			1350	350	350	.80	I
HB-24	17,400	1.8	96	.014	16 Watt	1550	450	450	.80	II
	15,600		98			1350	380	380	.80	I
HB-36	26,100	2.7	103	.09	25 Watt	1550	550	550	1.2	II
	23,500		103			1350	480	480	1.2	I
HB-48	34,800	3.5	103	.12	1/20	1000	750	550	1.4	II
	31,300		111			900	630	460	1.4	I
HB-60	43,600	4.4	105	.17	1/20	1000	900	650	1.4	II
	39,200		112			900	768	540	1.4	I
HB-72	52,300	5.3	104	.23	1/20	1000	1100	800	1.4	II
	47,000		106			900	950	700	1.4	I
HB-84	61,000	6.1	100	.24	1/12	1000	1400	900	2.2	III
	54,900		106			900	1100	750	2.2	II
HB-96	69,700	7.0	106	.29	1/12	1000	1400	930	2.2	III
	62,700		113			900	1100	800	2.2	II
HB-108	78,400	7.9	100	.36	1/12	1000	1800	1000	2.2	III
	70,500		103			900	1500	900	2.2	II
HB-120	87,100	8.8	102	.39	1/3	1140	1900	900	4.5	III
	95,800	9.6	104	.41	1/3	1140	2000	950	4.5	IV
HB-144	104,000	10.4	104	.43	1/3	1140	2200	1000	4.5	IV
	113,000	11.3	100	.53	1/3	1140	2600	1150	4.5	IV
HB-180	118,000	11.8	110	.60	1/3	1140	2200	800	4.5	III
	148,100	14.9	107	.79	1/3	1140	2900	1000	4.5	IV
HB-204	174,000	17.4	106	1.06	1/3	1140	3500	900	4.5	IV
	209,100	21.0	106	1.33	1/2	1100	4200	980	5.4	IV
HB-240	230,000	23.0	102	2.1	1/2	1100	5000	700	5.4	IV
	261,300	26.2	103	2.1	1/2	1100	5500	1000	5.4	IV

Performance based on 200° EWT, 60° E.A.T., 20° TD.

\* For the lower output, an optional Speed Controller must be ordered.

† Stated AMP is full load (FLA). AMP draw varies by motor manufacturer ± .2 AMPS.

Model No.	Output BTU/HR*	Cond. lbs./hr.	Sq. Ft. E.D.R.	Final Air °F	Motor HP	RPM	Nominal CFM	Outlet FPM	Nom. Amps @ 115VAC†	Nom. Fan Diam. (Inches)
HB-18	18,000	18.0	75	102	16 Watt	1550	395	395	.80	9
	16,200	16.2	68	105		1350	330	330	.80	9
HB-24	24,000	24.5	100	109	16 Watt	1550	450	450	.80	10
	21,600	22.0	90	112		1350	380	380	.80	10
HB-36	36,000	37.0	150	119	25 Watt	1550	550	550	1.2	10
	32,400	33.0	135	120		1350	480	480	1.2	10
HB-48	48,000	49.0	200	119	1/20	1000	750	550	1.4	12
	43,200	44.0	180	123		900	630	460	1.4	12
HB-60	60,000	61.0	250	121	1/20	1000	900	650	1.4	12
	54,000	55.0	225	131		900	700	510	1.4	12
HB-72	72,000	73.0	300	120	1/20	1000	1100	800	1.4	14
	64,800	66.0	270	123		900	950	700	1.4	14
HB-84	84,000	85.0	350	115	1/12	1000	1400	900	2.2	14
	75,600	76.0	315	123		900	1100	750	2.2	14
HB-96	96,000	97.0	400	123	1/12	1000	1400	930	2.2	16
	86,400	88.0	360	132		900	1100	800	2.2	16
HB-108	108,000	110.0	450	115	1/12	1000	1800	1000	2.2	16
	97,200	98.0	405	120		900	1500	900	2.2	16
HB-120	120,000	122.0	500	118	1/12	1140	1900	900	4.5	18
	132,000	134.0	550	121	1/3	1140	2000	950	4.5	18
HB-144	144,000	146.0	600	120	1/3	1140	2200	1000	4.5	18
	156,000	160.0	650	115	1/3	1140	2600	1150	4.5	18
HB-180	180,000	190.0	770	135	1/3	1140	2200	800	4.5	18
	204,000	208.0	850	124	1/3	1140	2900	1000	4.5	18
HB-204	240,000	244.0	1000	123	1/3	1140	3500	900	4.5	20
	280,000	280.0	1100	121	1/2	1100	4200	980	5.4	20
HB-240	300,000	310.0	1250	117	1/2	1100	5000	700	5.4	24
	360,000	366.0	1500	120	1/2	1100	5500	1000	5.4	24

Performance based on 2# steam pressure at heater with air entering @ 60°F.

Maximum working pressure 150 PSI, 366°F

\* For the lower output, an optional Speed Controller must be ordered.

† Stated AMP is full load (FLA). AMP draw varies by motor manufacturer ± .2 AMPS.

645 CONGRESS ST

# Horizontal Unit Heaters

## Motor Characteristics

### TOTALLY ENCLOSED MOTOR TYPE

HB Unit Model No.	AMP	MCA	HP	RPM
<b>115/1/60</b>				
18, 24, 108A, 118A	0.8	1	16W*	1550
136A	1.4	1.8	1/20*	1000
36, 125A	1.2	1.5	25W*	1550
48, 60, 72	1.4	1.8	1/20*	1000
84, 96, 108	2.2	2.8	1/12*	1000
120, 132, 144, 156, 180, 204, 240	4.5	5.6	1/3	1140
280, 300, 360	5.4	6.8	1/2	1100
<b>230/1/60</b>				
18, 24, 108A, 118A	0.4	0.5	16W	1550
136A	1.4	1.8	1/20†	1000
36, 125A	0.6	0.8	25W	1550
48, 60, 72	1.4	1.8	1/20†	1000
84, 96, 108	2.2	2.8	1/12†	1000
120, 132, 144, 156, 180, 204, 240	4.5	5.6	1/3†	1140
280, 300, 360	5.4	6.8	1/2†	1100
<b>208-230/460/3/60</b>				
48, 60, 72, 84, 96, 108, 120, 132, 144, 156, 180, 204, 240, 280, 300, 360	2.6-2.6/1.3	3.3-3.3/1.6	1/2**	1140

\*Optional variable speed switch is available.

\*\*These motors are without thermal overload protection

NOTE 1: All motors are constant speed and operate at top speed as indicated in motor data. Models 18 through 108, including 108A, 118A, 125A and 136A can be run at reduced speed with addition of optional variable speed switch. This switch is factory-calibrated for low and high speed ratings, with intermediate speeds infinitely controllable. Models 120 through 360 operate at constant speed as indicated in motor data. All 1/4 H.P. motors are P.S.C.

NOTE 2: Motors under 1/3 H.P. are totally enclosed, frame mounted, 115/1/60 with thermal overload protection and permanently lubricated sleeve bearings with optional speed controller available. 1/3 H.P. (115/1/60) motors are open frame constant speed with thermal over-load protection and ball bearings. 1/3 H.P. (230V) and 1/2 H.P. (230V) motors are open frame constant speed with thermal overload protection and ball bearings.

### EXPLOSION PROOF WITH THERMAL OVERLOAD MOTOR TYPE

HB Unit Model No.	AMP	MCA	HP	RPM
<b>115/1/60</b>				
48, 60, 72, 84, 96, 108, 120, 132	3.7	4.6	1/6	1140
144, 156, 180, 204	5.4	6.8	1/4	1140
240, 280, 300	7.4	9.3	1/3***	1140
360	7.4	9.3	1/2***	1140
<b>230/1/60</b>				
48, 60, 72, 84, 96, 108, 120, 132	3.7	4.6	1/6†	1140
144, 156, 180, 204	5.4	6.8	1/4†	1140
240, 280, 300	3.7	4.7	1/3***	1140
360	3.7	4.7	1/2***	1140
<b>230/460/3/60</b>				
144, 156, 180, 204, 240, 280, 300, 360	2.2/1.1	2.8/1.4	1/3	1140

\*\*\*These motors are 115/230 volts.

†230/1/60 unit has 115/1/60 motor supplied with field installed stepdown transformer.

NOTE 3: 1/3 and 1/2 H.P. motors are available as 230V single and 3 phase in open frame and explosion-proof housings, all available as options. 1/3 and 1/2 H.P. motors operate at single speed only.

NOTE 4: Stated AMP draw is Full Load Amp (FLA). AMP draw varies by motor manufacturer ± .2 AMPS. Verify FLA per unit motor data plate.

**CAUTION: Select appropriate AMP and MCA for the multiple voltage motors. For example, the AMP and MCA for Models 360 with a 460 volt Totally Enclosed motor is 1.3 and 1.6 respectively.**

## Hot Water Performance Data

Model No.	Output BTU/HR*	GPM	Final Air °F	Prsr. Drop FT./H <sub>2</sub> O	Motor HP	RPM	Nominal CFM	Outlet FPM	Nom. Amps @ 115VAC†	Sound Rating
HB-108A	8,030	.80	91	.80	16 Watt	1550	245	250	.80	II
	6,800		90			1350	210	215	.80	I
HB-118A	18,400	1.9	94	2.2	16 Watt	1550	500	500	.80	II
	15,650		96			1350	420	420	.80	I
HB-125A	24,800	2.5	102	2.2	25 Watt	1550	580	590	1.2	II
	21,230		106			1350	460	450	1.2	I
HB-136A	35,900	3.6	99	3.0	1/20	1000	850	550	1.4	II
	32,300		100			900	750	480	1.4	I
HB-18	13,050	1.3	95	.005	16 Watt	1550	395	395	.80	II
	11,725		99			1350	350	350	.80	I
HB-24	17,400	1.8	96	.014	16 Watt	1550	450	450	.80	II
	15,600		98			1350	380	380	.80	I
HB-36	26,100	2.7	103	.09	25 Watt	1550	550	550	1.2	II
	23,500		103			1350	480	480	1.2	I
HB-48	34,800	3.5	103	.12	1/20	1000	750	550	1.4	II
	31,300		111			900	630	460	1.4	I
HB-60	43,600	4.4	105	.17	1/20	1000	900	650	1.4	II
	39,200		112			900	700	510	1.4	I
HB-72	52,300	5.3	104	.23	1/20	1000	1100	800	1.4	II
	47,000		106			900	950	700	1.4	I
HB-84	61,000	6.1	100	.24	1/12	1000	1400	900	2.2	III
	54,900		106			900	1100	750	2.2	II
HB-96	69,700	7.0	106	.29	1/12	1000	1400	930	2.2	III
	62,700		113			900	1100	800	2.2	II
HB-108	78,400	7.9	100	.36	1/12	1000	1800	1000	2.2	III
	70,500		108			900	1500	900	2.2	II
HB-120	87,100	8.8	102	.39	1/3	1140	1900	900	4.5	III
	—		—			—	—	—	—	—
HB-132	95,800	9.6	104	.41	1/3	1140	2000	950	4.5	IV
	—		—			—	—	—	—	—
HB-144	104,000	10.4	104	.43	1/3	1140	2200	1000	4.5	IV
	—		—			—	—	—	—	—
HB-156	113,000	11.3	100	.53	1/3	1140	2600	1150	4.5	IV
	—		—			—	—	—	—	—
HB-180	118,000	11.8	110	.60	1/3	1140	2200	800	4.5	III
	—		—			—	—	—	—	—
HB-204	148,100	14.9	107	.79	1/3	1140	2900	1000	4.5	IV
	—		—			—	—	—	—	—
HB-240	174,000	17.4	106	1.06	1/3	1140	3500	900	4.5	IV
	—		—			—	—	—	—	—
HB-280	209,100	21.0	106	1.33	1/2	1100	4200	980	5.4	IV
	—		—			—	—	—	—	—
HB-300	230,000	23.0	102	2.1	1/2	1100	5000	700	5.4	IV
	—		—			—	—	—	—	—
HB-360	261,300	26.2	103	2.1	1/2	1100	5500	1000	5.4	IV
	—		—			—	—	—	—	—

Performance based on 200° EWT, 60° E.A.T., 20° TD.

\* For the lower output, an optional Speed Controller must be ordered.

† Stated AMP is full load (FLA). AMP draw varies by motor manufacturer ± .2 AMPS.

## Steam Performance Data

Model No.	Output BTU/HR*	Cond. lbs./hr.	Sq. Ft. E.D.R.	Final Air °F	Motor HP	RPM	Nominal CFM	Outlet FPM	Nom. Amps @ 115VAC†	Nom. Fan Diam. (Inches)
HB-18	18,000	18.0	75	102	16 Watt	1550	395	395	.80	9
	16,200	16.2	68	105		1350	330	330	.80	9
HB-24	24,000	24.5	100	109	16 Watt	1550	450	450	.80	10
	21,600	22.0	90	112		1350	380	380	.80	10
HB-36	36,000	37.0	150	119	25 Watt	1550	550	550	1.2	10
	32,400	33.0	135	120		1350	480	480	1.2	10
HB-48	48,000	49.0	200	119	1/20	1000	750	550	1.4	12
	43,200	44.0	180	123		900	630	460	1.4	12
HB-60	60,000	61.0	250	121	1/20	1000	900	650	1.4	12
	54,000	55.0	225	131		900	700	510	1.4	12
HB-72	72,000	73.0	300	120	1/20	1000	1100	800	1.4	14
	64,800	66.0	270	123		900	950	700	1.4	14
HB-84	84,000	85.0	350	115	1/12	1000	1400	900	2.2	14
	75,600	76.0	315	123		900	1100	750	2.2	14
HB-96	96,000	97.0	400	123	1/12	1000	1400	930	2.2	16
	86,400	88.0	360	132		900	1100	800	2.2	16
HB-108	108,000	110.0	450	115	1/12	1000	1800	1000	2.2	16
	97,200	98.0	405	120		900	1500	900	2.2	16
HB-120	120,000	122.0	500	118	1/3	1140	1900	900	4.5	18
	—	—	—	—		—	—	—	—	—
HB-132	132,000	134.0	550	121	1/3	1140	2000	950	4.5	18
	—	—	—	—		—	—	—	—	—
HB-144	144,000	146.0	600	120	1/3	1140	2200	1000	4.5	18
	—	—	—	—		—	—	—	—	—
HB-156	156,000	160.0	650	115	1/3	1140	2600	1150	4.5	18
	—	—	—	—		—	—	—	—	—
HB-180	180,000	190.0	770	135	1/3	1140	2200	800	4.5	18
	—	—	—	—		—	—	—	—	—
HB-204	204,000	208.0	850	124	1/3	1140	2900	1000	4.5	18
	—	—	—	—		—	—	—	—	—
HB-240	240,000	244.0	1000	123	1/3	1140	3500	900	4.5	20
	—	—	—	—		—	—	—	—	—
HB-280	280,000	280.0	1100	121	1/2	1100	4200	980	5.4	20
	—	—	—	—		—	—	—	—	—
HB-300	300,000	310.0	1250	117	1/2	1100	5000	700	5.4	24
	—	—	—	—		—	—	—	—	—
HB-360	360,000	366.0	1500	120	1/2	1100	5500	1000	5.4	24
	—	—	—	—		—	—	—	—	—

Performance based on 2# steam pressure at heater with air entering @ 60°F.  
Maximum working pressure 150 PSI, 366°F

\* For the lower output, an optional Speed Controller must be ordered.

† Stated AMP is full load (FLA). AMP draw varies by motor manufacturer ± .2 AMPS.

845 CONGRESS ST



# Horizontal Unit Heaters

## Motor Characteristics

### TOTALLY ENCLOSED MOTOR TYPE

HB Unit Model No.	AMP	MCA	HP	RPM
<b>115/1/60</b>				
18, 24, 108A, 118A	0.8	1	16W*	1550
136A	1.4	1.8	1/20*	1000
36, 125A	1.2	1.5	25W*	1550
48, 60, 72	1.4	1.8	1/20*	1000
84, 96, 108	2.2	2.8	1/12*	1000
120, 132, 144, 156, 180, 204, 240	4.5	5.6	1/3	1140
280, 300, 360	5.4	6.8	1/2	1100
<b>230/1/60</b>				
18, 24, 108A, 118A	0.4	0.5	16W	1550
136A	1.4	1.8	1/20†	1000
36, 125A	0.6	0.8	25W	1550
48, 60, 72	1.4	1.8	1/20†	1000
84, 96, 108	2.2	2.8	1/12†	1000
120, 132, 144, 156, 180, 204, 240	4.5	5.6	1/3†	1140
280, 300, 360	5.4	6.8	1/2†	1100
<b>208-230/460/3/60</b>				
48, 60, 72, 84, 96, 108, 120, 132, 144, 156, 180, 204, 240, 280, 300, 360	2.6-2.6/1.3	3.3-3.3/1.6	1/2**	1140

\*Optional variable speed switch is available.

\*\*These motors are without thermal overload protection

NOTE 1: All motors are constant speed and operate at top speed as indicated in motor data. Models 18 through 108, including 108A, 118A, 125A and 136A can be run at reduced speed with addition of optional variable speed switch. This switch is factory-calibrated for low and high speed ratings, with intermediate speeds infinitely controllable. Models 120 through 360 operate at constant speed as indicated in motor data. All 1/4 H.P. motors are P.S.C.

NOTE 2: Motors under 1/3 H.P. are totally enclosed, frame mounted, 115/1/60 with thermal overload protection and permanently lubricated sleeve bearings with optional speed controller available. 1/3 H.P. (115/1/60) motors are open frame constant speed with thermal over-load protection and ball bearings. 1/3 H.P. (230V) and 1/2 H.P. (230V) motors are open frame constant speed with thermal overload protection and ball bearings.

### EXPLOSION PROOF WITH THERMAL OVERLOAD MOTOR TYPE

HB Unit Model No.	AMP	MCA	HP	RPM
<b>115/1/60</b>				
48, 60, 72, 84, 96, 108, 120, 132	3.7	4.6	1/6	1140
144, 156, 180, 204	5.4	6.8	1/4	1140
240, 280, 300	7.4	9.3	1/3***	1140
360	7.4	9.3	1/2***	1140
<b>230/1/60</b>				
48, 60, 72, 84, 96, 108, 120, 132	3.7	4.6	1/6†	1140
144, 156, 180, 204	5.4	6.8	1/4†	1140
240, 280, 300	3.7	4.7	1/3***	1140
360	3.7	4.7	1/2***	1140
<b>230/460/3/60</b>				
144, 156, 180, 204, 240, 280, 300, 360	2.2/1.1	2.8/1.4	1/3	1140

\*\*\*These motors are 115/230 volts.

†230/1/60 unit has 115/1/60 motor supplied with field installed stepdown transformer.

NOTE 3: 1/3 and 1/2 H.P. motors are available as 230V single and 3 phase in open frame and explosion-proof housings, all available as options. 1/3 and 1/2 H.P. motors operate at single speed only.

NOTE 4: Stated AMP draw is Full Load Amp (FLA). AMP draw varies by motor manufacturer  $\pm$  .2 AMPS. Verify FLA per unit motor data plate.

**CAUTION: Select appropriate AMP and MCA for the multiple voltage motors. For example, the AMP and MCA for Models 360 with a 460 volt Totally Enclosed motor is 1.3 and 1.6 respectively.**

# CABINET UNIT HEATERS RATINGS AND SPECIFICATIONS

TABLE I

ENTERING WATER - 200°  
ENTERING AIR - 60°

UNIT SIZE		02	03	04	06	08	10	12	14
HEATING CAP - HOT WATER									
20' WTD	MBH	16.4	22.8	29.8	48.0	54.5	62.0	75.6	78.5
	GPM	1.64	2.28	2.98	4.80	5.46	6.20	7.56	7.85
HIGH CAP - COIL 2 ROW									
HEATING CAP	MBH	25.8	35.4	46.3	69.8	87.6	101.8	119.8	128.6
HOT WATER	GPM	2.58	3.54	4.63	6.98	8.76	10.18	11.98	12.86
20' WTD									
HEATING CAP - STEAM									
2 PSIG	MBH	22.6	31.4	41.0	66.1	75.1	85.4	104.1	108.2
STANDARD	EDR	94	131	171	276	313	356	434	451
COIL	COND LB/HR	23.4	32.5	42.4	68.4	77.7	88.4	107.7	112
COIL									
NUMBER FINS PER INCH		12	12	12	12	12	12	12	12
FACE AREA-FT		.97	1.5	1.8	2.6	2.8	3.1	3.6	4.4
COIL CONNECTIONS		1-1/4CU	1-1/4CU	1-1/4CU	1-1/4CU	1-1/4CU	1-1/4CU	1-1/4CU	1-1/4CU
BLOWERS									
NUMBER		1	1	2	2	3	3	4	4
DIAMETER/WIDTH		5-3/4 / 7	5-3/4 / 7	5-3/4 / 7	5-3/4 / 7	5-3/4 / 7	5-3/4 / 7	5-3/4 / 7	5-3/4 / 7
DRIVE		DIRECT	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT
RPM - HI		1050	1050	1050	1050	1050	1050	1050	1050
LOW		875	875	875	875	875	875	875	875
CFM									
HIGH		230	335	430	630	860	1060	1230	1410
LOW		185	270	345	505	685	845	985	1130
MOTOR									
H.P.		1/15	1/15	1/10	1/10	1 @ 1/10 1 @ 1/15	1 @ 1/10 1 @ 1/15	1/10	1/10
VOLTS/PHASE/HERTZ									
NUMBER		1	1	1	1	2	2	2	2
AMPERES		115/1/60	115/1/60	115/1/60	115/1/60	115/1/60	115/1/60	115/1/60	115/1/60
CONTROLS - STD		VAR.	VAR.	VAR.	VAR.	VAR.	VAR.	VAR.	VAR.
FILTER									
NO		1	1	1	1	1	1	1	1
TYPE		PERM.	PERM.	PERM.	PERM.	PERM.	PERM.	PERM.	PERM.
LENGTH		19-3/4	27-3/4	31-3/4	43-3/4	45-3/4	50-3/4	57-3/4	69-3/4
WIDTH		8-11/16	8-11/16	8-11/16	8-11/16	8-11/16	8-11/16	8-11/16	8-11/16
THICKNESS		1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
RIB LEVEL 18" FROM UNIT									
LENGTH		50	52	53	54	55	55	56	56
HEIGHT		35	43	47	59	61	66	73	85
DEPTH		25	25	25	25	25	25	25	25
		9-1/2	9-1/2	9-1/2	9-1/2	9-1/2	9-1/2	9-1/2	9-1/2

## FILTER IDENTIFICATION AND DATA

SIZE	PART NO.	FILTER SIZE
02	PC1297-2	15/32" x 8 11/16" x 19 3/4"
03	PC1297-3	15/32" x 8 11/16" x 27 3/4"
04	PC1297-4	15/32" x 8 11/16" x 31 3/4"
06	PC1297-6	15/32" x 8 11/16" x 43 3/4"
08	PC1297-8	15/32" x 8 11/16" x 45 3/4"
10	PC1297-10	15/32" x 8 11/16" x 50 3/4"
12	PC1297-12	15/32" x 8 11/16" x 57 3/4"
14	PC1297-14	15/32" x 8 11/16" x 69 3/4"

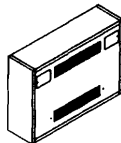
## CABINET UNIT HEATERS

SHIPPING WEIGHT  
(LBS)

	SIZE							
STYLE	02	03	04	06	08	10	12	14
RW	97	115	128	157	175	185	207	234

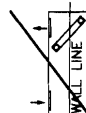
RECESSED WALL

RW

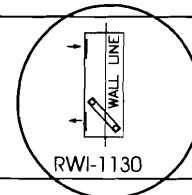


RECESSED WALL  
INVERTED FLOW

RWI



RW-1120



RWI-1130

# SPECIFICATIONS & WARRANTY\*

## \*STANDARD CABINET UNIT ONLY

The contractor shall furnish and install Beacon-Morris Cabinet Unit Heaters as selected to meet or exceed job requirements. The Cabinet Unit Heaters will conform to the items listed below and be certified under CSA guidelines.

### CABINETS

All cabinets will be constructed with 18 gauge electro galvanized steel internal cabinets, side panels and top. The front panel shall be furnished in 16 gauge electro galvanized steel. Adequate work area for installation of control valves or electrical equipment shall be provided on both sides of the internal cabinet.

The cabinet shall be provided with a neutral eggshell baked enamel prime coat as standard. (Available if specified) Powder coated baked enamel, color selected from Beacon-Morris Color Chart.

All cabinets shall be supplied with adjustable rear mounting brackets which will provide adjustment to correct alignment of the unit at installation to non square or out of true walls, joists, studs or surfaces. Adjustable leveling legs (two each base leg) are available when specified.

### RECESSED UNITS

All recessed units shall be supplied with a "Wall Seal" assembly. This assembly shall provide protection to the wall or ceiling construction material. The "Wall Seal" shall be supplied in an eggshell baked enamel prime coat as standard. (When specified) Baked enamel colors may be selected from Beacon-Morris Color Chart.

### CEILING MOUNT OR RECESSED UNITS

All "RC" units shall be supplied with a continuous hinged front panel. The continuous hinge shall provide full swing through 90°. A safety chain shall be provided as standard to prevent the face panel from swinging fully open accidentally. This chain must be easily detached to allow full access for servicing. Speed control switch will be shipped with wiring diagram for installation where desired.

### FILTERS

All filters supplied as standard shall be reusable aluminum media with a 69% arrestance level. Filters shall be slide in type which are locked into position with two cotter pins.

### FANS

Fan wheels shall be centrifugal, forward curved, double width of electro galvanized steel. Fan housings shall be of formed, galvanized sheet metal.

### MOTORS

All motors shall have integral thermal protection and start at 78 per cent of rated voltage. All motors shall be of p.s.c. design and be capable of operating in high static conditions. All motors shall be factory run-tested and assembled in unit prior to shipping.

### ELECTRICAL

All primary internal wiring shall be done at the factory and every unit shall be factory tested for reliability.

### FRESH AIR DAMPERS

When desired specify either of the following:

1. Where noted 25% Manual Outside Air Dampers shall be provided. A manually operated damper quadrant shall provide from 0% to 25% outside air through the use of a single blade damper.

2. Where noted 25% Motorized Outside Air Dampers shall be provided. A synchronous motor (115/60/1) interlocked with the blower shall automatically open the outside air damper when blower starts. The single blade damper shall be adjustable from 0% to 25% outside air. When the blower stops or there is a loss of power, the damper shall return to the closed position. A damper override switch shall be provided to prevent damper operation when desired.

### WARRANTY

The products in this catalog are warranted by Beacon-Morris, to be free from defects in material and workmanship for a period of one (1) year from the date of shipment from Beacon's plant. Beacon's liability under this warranty is limited to replacing or repairing at our option, F.O.B. our plant any defective component or assembly returned to our factory prepaid and with proper return authorization document. All repairs or replacements are made subject to factory inspection. In the interest of product improvement, Beacon-Morris reserves the right to make changes without notification.



260 North Elm Street • Westfield, MA 01085  
 Tel: (413) 562-5423 • Fax: (413) 572-3764  
 www.beacon-morris.com





# Multi-Split Submittal Data:

CTXS09DVJU Indoor Unit  
2MXS18DVJU Outdoor Unit

Job Name: \_\_\_\_\_ Location: \_\_\_\_\_  
 Purchaser: \_\_\_\_\_  
 Engineer: \_\_\_\_\_  
 Submitted To: \_\_\_\_\_ For:  Reference  Approval  Construction  
 Submitted By: \_\_\_\_\_ Date: \_\_\_\_\_  
 Unit Designation: Schedule #: \_\_\_\_\_ Model No.: \_\_\_\_\_

**Capacities & Efficiencies:**

Cooling Capacity 1x 9k (min.- nom.- max.)	5,900 - 9,000 - 9,500 Btu/h
Cooling Capacity 2x 9k (min.- nom.- max.)	7,300 -18,000 - 19,000 Btu/h
Seasonal Energy Efficiency Ratio	SEER 16
Moisture Removal	2.3 Pt/h
Heating Capacity 1x 9k (min.- nom.- max.)	4,100 -11,000 -11,000 Btu/h
Heating Capacity 2x 9k (min.- nom.- max.)	5,300 -22,000 -22,000 Btu/h
Heating Seasonal Performance Factor	HSPF 7.7
<b>Cooling Mode Nominal Conditions:</b>	<b>Heating Mode Nominal Conditions:</b>
Indoor: 80°F DB / 67°F WB	Indoor: 70°F DB / 60°F WB
Outdoor: 95°F DB / 75°F WB	Outdoor: 47°F DB / 43°F WB
Pipe Length: 25 ft	Pipe Length: 25 ft

**Indoor Units (2):**

Power Supply (V/PH/Hz)	208-230/1/60
Cooling Airflow Rate (H/M/L)	388/335/283 cfm
Heating Airflow Rate (H/M/L)	400/357/314 cfm
Running Current (Rated)	0.18 Amps
Weight	20 lbs
Sound Pressure Level at 3.3 ft (H/M/L)	44/40/35 dBA

**Outdoor Unit:**

Power Supply (V/PH/Hz)	208-230/1/60
Cooling Operating Range	14°F – 115°F DB
Heating Operating Range	5°F – 64°F DB
Minimum Circuit Amps (MCA)	12.7 Amps
Maximum Fuse Amps (MFA)	20 Amps
Starting Current	4.2 Amps
Running Current (Cooling/Heating)	7.17 Amps / 8.90 Amps
Weight	139 lbs
Sound Pressure Level at 3.3 ft (H)	51 dBA

**Piping:**

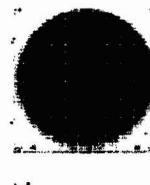
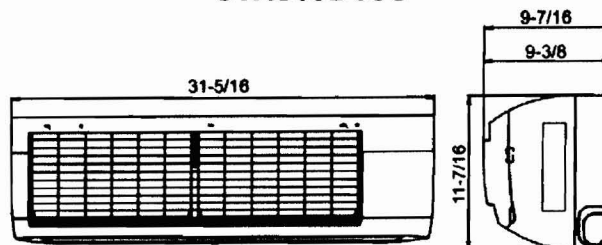
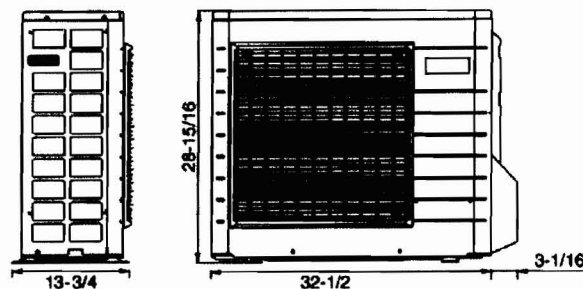
Maximum Height Difference	49 ft
Maximum Length (Per Unit)	164 ft (82 ft)
Minimum Piping Length	9.8 ft
Liquid Piping Connection (OD)	φ1/4"
Gas Piping Connection (OD)	φ3/8"
Condensate Drain Piping Connection (OD)	φ11/16"

**Standard Features:**

Compressor Warranty	7 years
Parts Warranty	5 years
Limited Labor Warranty	1 year
Remote Control	

**Options:**

Air Purifying Filter with Photocatalytic Deodorizing Function	
Centralized Control/Unified On-	

**R-410A****INVERTER****CTXS09DVJU****2MXS18DVJU**

Daikin AC (Americas), Inc. ♦ 1645 Wallace Drive – Suite 110 ♦ Carrollton, TX 75006

SDS CTXS09DVJU\_2MXS18DVJU 04-07

www.daikinac.com

(Daikin's products are subject to continuous improvements. Daikin reserves the right to modify product design, specifications and information in this data sheet without notice and without incurring any obligations)



# Latitude

York - TCGD 012 - 060 13 SEER Split Sys A/C

Date: 8/20/2009

Page: 5

Order No:

Project Name: 645 congress

Model #: TCGD18S41S1

Quantity: 1 Tag #:

System: TCGD18S41S1, S1-1TVM4F1

### Cooling Performance

Total capacity	14.80 MBH
Sensible capacity	14.80 MBH
Ambient DB temp.	95 °F
Power input (w/o blower)	1.30 kW

### Electrical Data

Power supply	208/230-1-60
Min circuit ampacity	9.80 Amps
Max over-current protection	15 Amps

### Dimensions & Weight

Hgt	28 in.	Len	23.5 in.	Wth	23.5 in.
Weight with factory installed options	112 lbs.				

### Clearances

Right	6 in.	Front	6 in.	Back	6 in.
Top	60 in.	Bottom	0 in.	Left	6 in.

### Matchup Information

ARI Reference Number	3005381
ARI Rated Capacity	17.50 MBH
ARI Rated Efficiency	13.00 SEER



## 1.5 Ton

### Standard Features

- Compact Footprints Ideal for Town Homes, Condos and Zero Lot Line Projects
- Industry-Leading Microchannel Coil Technology Adopted from the Automotive Industry
- Superior Durability
- Up To 7 Times Greater Corrosion Resistance Versus Conventional Coil Technologies
- Ideal for Coastal Applications
- 30% Lighter Versus Standard Coil Technologies
- Easy To Clean, Service and Repair
- Excellent Heat Transfer Performance
- 50% Less Refrigerant Charge Compared to Conventional Coil Technologies
- Aids In Environmental Responsibility and Sustainability
- Reduces the Possibility of Pre-Mature Compressor Failures
- Guardian Models Have A Heavy Duty, Wide-Spaced Wire Coil Guard With a Secondary Polymer Mesh for Excellent Coil Protection
- Latitude Models Have A Heavy Duty, Tight-Spaced Wire Coil Guard With a Secondary Polymer Mesh for Superior Coil Protection
- LX Models Have A Fully-Louvered Coil Guard With a Secondary Polymer Mesh for Supreme Coil Protection
- LX Models Have Corner Posts That Provide Additional Cabinet Strength (One Includes An Eye-Catching Stamped York Logo)
- Pre-Painted Galvanized Steel Provides Many Years of Attractive Appearance
- Pleasing Sound Levels Are Ideal for New Construction or Replacement Applications
- 13 SEER AC Models Do Not Require a Thermal Expansion Valve, Reducing Overall System Costs



645 CONGRESS ST ERV-1,2

# Fantech SER 11504N

Light Commercial ERV



The SER Series lowers demand on air conditioning systems. Air supplied from outdoors enters through the Energy Recovery Core where it transfers the heat and humidity to the exhaust air. The air supplied by the SER is now cooler, dryer and more comfortable. The

SER distributes the pre-conditioned fresh filtered air throughout the building by direct ductwork installed especially for the ERV or through the ductwork of a forced-air system.

## APPLICATIONS INCLUDE:

- Class Room
- Retail Shops
- Hair Salon
- Bars & Restaurants
- Offices
- Clinics
- Animal Shelters
- Larger Homes

## POWER & WEIGHT

- Volts 120V
- Amperage 10.8 Amps Total
- Weight 96Kg (212lbs)
- Shipping Weight 114Kg (252lbs)
- Blowers (x4) 120V, 60 Hz, 2.7 Amps
- Phase Single

## SPECIFICATIONS

**CASE** 20 gauge G90 galvanized steel sheet coated with baked powder paint, insulated with 25mm (1 inch) foil-faced high density polystyrene foam for condensation control.

**BLOWERS** Four (4) maintenance-free Ebm-Papst™ backward inclined motorized impellers with permanently lubricated sealed ball bearings and (TOP) thermal overload protected.

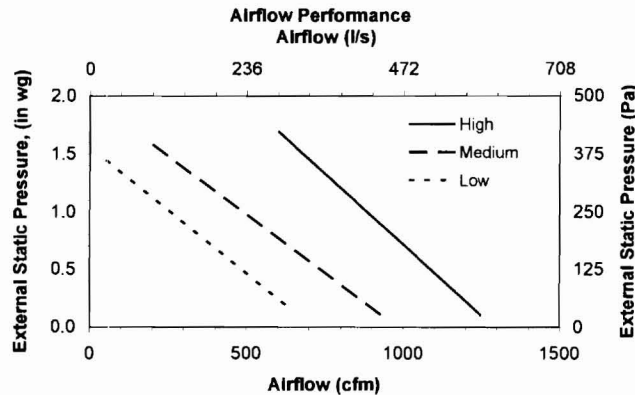
**CORES** Three (3) modular energy recovery cores manufactured from a flame-proof/Polyester-based synthetic paper designed to transfer sensible and latent heat. During winter, the core transfers heat and moisture from the outgoing air to the incoming fresh air. While in summer core transfers heat and moisture from the incoming air to the outgoing air to reduce the latent load.

**FILTERS** The exhaust and fresh air streams are protected by MERV1 washable filters constructed to meet UL Class2. Optional MERV6 filters are direct replacement to the MERV1. Use of MERV6 filters will add an additional system pressure of 72 Pa (0.29in.wg) at 543 l/s (1150cfm).

**MOUNTING** Brackets are included for mounting using threaded rod. Unit may also be seated on a platform. Flanges are provided to simplify ductwork connections.

**CONTROLS** External three (3) position (Low/Stand By/Medium) rocker switch that will offer continuous ventilation. Compatible with all Fantech ERV controls.

**SERVICEABILITY** Unit has hinged or screwed access panels on front and back of the unit. Cores, filters, and motors are serviceable from either sides of the unit. Fan assemblies are mounted on removable sliding base. Energy recovery cores conveniently slide out with only 380mm (22.6") clearance for ease of inspection, removal and cleaning. Electrical box can be installed on either side of the unit for improved accessibility.



**Note:** This model is not recommended for climates that experience temperature below -5°C (23°F) for extended periods of 2 or more days.

## NET EFFECTIVENESS

Flow l/s (CFM)	Heating			Cooling		
	Sensible (%)	Latent (%)	Total (%)	Sensible (%)	Latent (%)	Total (%)
406 (860)	62%	29%	49%	50%	28%	36%
543 (1150)	53%	22%	41%	42%	21%	29%

# MODES OF OPERATION

## 1. Continuous / Ventilation Mode

In this mode of operation both fans are operating and exchanging inside air for outside air. The energy recovery ventilator (ERV) will operate at the selected rate, either at low or medium speed, and switches to high speed when activated by an optional remote control. The "Low" and "Med" fan speed selection will cause the unit to operate in continuous ventilation mode at a reduced exchange rate. Continuous mode is recommended, since pollutants are slowly but constantly being generated in a building.

## 2. Intermittent / Standby Mode

The system is always on standby and operates at high speed when activated by an optional remote control (required): "Standby" should be selected if the user wishes to stop the unit from continuous exchange.

# SETTING SPEED

The ERV is shipped from the factory on low speed, intermittent operation can be obtain by toggle switch located on outside of cabinet. External low voltage contacts allow for high speed operation when optional remote control is used.

## Convenient Optional Low Voltage Wall Controls

### Main Control



#### EDF1

##### Triple Function Wall Control



2-wire

- Press button once for continuous low speed
- Press button twice and the unit will cycle 20 minutes ON/40 minutes OFF and repeat
- Press the button a third time and the system will run continuously on high speed
- Use in one central location

#### AQS1

##### Air Quality Sensor



3-wire

- Activates ERV to high speed if levels of pollutants exceed normal conditions
- Light changes color to indicate level of pollution
- Pushbutton override switch sets unit to run 1, 2, or 3 hours at high speed
- Use one per ERV

### Boost Switches

#### RTS3

##### Pushbutton Timer



3-wire

- 20-40-60 Min. Boost Timer
- Press button once to energize system to high speed for 20 minutes
- Press button twice unit will run for 40 minutes on high speed.
- Press button three times for 60 minutes of high speed
- Up to five can be used with one system

## INSTALLING DUCTS TO / FROM INSIDE

To maximize airflow in the ductwork system, all ducts should be kept short and have as few bends or elbows as possible. Forty-five degree are preferred to 90° elbows. Use "WYE" fittings instead of tees whenever possible.

All duct joints must be fastened with screws or duct sealant and wrapped with a quality duct tape to prevent leakage. Aluminum foil duct tape is recommended.

### SUPPLY AIR DUCTING

In buildings without a forced air HVAC systems, fresh air should be supplied to all habitable areas. Grilles that diffuse the air comfortably such as Fantech grille MGE (metal) or CG (plastic) grilles with "coanda effect" are recommended.

Optional inline duct heaters may be used to add heat if required.

### Direct Connection to Furnace/ Air handler return duct

- Should you wish to hard duct the supply air directly into the cold air return of the HVAC systems, remember to check the airflow balance of the ERV with the HVAC systems fan both "on" and "off" to determine that it does not imbalance the ERV more than 10%. Make sure you respect the minimum distance from the supply air in of the ERV and the HVAC systems.
- It may be necessary to install a separate fresh air supply ductwork system if the cooling is other than forced air.

When installing an ERV, the designer and installer should be aware of local codes that may require smoke detectors and/or firestats in the HVAC or ERV ductwork.

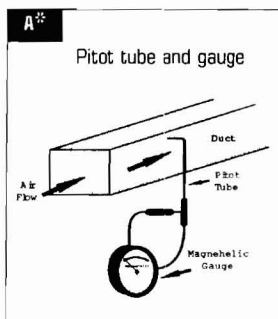
Because an ERV is designed to bring fresh air into the building, structures may require supply voltage interrupt when smoke or flame sensors are triggered, or when a central fire alarm system is activated.

### Exhaust Air ducting

The stale air exhaust system is used to draw air from the points in the building where the worst air quality problems occur. ( See installation examples in the manual.)

## AIR FLOW BALANCING

- The balancing procedure consists of measuring the exhaust air leaving the system and the supply air entering the system and ensuring that these two are equal. A deviation of 10% or less is acceptable.



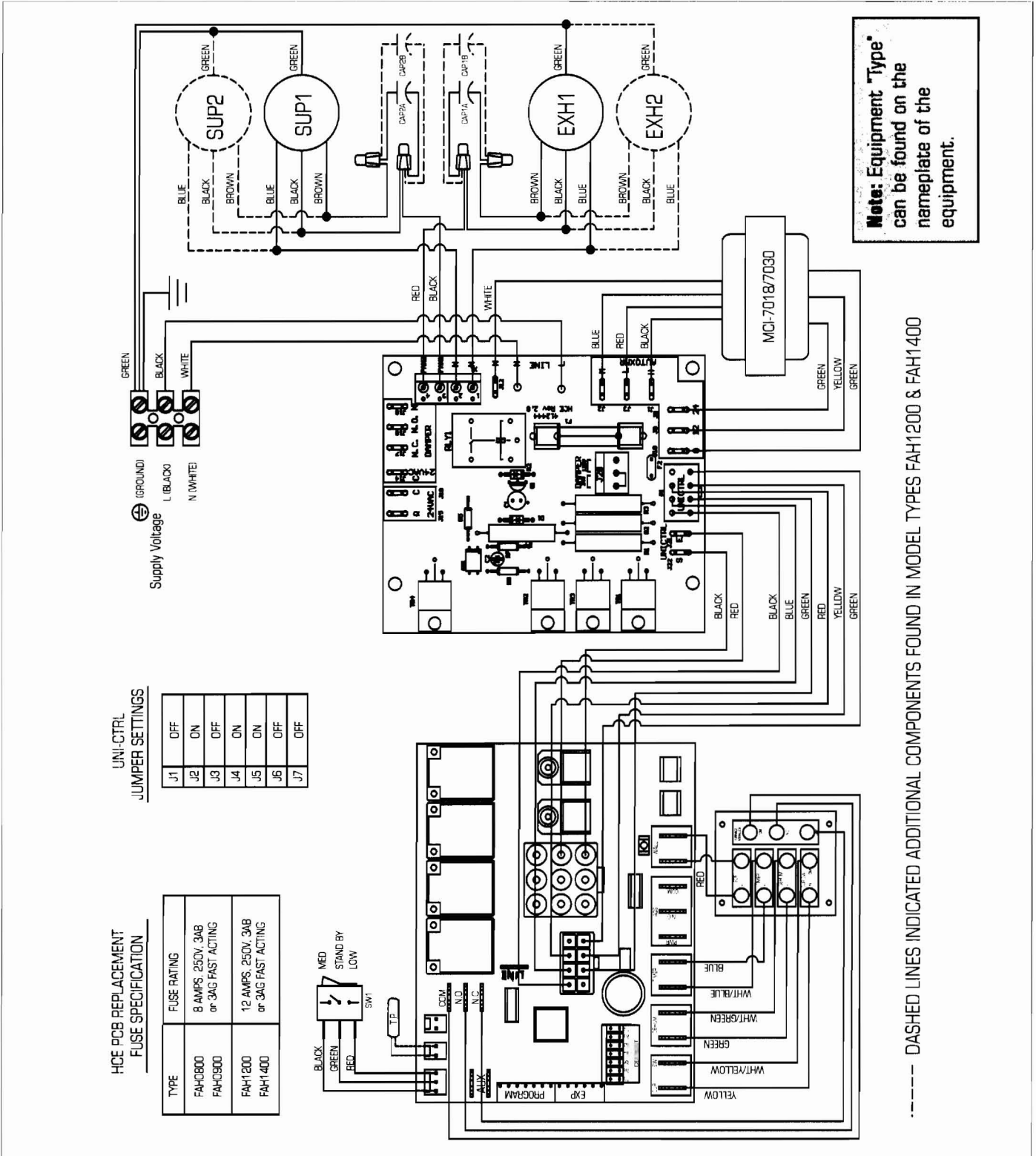
**A** The duct's airflow velocity is generally measured with a magnehelic gauge and a pitot tube.

- Velocity readings should be taken in a smooth duct section a minimum 3 equivalent duct diameter in length upstream and 1 equivalent duct diameter downstream from the Pitot tube.

**Note:** A professional air balancer should be contacted to commission the system properly. A skilled HVAC Tech may complete the balance of air providing they possess the proper equipment. Call Fantech Technical support for assistance.



# WIRING DIAGRAM



**HCE PCB REPLACEMENT FUSE SPECIFICATION**

TYPE	FUSE RATING
FAH0800 FAH0900	8 AMPS, 250V, 3AB or 3AG FAST ACTING
FAH1200 FAH1400	12 AMPS, 250V, 3AB or 3AG FAST ACTING

**UNI-CTRL JUMPER SETTINGS**

J1	OFF
J2	ON
J3	OFF
J4	ON
J5	ON
J6	OFF
J7	OFF

**Note: Equipment Type can be found on the nameplate of the equipment.**

----- DASHED LINES INDICATED ADDITIONAL COMPONENTS FOUND IN MODEL TYPES FAH1200 & FAH1400

United States  
 1712 Northgate Blvd.,  
 Sarasota, FL 34234  
 Phone: 800.747.1762; 941.309.6000  
 Fax: 800.487.9915; 941.309.6099  
 www.fantech.net; info@fantech.net

Canada  
 50 Kanalfakt Way,  
 Bouctouche, NB E4S 3M5  
 Phone: 800.565.3548; 506.743.9500  
 Fax: 877.747.8116; 506.743.9600  
 www.fantech.ca; info@fantech.ca

Fantech, reserves the right to modify, at any time and without notice, any or all of its products' features, designs, components and specifications to maintain their technological leadership position.

Item #: 450513  
 Rev Date: 03102008

# shinberg

CONSULTING, LLC

- NO EXCEPTIONS TAKEN
- MAKE CORRECTIONS NOTED
- AMEND & RE-SUBMIT

- SUBMIT SPECIFIED ITEM
- REJECTED-SEE REMARKS
- SEE COMMENTS BELOW

CHECKING IS ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. ANY ACTION SHOWN IS SUBJECT TO THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE, FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION, COORDINATION OF THE WORK WITH THAT OF OTHER TRADES AND THE SATISFACTORY PERFORMANCE OF THE WORK.

SIGNATURE

REVIEW DATE

**Project:** 645 Congress Street Rennovations

**Submittal:** Mechanical Submittals / Mechanical Room Equipment

**Comments:**



PLUMBING, HEATING, COOLING, AND INDUSTRIAL SUPPLIES  
SERVING NEW ENGLAND & NEW YORK SINCE 1866

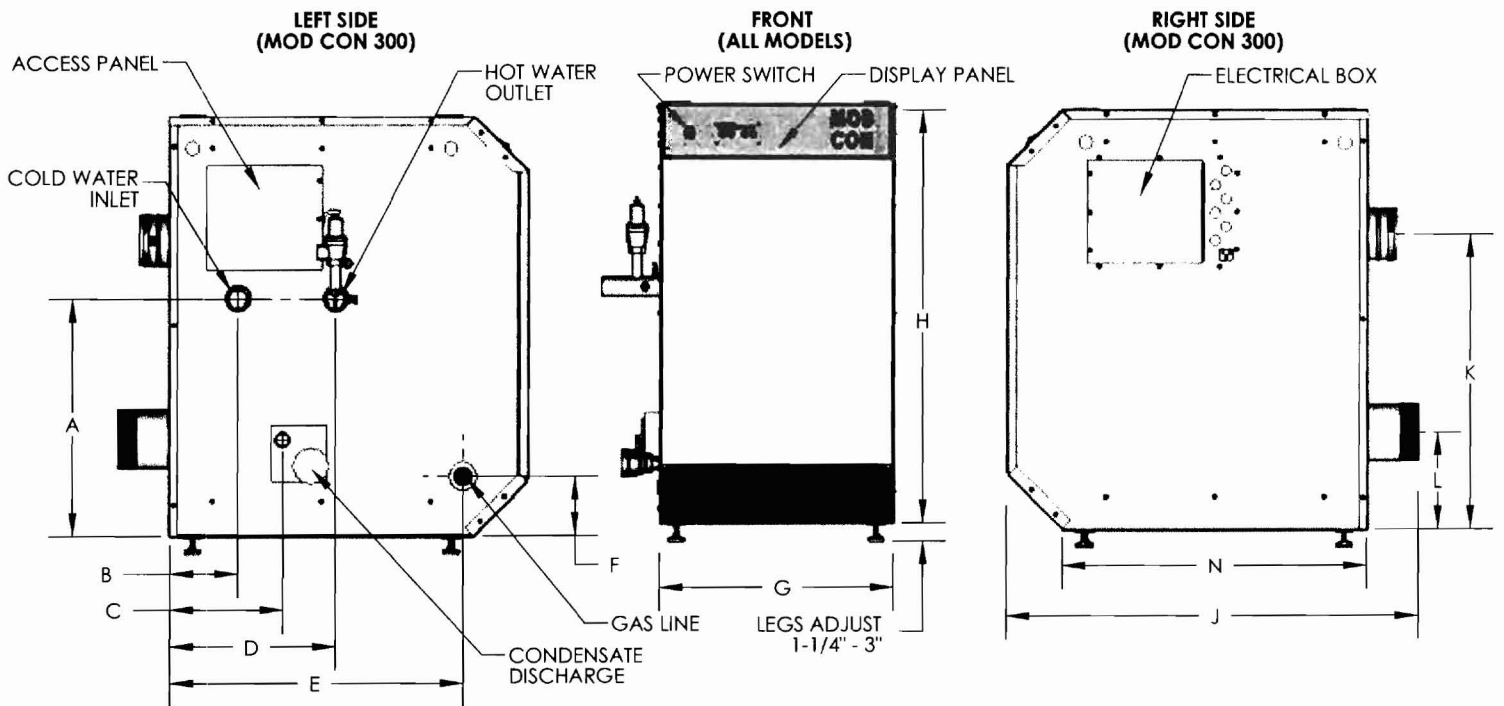
## F.W. WEBB COMPANY

**P&P Plumbing & Heating Inc.**

**645 Congress St. Renovations  
Portland, Me.**

**Jim Senter @ FW Webb Co.  
08/26/09**

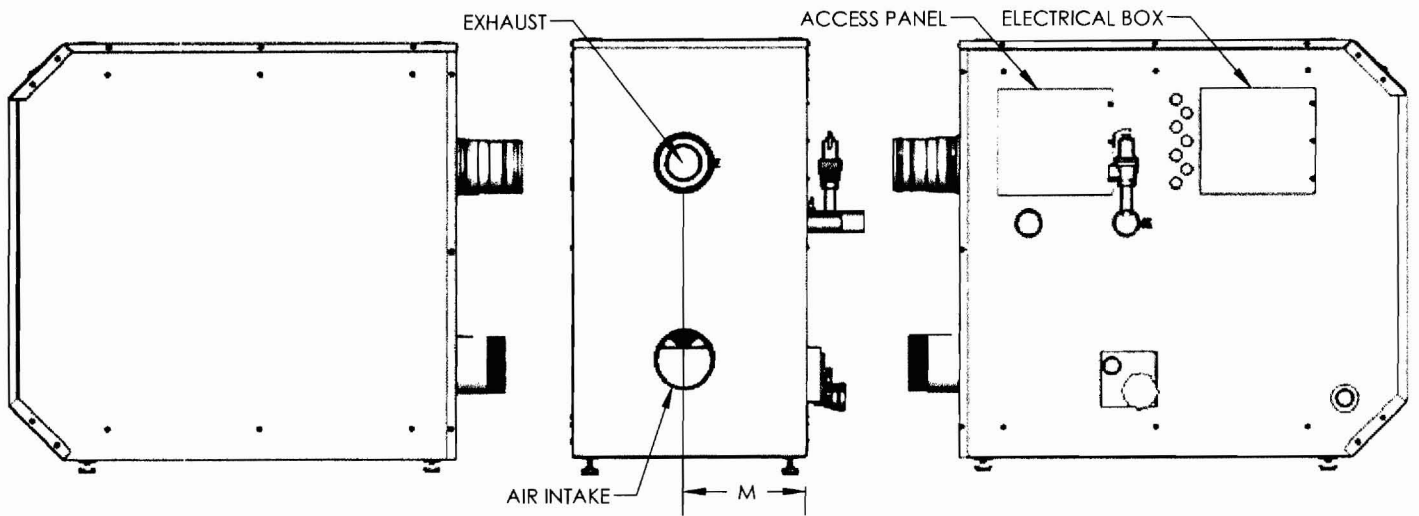
**150 Postal Service Way • South Portland, Maine  
Phone: (207) 772-8364 Fax: (207) 773-4571**



**RIGHT SIDE (MOD CON 500/850)**

**REAR (ALL MODELS)**

**LEFT SIDE (MOD CON 500/850)**



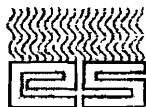
MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N
MOD CON 500	20.00"	6.25"	13.25"	14.50"	33.30"	5.15"	20.50"	36.00"	41.75"	25.50"	8.25"	10.50"	34.00"

**NOTE: ALL DIMENSIONS ARE APPROXIMATE AND HEIGHTS DO NOT INCLUDE ADJUSTABLE LEGS.**

MODEL	BTU/HR INPUT LOW FIRE	Gross Output BTU/hr	Net I=B=R BTU/hr	Thermal Efficiency	Boiler Water	Supply/Return Connection	Gas Conn.	Vent Dia.	Ship Wt.	High Fan Speed	Low Fan Speed	ignition
MOD CON 500	100,000-500,000	470,000	409,000	94%	4.2	2"	1-1/2"	4"	505	6930	1250	3000



# TRANSMITTAL



**EMERSON-SWAN, INC.**

300 POND STREET  
RANDOLPH, MA 02368  
781-986-2555  
FAX 781-986-2027

30 WATERVLIEET AVE.  
ALBANY, NY 12206  
518-435-9900  
800-553-7926  
FAX 518-435-9929

222 ST. JOHN ST.  
SUITE 238  
PORTLAND, ME 04102  
207-774-5578  
FAX 207-772-8253

2275 SILAS DEAN  
HIGHWAY  
ROCKY HILL, CT 06067  
800-300-4920  
FAX 860-257-6166

**To:** P & P Plumbing & Heating  
24 Caddie Lane  
Portland, ME 04103

**Date:** 8/27/2009

**Attention:** Jeff Yankowsky

**Project:** 645 Congress Street  
Portland, Maine

We are  Submitting  Resubmitting 4 Sets of Drawings\* for

Approval  
 Record Purpose

We are  Submitting  Resubmitting     Sets of O&M's

\* plus one electronic set

**Covering the Following Material:**

Alfa-Laval  
 BAC  
 Canariis  
 Cemline

Dri-Steem  
 Flow Design  
 Lakos  
 J.L. Wingert

Mitsubishi  
 Paco  
 Pep Filters  
 Skidmore

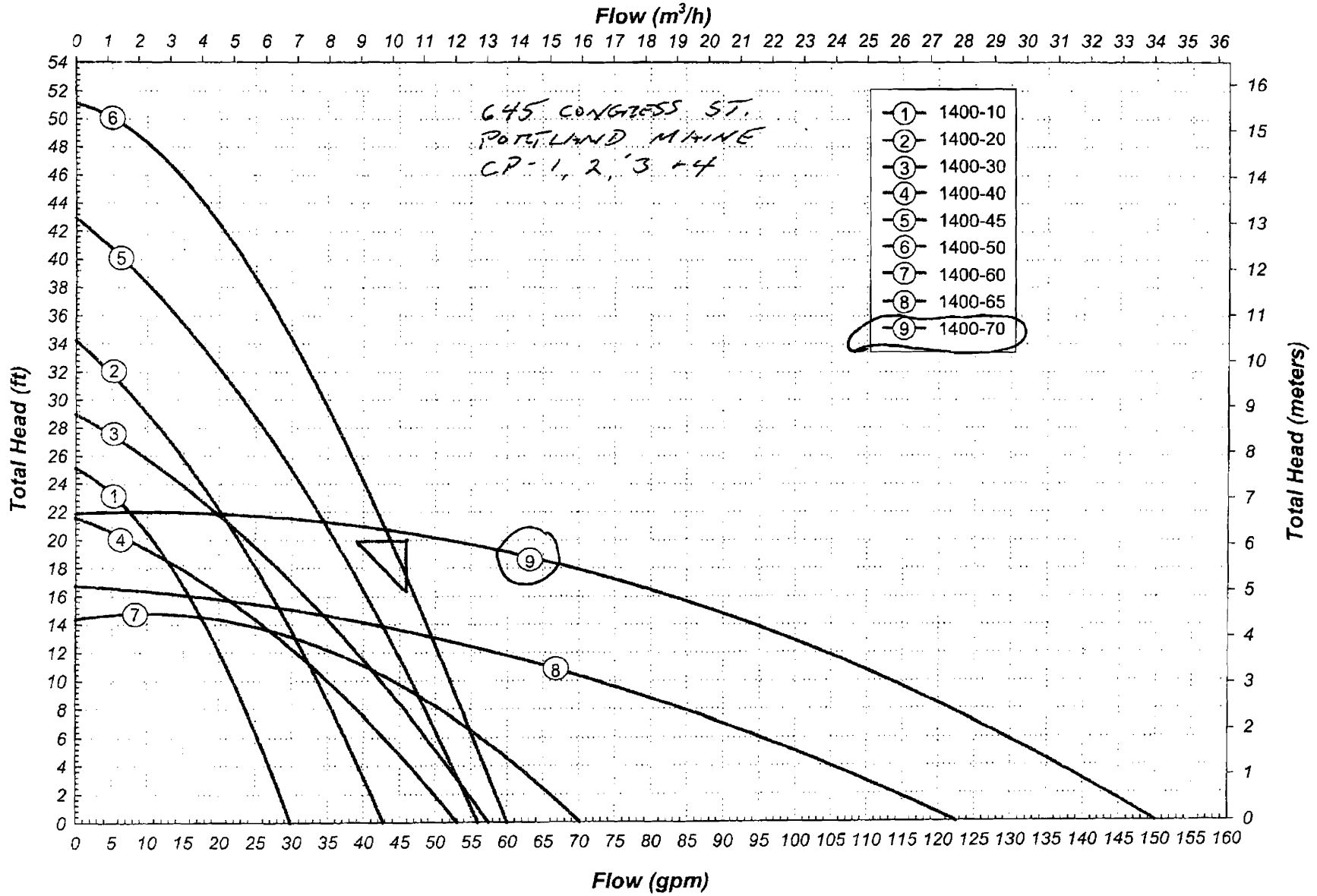
Taco  
 Twin City  
 Whalen

Your Order has been entered for  Hold for Release  Immediate Shipment

**Estimated Shipping Time Required: 4 weeks ARO**

**Remarks: Please return one (1) approved copy with your release**

**Taco** 1400 Series — High Capacity Circulators — 60Hz



8/26/2009

TACO, Inc.

TacoNet Pump Selection, version 7.03

Job Name: 645 CONGRESS ST  
Company: P&P PLUMBING & HEATING  
Customer: JEFF YANKOWSKY

Engineer: BENNETT ENGINEERING  
Representative: EMERSON-SWAN  
Salesman: TED EDWARDS

\*\* INPUT PARAMETERS \*\*

Single Pump System  
Fluid Type: Water @ 60 F  
Min. Pump Eff.: 0  
Motor RPM: All  
Pump Types:

Design Point:  
System Flow Rate: 28(gpm)  
Head: 30(ft)

\*\* SELECTION RESULTS \*\*

Pump 1							
-Model	Imp.Dia.	NPSH(ft)	RPM	Eff%	HP	NOL HP	Suct/Disch
1615/1915	5.6	5	1750	49	0.43	0.58	1-1/2 x 1-1/2

8/26/2009

TACO, Inc.

TacoNet Pump Selection, version 7.03

Job Name: 645 CONGRESS ST

Company: P&P PLUMBING & HEATING

Customer: JEFF YANKOWSKY

Engineer: BENNETT ENGINEERING

Representative: EMERSON-SWAN

Salesman: TED EDWARDS

\*\* INPUT PARAMETERS \*\*

Single Pump System

Fluid Type: Water @ 60 F

Min. Pump Eff.: 0

Motor RPM: 1760

Pump Types: KV

Design Point:

System Flow Rate: 150(gpm)

Head: 50(ft)

\*\* SELECTION RESULTS \*\*

Pump 1

-Model	Imp.Dia.	NPSH(ft)	RPM	Eff%	HP	NOL HP	Suct/Disch
KV/KS3007	7.1	3	1760	68	2.80	4.38	3 x 3





# Submittal Data Information

## Plus Two Multi-Purpose Valve

301-235

SUPERSEDES: February 20, 2006

EFFECTIVE: March 1, 2006

JOB 645 CONGRESS ENGINEER BONNETI CONTRACTOR P-P P-H REP. E-S

ITEM	QUANTITY	MODEL NO.	SIZE
FOR CP-5 v6	TWO	MPV-025	2 1/2"

### DIMENSIONS

Model Number	Size	Connection	A	B (125#)	B (250#)	C	D	E	F	Cv	Weight (125#)	Weight (250#)
MPV 015-4	1 1/2 (38.1) NPT	Threaded	8.00 (203)	1.44 (037)	1.44 (037)	4.70 (119)	2.39 (061)	5.64 (143)	1.3 (33.0)	69	12 (5.5)	12 (5.5)
MPV 020-4	2 (50.8) NPT	Threaded	8.00 (203)	1.44 (037)	1.44 (037)	4.70 (119)	2.39 (061)	5.64 (143)	1.3 (33.0)	77	12 (5.5)	12 (5.5)
MPV 025-4	2 1/2 (63.5) NPT	Threaded	10.63 (270)	1.93 (049)	1.93 (049)	4.97 (126)	3.50 (089)	7.30 (185)	1.6 (40.6)	122	32 (15)	32 (15)
MPV 030-4*	3 (76.2)	Flanged	11.75 (298)	3.75 (095)	4.13 (105)	6.15 (156)	3.90 (099)	7.85 (199)	1.8 (45.7)	209	38 (17)	46 (21)
MPV 040-4*	4 (101.6)	Flanged	13.75 (349)	4.50 (114)	4.50 (114)	8.51 (216)	4.18 (106)	9.63 (245)	2.1 (53.3)	366	67 (30)	84 (38)
MPV 050-4*	5 (127.0)	Flanged	17.63 (448)	5.00 (127)	5.50 (140)	11.26 (286)	5.25 (133)	12.28 (312)	2.4 (61.0)	459	105 (48)	126 (57)
MPV 060-4*	6 (152.4)	Flanged	20.35 (517)	5.50 (140)	6.25 (159)	11.28 (287)	6.07 (154)	14.23 (361)	2.7 (68.6)	701	134 (61)	176 (80)
MPV 080-4*	8 (203.2)	Flanged	25.88 (657)	6.75 (171)	7.50 (191)	13.58 (345)	6.75 (171)	19.13 (486)	3.9 (99.1)	1200	293 (133)	341 (155)
MPV 100-4*	10 (254.0)	Flanged	30.00 (762)	8.00 (203)	8.75 (222)	15.82 (402)	8.81 (224)	21.20 (538)	4.4 (111.8)	1826	466 (212)	536 (243)
MPV 120-4*	12 (304.8)	Flanged	36.70 (932)	9.50 (241)	10.25 (260)	17.54 (446)	9.98 (253)	26.64 (667)	4.9 (124.5)	2430	724 (329)	811 (368)

NOTE: Dimensions are in inches. Metric dimensions are in millimeters and are in parentheses ( ). Weights are in lb (kg).

'F' is the distance required to replace packing under pressure. 'A,C,D,E,F' apply to 250# valve also.

\* Append 'A' for 250# working pressure (e.g. Model Number MPV 030-4A).

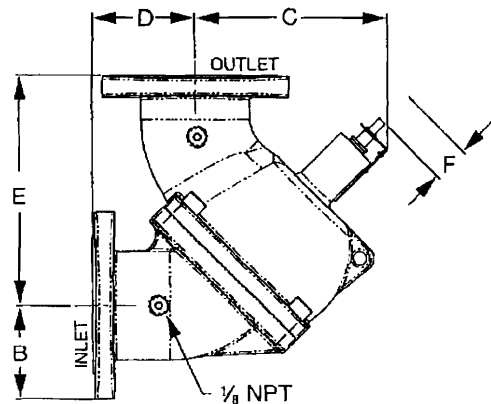
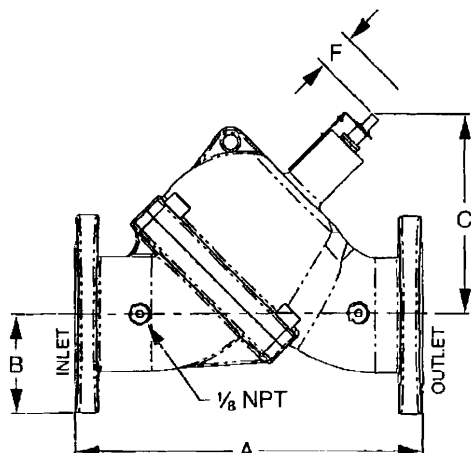
### FEATURES

- Horizontal or Vertical Installation
- Field Convertible to a Right Angle Valve
- Stem Seal Packing (replaceable under pressure)
- Bronze Fitted Construction
- Memory Indicator, Pointer and Scale
- Shrader Valve Metering Connections
- "O" Ring Sealed Valve Body
- Replaceable "Soft Seal"
- Low Pressure Drop (equal to or better than any comparable valve on the market today)
- Five (5) Valves in One:
  - Shut Off Valve
  - Flow Control Valve (globe style)
  - Non Slam Check Valve
  - Flow Metering Valve
  - Straight Pattern Valve Convertible to a Right Angle Pattern Valve
- Available in 125 psi and 250 psi Working Pressure
- Available with Flanged or Grooved End Connections

(All sizes available with optional DIN flanges. Consult Factory for details.)

### MATERIALS OF CONSTRUCTION

- Body - Ductile Iron
- Spring - Stainless Steel (302)
- Gland - Bronze
- Stem Packing - Teflon Impregnated Aramid Fiber (asbestos free)
- Stern - Bronze/Stainless Steel (416)
- Seat - EPDM
- Seat Disc - Bronze
- Body O-Ring - EPDM





# Submittal Data Information

401-075

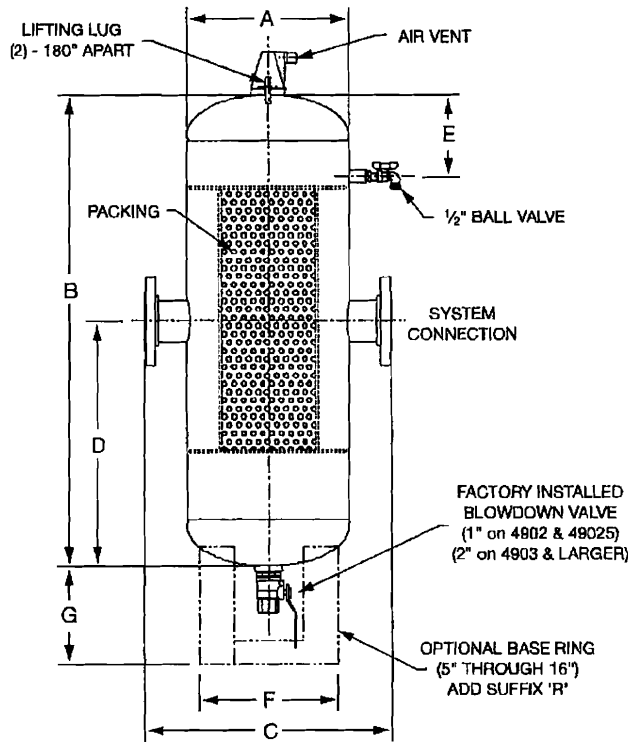
## "4900" Series High Velocity Air/Dirt Separator

EFFECTIVE: SEPTEMBER 1, 2008

SUPERSEDES: AUGUST 1, 2006

JOB 646 CONVERSE ENGINEER BEANETT CONTRACTOR P-P P-M REP. 8-5

ITEM	QUANTITY	MODEL NUMBER	SIZE
AS-1	ONE	4903 ADH	3"



WORKING PRESSURE: 125 PSI @ 270°F (150 PSI @ 270°F OPTION AVAILABLE)

PIPE SIZE	MODEL NUMBER	A DIA. (INCH)	B MAX. (INCH)	C (INCH)	D (INCH)	E (INCH)	F DIA. (INCH)	G (INCH)	SURFACE AREA* (SQ. FT.)	OPTIMUM FLOW (GPM)	APPROX. WGT. (LBS)
2	4902ADH	14	32 <sup>11</sup> / <sub>16</sub>	21 <sup>3</sup> / <sub>4</sub>	17	7	-	-	107.3	110	100
2½	49025ADH	14	32 <sup>11</sup> / <sub>16</sub>	21 <sup>3</sup> / <sub>8</sub>	17	7	-	-	65.6	165	105
3	4903ADH	14	40 <sup>1</sup> / <sub>8</sub>	21 <sup>1</sup> / <sub>4</sub>	20 <sup>13</sup> / <sub>16</sub>	7	-	-	81.2	251	120
4	4904ADH	14	40 <sup>1</sup> / <sub>8</sub>	24	20 <sup>13</sup> / <sub>16</sub>	7	-	-	81.2	434	130
5	4905ADH	20	57 <sup>1</sup> / <sub>2</sub>	30	29 <sup>3</sup> / <sub>4</sub>	8½	18	12 <sup>16</sup> / <sub>16</sub>	162.8	687	255
8	4906ADH	20	57 <sup>1</sup> / <sub>2</sub>	29 <sup>5</sup> / <sub>8</sub>	29 <sup>3</sup> / <sub>4</sub>	9¼	18	12 <sup>15</sup> / <sub>16</sub>	162.8	991	270
8	4908ADH	24	69 <sup>1</sup> / <sub>16</sub>	34 <sup>5</sup> / <sub>8</sub>	35 <sup>3</sup> / <sub>4</sub>	9¼	20	13 <sup>1</sup> / <sub>8</sub>	287.7	1716	520
10	4910ADH	30	85 <sup>13</sup> / <sub>16</sub>	41¼	44 <sup>7</sup> / <sub>16</sub>	11 <sup>3</sup> / <sub>8</sub>	24	13 <sup>3</sup> / <sub>4</sub>	454.7	2700	735
12	4912ADH	30	85 <sup>13</sup> / <sub>16</sub>	42 <sup>3</sup> / <sub>4</sub>	44 <sup>7</sup> / <sub>16</sub>	11 <sup>3</sup> / <sub>8</sub>	24	13 <sup>3</sup> / <sub>4</sub>	454.7	3833	785
14	4914ADH	36	102 <sup>15</sup> / <sub>16</sub>	49 <sup>5</sup> / <sub>8</sub>	53¼	13	30	13 <sup>5</sup> / <sub>8</sub>	797.8	4625	1100
16	4916ADH	36	102 <sup>15</sup> / <sub>16</sub>	51	53¼	13	30	13 <sup>5</sup> / <sub>8</sub>	797.8	6041	1125

\* COALESCENCE (PALL RING) SURFACE AREA

Designed and constructed per ASME Section VIII Div. 1.

**Do it Once. Do it Right.®**

TACO, INC., 1160 Cranston Street, Cranston, RI 02920 Telephone: (401) 942-8000 FAX: (401) 942-2360.  
 TACO (Canada), Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3. Telephone: 905/564-9422. FAX: 905/564-9436.

Visit our web site at: <http://www.taco-hvac.com>

Printed in USA

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TACO, Inc.



# Submittal Data Information PAX Expansion Tanks

401-003C

JOB: 645 CONGRESS ST

CONTRACTOR: P&P PLUMBING & HEATING

ENGINEER: BENNETT ENGINEERING

REP: EMERSON-SWAN

COMMENTS:

QUANTITY	ITEM NO.	MODEL NO.	PRECHARGE	WORKING PRESSURE
1	ET-2	PAX-215	40	125

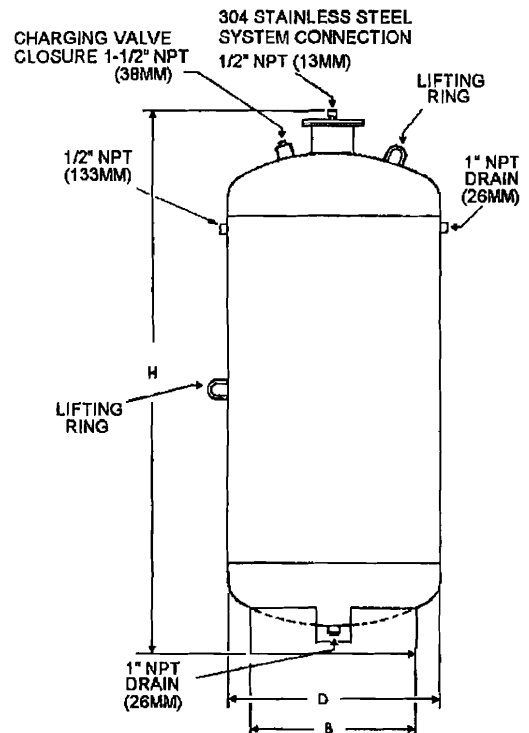
## (for Potable Water Applications)

### CONSTRUCTION

Bladder type for permanent separation of air and water  
Water expands into bladder, air precharge on shell side

### SPECIFICATIONS

Shell-Fabricated Steel designed and constructed  
per ASME Section VIII, Div. 1.  
Bladder-Heavy Duty Butyl removable for inspection  
Working Pressure-125 PSIG (862 KPa) (150 PSIG optional)  
Operating Temperature - 240 F (116 C) Max.  
All wetted components of FDA approved materials.



Model	VOL-gal	VOL-lit	ACC. VOL-gal	ACC. VOL-lit	H-inch	H-mm	B-inch	B-mm	D-inch	D-mm	WT.lbs.	WT.kg.
PAX215	57	215	31	117	57-1/4	1454	16	406	20	508	250	113

Allow 18" clearance above tank for piping system connection

## COMPARE. YOU'LL TAKE TACO.

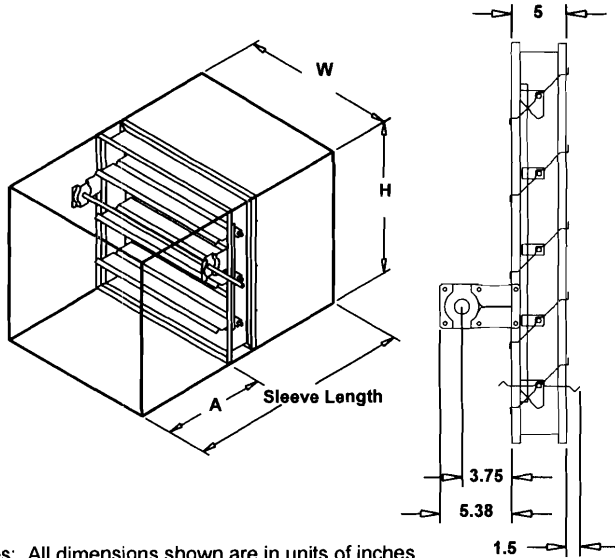
TACO, INC., 1160 Cranston Street, Cranston, RI 02920 Telephone: (401)942-8000 FAX: (401)942-2360.  
TACO (Canada), Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3. Telephone: 905/564-9422. FAX: 905/564-9436

# FSD-211

## Combination Fire Smoke Damper

### Application & Design

Model FSD-211 is a combination fire smoke damper with 3-Vee style blades. The FSD-211 has been qualified to 2,000 ft/min and 4 in wg for operation and dynamic closure in emergency fire smoke situations. Model FSD-211 may be installed vertically (with blades running horizontal) or horizontally and is rated for airflow and leakage in either direction. Galvanized 3-Vee Style Blades. UL 555S Leakage Class I. UL 555 1-1/2 Hour Fire Resistance Rating. Minimum Size: 8 in W x 6 in H, Maximum Single Section Size: 32 in W x 50 in H or 36 in W x 48 in H, Horizontal Maximum Multiple Section Size: 144 in W x 96 in H, Vertical Max. Multiple Section Size: 128 in W x 100 in H



### Codes Approved

This model meets the requirements for fire dampers established by: NFPA Standards 90A, 92A, 92B & 101, UL Classified to U.S. and Canadian safety standards 555 (Listing #R13317), IBC, BOCA, ICBO, SBCCI (Building Codes), CSFM California State Fire Marshall Fire Damper Listing (#3225-0981:103) and Leakage (Smoke) Damper Listing (#3230-0981:104), and New York City (MEA listing #260-91-M).

Notes: All dimensions shown are in units of inches.

W & H furnished approximately 0.25 in undersized and only refer to damper dimensions (sleeve thickness is not included).

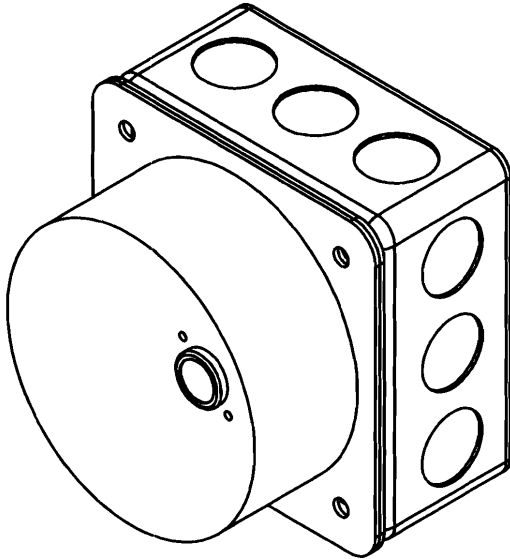
Electrical accessory wiring terminates at the accessory. Field wiring is required to individual components.

### CONSTRUCTION FEATURES

<b>Mounting:</b>	Horizontal	<b>Actuator Type:</b>	120 VAC
<b>Closure Device:</b>	RRL	<b>Actuator Mount:</b>	External
<b>Closure Temp. (F):</b>	165	<b>Actuator Location:</b>	Right Side
<b>Frame Thickness (ga):</b>	16	<b>Fail Position:</b>	Closed
<b>Sleeve Length (in):</b>	16	<b>Temperature (F):</b>	250
<b>Sleeve Thickness (ga):</b>	20	<b>Velocity (ft/min):</b>	2,000
<b>Axle Bearings:</b>	Bronze	<b>Cycle:</b>	60 Cycle
<b>Sizing:</b>	Nominal		



ID #	Tag	Qty	W (in)	H (in)	Drive Arr.	Actuator	Act. Qty.	Sleeve Length (in)	Slv Thkne...	A-Dim. (in)
1-1		4	12.000	12.000	11-1FER-1	ML4202	1	16	20	7.188
1-2		5	18.000	12.000	11-1FER-1	ML4202	1	16	20	7.188



## RRL Option

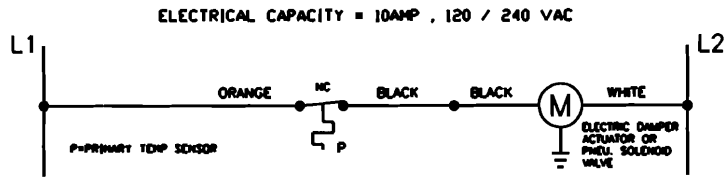
### Resettable Link Option

#### Application & Design

The RRL option replaces the fusible link on a combination fire smoke damper with an electric sensor (thermostat). The sensor has a fixed temperature setting (165 F, 212 F, 250 F or 350 F) and performs the same function as the fusible link that it replaces. The sensor interrupts power to the actuator and the actuator's spring return mechanism causes the damper to close.

The sensor is of the manual reset type and can be reset after temperature has cooled below the sensor set point. Before resetting any sensor, a careful inspection should be done of the entire damper and sensor as exposure to actual fire conditions may render these devices unusable.

This option requires factory installation of the damper actuator and sensor to meet UL requirements. If the damper is equipped with a pneumatic actuator, an EP switch is required with the appropriate electric power circuit, to allow the electric thermostat to control the pneumatic actuator.



## 2.3 HANGERS

- A. Adjustable Swivel Hanger: Pipe Sizes 2" and Less: Carpenter and Paterson Fig. 800 conforming to MSS-SP-58, oversize for insulated piping systems. Pipe Sizes Larger Than 2": Carpenter and Paterson Fig. 100, oversize for insulated piping systems.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 and Fig. 126 CT conforming to MSS-SP-58, provide copper plated clamps on copper pipes.
- C. Spring Vibration Isolation Pipe Hangers: Mason Industries Model PC30N, or approved equal by Amber-Booth or Vibration Mountings and Controls, combination spring and double deflection bridge-bearing neoprene hangers, 1" static deflection.

## 2.4 VALVES

- A. Ball Valves: Apollo 70-100 Series, bronze body, Fed. Spec. WW-V-35, Type II, Class A (bronze), Style 3, blow-out proof stem, 600 pound W.O.G., screwed connection for steel pipe, sweat connection for copper tube. Provide stem extension to allow operation without interfering with pipe insulation. Provide Tee handles for valves thru 2" pipe size.
- B. Gate Valves: Nibco Model S-113 or T-113, bronze body Fed. Spec. WW-V-54, wedge disc, rising stem, screwed connection for steel pipe, sweat connection for copper tube, 150-pound class.
- C. Outside Screw and Yoke (OS&Y) Gate Valves: Nibco Model F-617-0, iron body, Fed. Spec. WW-V-58 with bronze trim, 125 pound class.
- D. Check Valves: Nibco Model S-413 or T-413, bronze body Fed. Spec. WW-V-51, regrinding swing check type, 200 pound class.
- E. Butterfly Valves: Centerline or Norris, valves shall conform with MSS-SP67, Type I 150 psig - Tight shut off valve, ends shall be flangeless or grooved, cast iron body, type 300 series corrosion resistant steel stems and corrosion resistant or bronze discs with molded elastomer disc seals. Valves shall have throttling handles with a minimum of 7 locking positions. Valves shall be suitable for water temperatures up to 220 degrees F.

## 2.5 PIPING, VALVE AND EQUIPMENT IDENTIFICATION

- A. Pipe Identification: Provide plastic "wrap around" identification markers by Seton or Setmark indicating flow direction and fluid flowing for the following:

Hot Water Supply Piping  
Hot Water Return Piping  
Chilled Water Supply Piping  
Chilled Water Return Piping  
Refrigerant piping

1. Markers shall be placed 30-50 ft. apart for piping in accessible areas.

hydrostatically in accordance with Section VIII of the ASME Boiler Pressure Vessel Code. The tank bladder shall be butyl rubber and shall be removable for inspection. Tank shall have air charging and system connections, and shall be factory pressurized to 18 psig.

- D. Strainers: Watts Model 77S, MIL-S-16293, 125 psig minimum rating wye strainers, cast iron or bronze body, screen shall be stainless steel, monel or bronze with 20 mesh perforations. Provide with blowdown ball valve and 3/4" hose connection.
- E. Automatic Air Vents: Armstrong No. 1-AV, float type to vent air in hydronic systems. Vent constructed with cast iron body and stainless steel internals and with NPT male inlet and outlet for 1/4 inch overflow for safe water connection. 150 psi working pressure, 250°F maximum temperature.
- F. Air Separator (AS-\*): Taco model 4900A-D, or Spirovent, as scheduled, steel construction, designed for not less than 125 psig and constructed and tested in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. Tank shall have fabricated connections, screwed for sizes 2" and smaller, flanged for sizes 2-1/2 inches and larger. Separators shall be factory prime-painted. Each air separator shall have an internal design suitable for creating the required conditions for optimal air separation and microbubble removal. Provide fittings for connection of automatic air vent and for connection of manual blow-down valve.
- G. Manual Air Vents: Brass body, fiber discs, 125 psi working pressure, 240°F maximum temperature, adjustable for quick venting at system start-up.
- H. Circulator (inline) (CP): Taco model indicated, Paco, Grundfos, Bell and Gossett, or approved equal, pumps shall be inline cartridge-type or close coupled pump of capacity and performance indicated with cast-iron body and bronze-fitted, 175 psig rated working pressure, 220°F maximum water temperature, carbon Ni-resist mechanical seal, flexible coupling, resilient-mounted drip-proof sleeve bearing motor. The pumps shall be factory tested, cleaned, and painted with machinery enamel. A set of installation instructions shall be included with the pump. Provide premium high efficiency motors. Following the completion of testing and balancing, provide pump impeller trim to match impeller size to the operating conditions. Motors shall be premium high efficiency type, open drip-proof or TEFC by Baldor, Magnetek or Toshiba. Motor efficiencies shall comply with the Consortium for Energy Efficiency Standard.
- I. Circuit Balance Valves: Taco "Accu-Flo" circuit setter or Bell and Gossett (as located in main branches only).
  - 1. Bronze or brass body and internals, teflon seats, 175 psi working pressure, 250°F working temperature. Balancing devices shall be adjustable and shall have provisions for connecting a portable differential pressure gauge for flow measurement. Each balancing device shall be sized to provide a differential pressure reading between 2 and 5 feet with the valve full open at design flow rates.
  - 2. Install per manufacturer's recommendations for adjacent length of straight pipe.



- B. Provide 4"/6" Schedule 40 CPVC plastic or AL29-4C stainless steel venting, intake ducting, vent kits and condensate drain piping installed in accordance with the manufacturer's recommendations.
- C. Accessories shall include, 50 psig ASME rated pressure relief valves, thermostatic radiator valve, operating aquastat, concentric wall intake/exhaust venting, low water cut-off with manual reset and test, alarm bell, adjustable high limit with manual reset, condensate neutralization kit and flow switch. Provide a Tekmar 265 controller, or equal, to stage / modulate the boilers, equalize runtime, cycle the pumps, control the indirect-fired water heaters and reset the hot water supply temperature.
- D. The boiler/burner units shall be started and adjusted by a factory representative who shall submit an efficiency report for Engineer review. Boiler installation and start-up shall be supervised by an authorized representative of the manufacturer.
- E. Provide firestats, emergency shut-off switches, and service switches as required by NFPA 54. Installation and piping shall be per the boiler manufacturers recommendations.

## 2.9 CABINET UNIT HEATERS

### A. Construction:

1. Cabinet unit heaters and fancoil units shall be manufactured by the Trane Co., Sterling, McQuay or American Air Filter. Unit configuration shall be inverted airflow, ducted, wall-mounted or floor-mounted as indicated. Cabinets shall be surface-mounted, semi-recessed or fully recessed, as indicated. Coils shall be copper tube mechanically expanded into aluminum fins and pressure rated at 200 psig at 250°F. Fans shall consist of multiple squirrel cage blowers on a common shaft. Coils shall be certified in accordance with ARI Standard 410. Casings shall be galvanized steel. Exposed cabinets shall be finish painted in a factory-applied baked enamel with color selection by the Architect.
2. Furnish units with a 3-speed fan switch, disconnect switch and throwaway dust filter (with 2 spare sets per unit).
3. Ducted units shall have high external static pressure motors.

### B. Performance:

1. Performance and capacity shall be as scheduled.

### C. Hangers:

1. Ceiling mounted units be supported from the structure and shall have four (4) minimum threaded rods with Vibration Mountings and Controls Model "RSH" "Spring-Flex" hangers.

## 2.10 HORIZONTAL UNIT HEATERS

- A. Horizontal unit heaters shall be manufactured by the Trane Co., Sterling, Vulcan or American Air Filter. Coils shall be copper tube mechanically expanded into

of 980 BTUH/ft. with 180°F average water temperature, 65°F entering air temperature and a 2.0 GPM water flow rate. The finned element shall be 3/4" copper tube with aluminum fins at 40 fins per foot. The enclosure shall be 16 gauge cold rolled steel, 4" deep x 11" high with factory enamel finish and color selection by the Architect. Installation including mounting height shall be per the manufacturer's recommendations, or as scheduled. Furnish with allen screw operated dampers.

#### 2.14 AIR-COOLED CONDENSING UNITS

- A. Shall be Trane, McQuay, Carrier, York or approved equal with capacities and performance, as scheduled. The condensing unit shall be factory assembled and wired. The structural frame shall be constructed of minimum 14 GA. welded galvanized steel with a phosphatized and painted finish. A decorative steel grille shall protect the condenser coils from physical damage. Refrigerant shall be R407C.
- B. The compressors shall be multiple scroll compressors, suction gas-cooled, direct-drive, operating at 3600 RPM. The unit shall have a centrifugal oil pump, oil charging valve and oil level sightglass.
- C. The condenser coil(s) shall have configured aluminum fins mechanically bonded to copper tubing with an integral subcooler. The condensers shall be factory leak-tested at 450 psig. The fans shall be direct-drive vertical discharge, statically and dynamically balanced. Three-phase motors shall have permanently lubricated ball bearings and thermal overload protection. A minimum of two (2) independent circuits and two (2) compressors shall be provided.
- D. A factory provided 115v. control circuit shall include fusing and control power transformer. Factory-wired magnetic contactors shall be provided for the compressors and fans with 3 leg solid-state overload protection, phase loss protection and high-low pressure cut-outs. Charge isolation, reset relay and anti-recycle compressor timer(s) shall be provided. Furnish with a weatherproof non-fused disconnect switch.
- E. The condensing units shall include a five (5) year compressor warrantee for parts and labor and a non-fused disconnect switch.

#### 2.15 AIR-TO-AIR ENERGY RECOVERY UNITS

- A. Shall be Renewaire, or approved equal, with capacities and performance as scheduled. The heat recovery equipment shall be a factory assembled and tested package, constructed and rated in accordance with ARI, AMCA and UL. The units shall be ARI certified and listed in the ARI 1060 directory of certified air-to-air energy recovery ventilation equipment. System components shall include fan(s), air-to-air heat exchangers, electric preheat coil for frost protection, hot water heating coil, dampers, filter sections, drain pans, vapor-tight lights, 120v. NEMA 3R service outlet, motor starters, electric preheat defrost system, welded structural steel base, non-fused disconnect switches and double-wall, insulated airtight casing with interior sheetmetal liner. The casing shall have 1" thick (minimum) 3.0 pcf fiberglass thermal insulation.

provisions for manufacturer recommended service and access clearances.

2.16 WALL HEATERS (WH) AND KICKSPACE HEATERS (KSH)

- A. Shall be Smith's Environmental Products, or approved equal, Model KS2008, 7.9 MBH with 1.0 GPM, 180F. EWT, 65F. EAT.

2.17 PACKAGED ROOFTOP AIR CONDITIONING EQUIPMENT

- A. Provide high efficiency packaged gas-electric air conditioning units and coils of manufacturer, model and performance indicated, Lennox, Trane "Precedent", York, McQuay, Carrier or approved equal.
- B. The air conditioning units shall consist of a fan section, gas burners, coil sections, coils, and filter/mixing box section with economizer dampers and barometric relief or powered exhaust, convertible horizontal / downflow arrangement as required. Performance shall be ARI 430 certified. Provide access doors in each section. Furnish with roof curb, packaged controls and high static pressure drive. Provide with through the base electrical connections. Furnish with unit-mounted disconnect.
- C. Cabinet Construction: Steel reinforced and braced with steel angle framework, factory-assembled, sectionalized fan and coil sections, removable access panels to internal parts. Metal parts galvanized steel or chemically cleaned, phosphatized, primed and finished with enamel topcoat.
- D. Fans: Shall be as scheduled, multiblade centrifugal type, statically and dynamically balanced and tested. Bearings shall be self-aligning, grease lubricated ball type. Fan motor shall be 1800 RPM, open drip-proof or TEFC type, with greasable ball bearings, variable pitch sheave and mounted on an adjustable base. Provide extended grease lines. The fan drive shall have a 1.5 service factor for the maximum rated horsepower. Motors shall be premium high efficiency with minimum motor efficiency conforming to Section 23 05 00 "Electric Motors and Motor Controls". Submit certificate of conformance for motor efficiency.
- E. Coils: Capacities and pressure drops shall be rated in accordance with ARI 410. Coils shall be pressure tested at 300 psig and shall be suitable for 150 psig service.
  - 1. Coils: Copper tubes, aluminum fins and copper headers. Casings shall be 16 gage galvanized steel.
- F. Mixing box section: Outside air and return air dampers shall be "low leak" type. Blade seals shall be neoprene and jamb seals shall be compressible aluminum or stainless steel.
- G. Filters: Provide Farr 30-30 pleated media, 25-30% efficient. Furnish with one (1) initial and two (2) spare sets. Efficiencies shall be as tested in accordance with ASHRAE Standard 52-76.
- H. Submit fan curves for each fan with the design operating point clearly marked.
- I. The compressors shall be direct-drive, scroll or reciprocating hermetic type. Units with two (2) compressors shall have two (2) independent refrigeration circuits.

the main downward or off the side with a minimum of two 90° elbows provided on runout from main.

- H. Install stop valves and unions to facilitate isolation and removal of equipment. Provide final connections for hydronic specialties furnished under other sections of the Specifications.
- I. Steel piping shall have screwed or welded connections. Threads on piping shall be full length and clean-cut with inside edges reamed smooth to the full inside bore. Close nipples shall not be used. Pipe threads: standard pipe threads, machine cut and full length. Pipe: reamed to remove burrs and up-ended and rapped to dislodge dirt and scale. Joint compound shall be applied to male thread only. If it is necessary to back off a screwed joint after it is made, the thread shall be cleaned and new compound applied. Caulked threads will not be permitted.
- J. Steel Piping 2-1/2" and larger shall have welded connections.
  - 1. Welded Joints:
    - a. Welding Procedure Specifications: Before any welding is performed, submit copies of welding procedure specification for metals included in the work together with proof of qualification as outlined in ANSI B31.1.
    - b. Performance Qualification Record: Before any welder or operator shall perform any welding, submit 2 copies of the Welder's Performance Qualification Record in conformance with ANSI B31.1 showing that the welder was tested under the approved procedure specification submitted. In addition also submit each welder's assigned number, letter, or symbol which shall be used to identify the work of the welder, affixed to the joint immediately upon completion of the weld. Welders making defective welds after passing a qualification test shall be given a requalification test and upon failing to pass the test shall not be permitted to work this contract.
    - c. Previous Qualification: Welding procedures, welders and welding operators previously qualified by test may be accepted for this contract without requalification subject to approval and provided that the conditions specified in ANSI B31.1 are met before a procedure can be used.
    - d. Surface Conditions: Welding shall not be done when the atmospheric temperature is less than 0 degrees F, when the surfaces are wet, when rain or snow is falling or moisture is condensing on the surfaces to be welded, nor during periods of high wind, unless the welder and the work are protected properly. At temperatures between 32 degrees and 0 degrees F, the surfaces for an area within 3 inches of the joint to be welded shall be heated with a torch to a temperature warm to the hand before welding. Surfaces to be welded shall be free from loose scale, slag, rust, paint, oil and foreign material. Joint surfaces shall be smooth, uniform, and free from fins, tears and other defects which might affect proper welding. Slag shall be removed from flame cut edges to be welded by grinding, temper colors need not be removed. Each layer of

- 6) Removal of adjacent base metal during welding - chip or grind weld to sound base and weld metal and form full size by depositing additional weld metal. Pipe or fittings which cannot be rewelded satisfactorily shall be replaced with new pipe or fittings at the Contractor's expense. Caulking of welds shall not be done. Before adding weld metal or rewelding, the surfaces shall be cleaned thoroughly. The removal of weld metal from a defective weld shall not extend into the base metal beyond the weld penetration. Where incomplete fusion is disclosed by chipping or grinding to correct defects, the part of the weld shall be removed and rewelded. In chipping or grinding welds, the weld or base metal shall not be nicked or undercut.

2. Victaulic Joints:

- a. Not permitted.
- K. Connections between copper and steel piping shall be made with brass or dielectric fittings.
- L. Install thermometer wells for temperature gauges and sensors, projecting a minimum of 2" into the pipe with extension to face of insulation. Piping 1-1/2" and smaller shall be enlarged to 2" where wells are installed. Wells shall be installed in active sections of piping. Fill wells with heat transfer fluid.
- M. Solder joints shall be made with non-lead solder. Clean surfaces to be soldered and use a paste flux. Wash joints with sodium bicarbonate and water to remove corrosive effects of heated solder paste. Hot wipe solder at each fitting.
- N. PVC piping shall have solvent welded joints except at connections to equipment and valves which shall be screwed for sizes 2" and smaller and flanged for sizes 2-1/2" and larger. Solvent welded joints: Pipe ends deburred, and beveled. Pipe end and fitting: Cleaned and dried, primed to soften bonding surfaces. Pipe end: Apply even full layer of solvent cement after priming. Before cement starts to set, insert pipe end into fitting and turn 1/4 turn to evenly distribute cement. Hold joint together until cement sets-up, wipe excess cement off joint.
- O. Pipe penetrations through walls, floors and ceilings shall have pipe sleeves of the same material as the pipe and in accordance with Section 23 05 00 "Common Work Results for HVAC" and the IBC. Pipe sleeves shall be suitable for firestopping in accordance with the firestopping manufacturers recommendations. Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy.
- P. Automatic Air Vents: Shall be installed with a manual isolation valve. The vent discharge shall be piped to a local floor drain.
- Q. Refrigeration Piping:
1. Provide and install refrigeration piping, hangers, and accessories as specified and required. The piping installation shall be performed by a qualified

f. Thermal expansion valve on each refrigeration circuit.

R. Secondary fuel oil containment piping shall be installed in accordance with the manufacturer's installation instructions.

3.3 PIPE HANGERS

A. Impact driven studs are not acceptable.

B. Pipes (copper or steel) shall be supported at intervals and rod sizes as follows, double nuts on hangers and on beam clips.

Pipe Size	Hanger Intervals	Rod Sizes
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	7'	3/8"
1-1/4"	8'	3/8"
1-1/2"	9'	3/8"
2"	10'	3/8"
2-1/2"	11'	1/2"
3"	12'	1/2"

C. Verticals: Supported at the base and at intervals as follows by use of clamp hangers:

Steel Pipe: Not more than 16 ft.

Copper Pipe and Tubing:

- 1-1/2" and larger - Not more than 12 ft.
- 1-1/4" and smaller - Not more than 6 ft.

D. Provide welded steel saddles at each hanger on steel piping systems 4" and larger.

E. PVC Piping: Supported at 4' intervals.

3.4 INSTALLATION OF BOILERS

A. Install gas boilers per NFPA-54 and manufacturer's instructions. Provide gas boilers with interconnecting power and control wiring.

3.5 CLOSING IN WORK

A. Cover up or enclose work after it has been properly and completely tested and reviewed.

B. No additional cost to the Owner will be allowed for uncovering or recovering any work that is covered or enclosed prior to required test and review.

3.6 TEST AND ADJUST

## SECTION 23 09 00 - INSTRUMENTATION AND CONTROLS FOR HVAC

## PART 1 - GENERAL

## 1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the automatic temperature control system indicated. The system shall be a direct digital control (DDC) system with dynamic color graphics software to provide the sequences as described in these specifications. The ATC system shall be complete with required components including, low voltage and line voltage wiring and conduit. Wiring shall be in accordance with Division 26, "Electrical" of the specifications and NFPA 70, National Electrical Code. See "System Point Lists" for additional requirements and information. The Building Management System shall be fully integrated to provide the end users with full control, monitoring and management functions, based on a common computer operating system and operating procedures. Industry standard Open Communication Protocols shall be provided, as specified.
- B. Recognized hazardous materials such as lead, mercury or asbestos shall be prohibited from the project. Submit MSDS sheets to the Owner for review.
- C. The following features and components shall be included:
1. Microprocessor-based primary plant controllers and intelligent room controllers interfacing directly with sensors, actuators and environmental delivery systems (i.e. HVAC equipment such as boilers, room climate controls, electrical systems, etc.
  2. Electric / electronic sensors and final control elements including valves and actuators.
  3. A two wire peer communication network to allow data exchange between primary controllers and centrals.
  4. A personal computer (PC)-based central, with graphical interface and associated operator station(s), and software functioning as the primary operator interface to the BMS.
  5. All system components shall be fault tolerant.
    - a. Provide satisfactory operation without damage at 110% and 85% of rated voltage and at +3 Hz. variation of line frequency.
    - b. Provide static, transient and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus-connected devices shall be transformer coupled or equivalent so that any single device failure shall not disrupt or halt bus communication.

- A. The General Conditions, Supplemental General Conditions and Instructions to Bidders shall apply to this work. Read these to be familiar with conditions related to the installation of the work.

#### 1.4 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00 relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the shop drawings paragraph in Section 23 05 00 "Common Work Results for HVAC", apply are as follows:
  - 1. Temperature control system schematic including variables, flow diagrams, ladder diagrams, and point to point wiring diagrams, indicating set points, reset ranges, throttling ranges, controller gains, differentials, operating ranges, normal positions, controller action, dial ranges, voltages, currents, mounting locations, indicators, and terminal strip points.
  - 2. Sequence of operation for each system and function.
  - 3. Generic, functional description of each control component indicated.
  - 4. Equipment interlocks required by sequence of operation.
  - 5. Automatic valve schedule showing flow, Cv, and pressure drop.
  - 6. Manufacturer's Data:
    - a. Dampers, valves and operators.
    - b. Controllers, including wiring and connection diagrams.
    - c. Thermostats, temperature sensors, including wiring and connection diagrams.
    - d. Temperature and pressure indicators.
    - e. Pressure sensors, including wiring and connection diagrams.
    - f. Switches, relays, transmitters, transformers, including wiring and connection diagrams.
  - 7. Dynamic color graphics software data.
  - 8. Operator's Display Terminal, computer and peripheral hardware.

### PART 2 – PRODUCTS AND FEATURES

#### 2.1 CONTROL PANELS

- A. In general, relays, transformers, or other control devices (not including room thermostats or duct-mounted instruments) shall be grouped and mounted in a factory-built cabinet enclosure.

#### 2.2 AUTOMATIC CONTROL DAMPERS



covering in such a manner as to prevent sweating and interference with the insulation.

4. Where indicated, damper actuators shall be provided with an auxiliary switch rated at 120 V AC, and accept a 0 to 20 ma input.

### 2.3 AUTOMATIC CONTROL VALVES (HOT WATER, 250°F MAX.)

- A. Valves shall have removable composition discs with monel stem. Bodies two inches or smaller shall be bronze with screwed ends. Bodies 2-1/2 inches and larger shall be cast-iron with flanged ends. Valve bodies, trim and stuffing boxes shall be designed for not less than 125 psi working pressure. Valve packing shall be non-lubricated teflon packing suitable for hot water service, as required.
- B. Modulating valves shall be sized for maximum pressure drop of 1.5 to 4.0 psi.
- C. Automatic control valve differential shut-off pressure shall be a minimum of 35 psig.
- D. Heating valves shall fail to the "normally-open" position.
- E. Valves shall have a clearly marked position indicator as part of the operating linkage.
- F. Actuator: Shall be electronic, direct-coupled, pulse width modulation (PWM) or spring return type and have a rating of not less than twice the torque needed for actual operation of the valve.

### 2.4 TEMPERATURE SENSORS

- A. Temperature Sensors: RTD Elements, accuracy of  $\pm 0.1\%$  at 70°F, sensors shall be securely attached to a single gang electrical box or other suitable base, securely mounted on the wall or other building surface. Each sensor shall be located where shown or, if not shown, where it will respond to the average temperature in the room. Sensors, generally, shall be mounted 48 inches above the floor, and shall not be mounted on outside walls if other locations are possible. If located on an outside wall, it shall have an insulated base. Sensors shall have locked or concealed adjustment devices, by means of which the operating points can be adjusted through a range of not less than 10 degrees above and below the operating points specified.
- B. Room temperature sensors shall be equal to Honeywell Model T7560 Digital Wall Module or Vaisala, with setpoint adjustment and override button, digital LCD display for temperature and setpoint status and LED override status indication. Room sensor setpoints shall have software adjustable limits to keep setpoint within the specified range. Provide heavy-duty tamperproof cast aluminum guards, where indicated. Temperature sensors / thermostats with guards shall have a blank cover (tamperproof).

### 2.6 OPERATOR'S DISPLAY TERMINAL

- A. Provide a standard 17" Super VGA color video display terminal and a minimum 80 key keyboard with Microsoft-compatible mouse capable of displaying and changing

4. Five cycle carry over during utility loss.
  5. Temperature range 32 - 105°F. Humidity range 0 - 95%.
- G. Drive control function shall be adjustable from a digital operator keypad located on the front of the drive. Drive parameters shall include the following: Programmable keypad speed and start command; forward or reverse start; stop and digital speed control; maximum and minimum frequency limits; two acceleration and deceleration times; critical frequency avoidance lockout zones; electronic overload and torque limit; multiple attempt restart; jog and preset speeds; spinning motor functions; two digital output relays; analog output relay; DC injection braking time; programmable PI process control; digital potentiometer.
- H. The drives shall have the following system interfaces:
1. Inputs: Process control speed reference interface to receive either a 0-10 Vdc; 4-20 ma DC or speed potentiometer signal; remote mode start and stop contacts; remote forward and reverse contacts; remote preset speed contacts; remote external stop contact; remote reset contact; remote jog contact.
  2. Outputs: Two programmable digital relays N.O. contact; Form C contact to indicate protective function trip; two programmable analog output signals.
  3. Provide a LonWorks or equal interface card for each drive.
- I. Drives shall have a two line sixteen character each display indicating output current, output frequency, motor RPM, output voltage, power, load, elapsed time, cause of trip.
- J. The drives shall contain the following protection functions; over current, over/under voltage, over frequency, phase loss, over temperature, ground fault and short circuit.
- K. Drives shall have a 3 year warranty (parts and labor) and be started up by a factory-authorized technician. Drive enclosures shall be NEMA 1 rated.
- L. Provide one drive for each fan or pump (as indicated).

## 2.8 REMOTE NOTIFICATION

- A. The workstation shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), and email accounts based on a point's alarm condition.
- B. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.
- C. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.

shut down for space heating when the outside air temperature is above 60F. and the 2-way control valve (V1) shall be closed.

2. Main Heating Hot Water Circulators (CP-5 & CP-6): Operate Lead/Lag - if lead circulator fails the Lag circulator shall run. The lead-lag pumps shall be alternated based on runtime. At outside air temperatures above 60°F, CP-5 and CP-6 shall be de-energized. The pumps shall operate again under the following conditions: The outside air temperature drops to 50°F. and / or any space sensor temperature drops below 68°F. Once the pumps start they shall operate continuously to maintain a constant differential pressure at the location indicated on the drawings by proportioning the variable frequency drive controlling each pump.
3. Boiler Circulators (CP-1, CP-2, CP-3 & CP-4): Shall operate from the boiler controller to stage the boilers in sequence and modulate the firing rate with automatic alternation of the "lead" boiler.
4. Unit Heaters and Cabinet Unit Heaters:
  - a. On a call for heating by the electric room thermostat, the fan shall operate subject to the pipe mounted aquastat to satisfy the heating setpoint (68°F).

- b. "Unoccupied" Mode;
  - 1. The unit shall remain off.
- 7. Blower-Coil Units (AC1, 2, 3):
  - a. Shall operate on an "occupied-unoccupied" sequence.
  - b. During "occupied" periods the fan shall operate continuously. During "unoccupied" periods, the fan shall cycle to maintain a reduced room heating setpoint.
  - b. The 2-way control valves shall proportion to maintain the space heating setpoint. DX cooling shall be staged as required to maintain the cooling setpoint. The condensing units shall be electrically interlocked to operate only when the respective Blower-Coil unit is operating.
- 8. Packaged Rooftop Air Conditioning Unit (AC-4):
  - a. AC-4 shall be started / stopped by the EMCS. The unit shall have packaged controls for gas heat / DX cool / economizer, and limit controls.
  - b. During "occupied" periods, the units shall operate continuously. During "unoccupied" periods, the units shall cycle on a call for heat from any room sensor.
  - c. A freeze-protection thermostat shall shut down the unit and close the motorized outside air damper if the discharge drops below 45°F.
  - d. A duct smoke detector shall shut down the unit and send a signal to the fire alarm panel if smoke is detected.
- 9. Indirect-Fired Water Heaters (IFWH1, 2, 3, 4):
  - a. Shall operate to maintain a supply water temperature of 140F..
  - b. The boiler controller with domestic hot water priority shall cycle the indirect-fired water heater pumps on a call for hot water.
- 10. Summer-Winter Changeover:
  - a. When the outside air temperature is above 60F., the heating only control valves shall be closed.
  - b. When the outside air temperature is below 60F., the heating only control valves shall be controlled by their local space sensor.
- 11. Combination Fire / Smoke Dampers:
  - a. Dampers shall be open when the unit fan is operating. When the Corridor smoke detector senses smoke, the dampers shall close and the unit shall be shut down, and a signal sent to the Fire Alarm Panel.

wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in the piping at elbows to effect proper flow across the entire area of the well. Wells may either look upstream or downstream. Provide thermal transmission material within the well to speed the response of temperature measurement. Provide wells with sealing nuts to contain the thermal transmission material and allow for easy removal. Wells shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area. Increase piping size as required to avoid restriction.

### 3.3 ADJUSTMENTS

- A. Adjust controls and equipment to maintain the conditions indicated, to perform the functions indicated, and to operate in the sequence specified.

### 3.4 DUCT SMOKE DETECTORS

- A. The Fire Alarm Contractor shall furnish and wire duct smoke detectors. Installation shall be accomplished by the sheetmetal contractor and be wired by the Fire Alarm Contractor.

### 3.5 INSTRUCTING OPERATING PERSONNEL

- A. Upon completion of the work and when designated by the Architect, furnish the services of a competent technician regularly employed by the temperature control manufacturer for the instruction of Owner in the operation and maintenance of each automatic space temperature control system. The period of instruction shall be for not less than five (5) 8-hour non-concurrent working days and shall include video tape demonstration of controllers.

### 3.6 FIELD INSPECTION AND TESTS

- A. Tests shall be performed or supervised by employees of the ATC system or manufacturer of the ATC system, or by an authorized representative of the ATC manufacturer. Give Architect 14 calendar days advance written notice prior to the date of the field acceptance testing. If the Architect witnesses tests, such tests shall be subject to approval. If the Architect does not witness tests, provide performance certification.
- B. Plan for Inspections and Tests: Furnish a written inspections and tests plan at least 60 days prior to the field acceptance test date. This plan shall be developed by the manufacturer of the ATC system. The plan shall delineate the inspections and testing procedures required for the ATC system to demonstrate compliance with the requirements specified. Additionally, the test plan shall indicate how ATC system is to be tested, what variables will be monitored during test, names of individuals performing tests, and what criteria for acceptance should be used. Indicate how operation of H&V system and ATC system in each seasonal condition will be simulated.
- C. Field Acceptance Testing: Upon completion of 72 hours of continuous H&V and ATC systems operation and before final acceptance of work, test the automatic temperature control systems in service with the heating, ventilating and air conditioning systems to demonstrate compliance with contract requirements. Test

**SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The General Conditions, Supplemental General Conditions and Instructions to Bidders shall apply to this work. Read these to be familiar with conditions related to the installation of the work.

**1.2 WORK SHOWN ON DRAWINGS**

- A. The drawings accompanying this specification, as a part thereof, are working drawings indicating the location and arrangement of the increments of the systems of this section of work. Material deviation from this arrangement, process or means of application, shall bear the Engineer's review stamp before the change is made on the job or materials are ordered. Changes made without such review shall be ordered removed and items installed as specified shall be provided at no additional expense to the Owner.
- B. The drawings are not intended to show in minute detail minor items of installation or materials such as specific fittings or findings.

**1.3 MATERIALS AND LABOR**

- A. Furnish materials and labor necessary to deliver to the Owner a complete and operable system installed in accordance with the contract documents.
- B. Materials shall be of the best quality. Workmanship shall be of highest grade and construction shall be done according to best practices of the trade.
- C. Provide, when required, labeled samples of material or equipment specified herein or proposed to be used in this work.
- D. Where words "furnish", "provide", or "install" are mentioned, either singly or in combination, these words are hereby interpreted to mean "furnish and install" or "provide and install", including materials complete with connections, supplemental devices, accessories and appurtenances, unless specifically otherwise noted. These words are likewise hereby interpreted as being prefixed to materials, equipment, and apparatus hereinafter mentioned, either in abbreviated or scheduled information or in the technical sections of the specifications.

American Society of Heating, Refrigerating, and Air  
Conditioning Engineers (ASHRAE)  
American Society of Mechanical Engineers (ASME)  
National Electrical Manufacturers Association (NEMA)  
Institute of Electrical and Electronics Engineers (IEEE)  
American National Standards Institute (ANSI)  
National Fire Protection Association (NFPA)  
American Water Works Association (AWWA)  
Local Fire Code  
Local Plumbing Codes  
American Welding Society

#### 1.11 SHOP DRAWINGS

- A. Submit shop drawings, manufacturers' data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, eight (8) copies, to be submitted to the Architect. Shop drawings will be returned "No Exceptions Taken", "Make Corrections Noted", "Amend and Resubmit", "Submit Specified Item", or "Rejected" less two (2) copies. Work shall progress in accordance with "Reviewed" shop drawings (ONLY).
- B. Groups of similar shop drawings shall be submitted as individual bound documents with covers and indexes. Typical similar items would be "Diffusers and Registers", "Valves and Controls". Rejection of individual items shall not be cause for rejection of the entire document.
- C. Clearly indicate item(s) to be reviewed on each submission by highlighting or underlining intended item(s). Submissions not clearly marked shall be returned "Amend and Resubmit".
- D. Shop drawings must bear the Engineer's review stamp. In the event that the Engineer returns shop drawings "Amend and Resubmit" or "Rejected", the shop drawing must be revised and resubmitted for review.
- E. Furnishing of the specified item must still produce the results and performance, dependability and quality reasonably to be expected within the spirit of the specifications, drawings, and the standard of good mechanical performance normal to the trade.

#### 1.12 SUBSTITUTIONS

- A. Refer to Specification Section 01 60 00 / 22. Where the specifications allow the substitution of a product, still this product is subject to review by the Engineer in accordance with the paragraph entitled "Shop Drawings". Review of a substitute item is an indication only that the substitute item is compatible with the specified item as a claim of the manufacturer. Insure dimensional propriety, performance, and quality of the substitute item.
- B. Reference in the specifications or on the drawings to any product, material, fixture, form or type of construction, by proprietary name, manufacturer, make or catalog number, establishes a standard of quality or design and is not meant to limit competition. Use any equivalent substitute provided favorable written review by the

**3.4 CONNECTION TO EQUIPMENT**

- A. Provide piping connections, supports, brackets, compensators or flexible connections to prevent application of excessive stresses to equipment.
- B. Equipment shall be installed with flanges or unions in such a manner as to permit disconnecting for removal of tubes, coils, elements and other equipment for inspection, service and repairs.

**3.5 ACCESS TO EQUIPMENT**

- A. The installation of work performed shall provide reasonable accessibility for operation, inspection, and maintenance of equipment and accessories. The Engineer shall determine the adequacy of such accessibility.

**3.6 ACCESS PANELS**

- A. Access panels shall be provided where indicated on the drawings and as required for access to valves and other serviceable components. Access doors shall be Milcor, Zurn or approved equal hinged with primed finish and with allen wrench operated latch.
- B. Access panels installed in fire-rated assemblies shall have the same fire rating as the assembly.

**3.7 PAINTING OF EQUIPMENT**

- A. Exposed ironwork, including steel supports and hangers in unfinished spaces, e.g. boiler rooms, mechanical rooms, pits, and trenches shall be properly cleaned, prepared and painted with two (2) coats of black asphaltum varnish.

**3.8 GUARDS**

- A. Exposed moving and rotating elements of mechanical equipment items shall be protected with suitable guards for personnel protection. Guards shall be of rigid construction, firmly positioned. Holes shall be provided in guards at shaft centers to facilitate tachometer readings.

**3.9 LUBRICATION**

- A. Furnish and install grease fittings for points requiring lubrication. Furnish extension type fittings as required to provide easy access for maintenance lubrication.
- B. Furnish initial charges of lubricants for equipment. Lubricants shall be in conformance with the manufacturer's requirements and recommendations.



3.12 STARTING OF EQUIPMENT

- A. Testing or starting of equipment shall be done in collaboration with trades concerned to insure safe and proper operation of the equipment.
- B. Prior to starting equipment, provide lubrication at required points. Before starting any electrical or electric motor driven equipment, a check must be made to insure that proper heater coils are installed in the starters and that the equipment is rotating in the proper direction.

3.13 OPERATIONAL TESTING

- A. Operate systems until successful operation is demonstrated to the Engineer. This initial operation shall be in addition to the testing of the system and shall be done after the system is cleaned and finished.

3.14 RECORD DRAWINGS

- A. During construction, keep an accurate record of deviations to the installation of the work as indicated on the drawings. Upon completion of the work, furnish a copy of this record to the Engineer. **Submit record drawings before requesting final payment.**

3.15 MANUFACTURER'S REPRESENTATIVE

- A. As indicated in the Technical Sections of this specification or as directed by the Engineer, provide the services of a factory trained Engineer or Technician to inspect, adjust, and place in proper operating condition the equipment or item involved. No additional compensation will be allowed for such service.

3.16 MANUFACTURER'S INSTRUCTIONS, OPERATION AND MAINTENANCE DATA

- A. Provide for each item of equipment or apparatus furnished, a complete set of printed instructions obtained from the manufacturer covering proper operation, maintenance, lubrication, cleaning, servicing, adjustment, and safety instructions.
- B. Manufacturer's data shall include performance data (curves are preferred where applicable) complete parts lists, recommended spare parts lists, piping, and wiring diagrams.
- C. Arrange data in complete sets, properly indexed and marked.
- D. Data shall include a complete set of shop drawings.
- E. Material shall first be submitted in preliminary form for review by the Engineer. After review, submit two (2) copies in bound volumes to the Engineer for distribution.

**SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING FOR HVAC**

**PART 1 - GENERAL**

1.1 DESCRIPTION: The work covered by this section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required for testing and balancing the air and water systems.

1.2 RELATED DOCUMENTS

- A. The General Conditions, Supplemental General Conditions and Instructions to Bidders shall apply to this work. Read these to be familiar with conditions related to the installation of the work.

1.3 DEFINITIONS

- A. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment, (e.g., reduce fan speed, throttling).
- B. Balance: To proportion flows within the distribution system (submains, branches and terminals) in accordance with specified design quantities.
- C. Procedure: Standardize approach and execution of sequence of work operations to yield reproducible results.
- D. Report Forms: Test data sheets arranged for collection of test data in logical order to submission and review. This data should also form the permanent record which shall be used as the basis for any future testing, adjusting, and balancing required.
- E. Test: To determine quantitative performance of equipment.

1.4 SUBMITTALS: Submit the following:

- A. Standards Compliance:
  - Testing Agency
  - Testing Agency Personnel
  - Professional Engineers
  - Instrument Calibration

Air	10 or less	1/2
Air	over 10	1
Water	10 or less	1/10
Water	10-20	1/2
Water	over 20	1

F. Flow Rate Tolerance: Values are based on discussion in ASHRAE "HVAC Applications", Chapter 34. Air filter resistance during tests, artificially imposed if necessary, shall be 80 percent of final values.

1. Air Handling Unit CFM: Minus 0 percent to plus 10 percent.
2. Other Fans: Minus 0 percent to plus 10 percent.
3. Air Terminal Units (VAV Boxes): Minus 5 percent to plus 10 percent.
4. Minimum Outside Air (for manually set dampers): Minus 0 percent to plus 10 percent.
5. Individual Room Air Outlets and Inlets, and Air Flow Rates Not mentioned Above: Minus 10 percent to plus 10 percent.
6. Heating System Pumps GPM: Minus 0 percent to plus 10 percent.
7. Other Pumps GPM: Minus 10 percent to plus 10 percent.
8. Air Handling Unit Coils GPM: Minus 5 percent to plus 10 percent.
9. Terminal Unit Coils/Elements GPM: Minus 10 percent to plus 10 percent.

**1.8 COMMISSIONING**

A. Mechanical systems in this project will be commissioned by an independent commissioning agent, hired by the owner. All division 23 contractors and subcontractors will be responsible for carrying out the commissioning requirements specified in Section 019131 - General Commissioning Requirements, and other sections referenced in 019131, at no additional cost to the owner.

**PART 2 - PRODUCTS**

**NOT USED**

- C. **Water Measurements and Balancing:** Use venturi tubes, orifices, or other metering fittings and pressure gages. Adjust systems to provide the design flow rates through the heat transfer equipment prior to the capacity testing. Perform measurement of temperature differential with the air system, adjusted as described herein, in operation.
- D. **Automatic Controls:** Position automatic control valves for full flow through the heat transfer equipment of the system during tests.
- E. **Flow:** Flow through by-pass circuits at three-way valves shall be adjusted to balance that through the supply circuit.
- F. **Distribution:** Adjust distribution by means of balancing devices (cocks, valves, and fittings) and automatic flow control valves. Do not use service valves for adjustment. Where automatic flow control valves are utilized in lieu of venturi tubes, record only the pressure drop across the valve if within the pressure drop rating on the valve tag.
- G. **Special Procedures:** Where available, pump capacity (as designed) is less than total flow requirements of individual heat transfer units of system served, full flow may be simulated by the temporary restriction of flow to portions of the system.

**3.3 CERTIFIED REPORTS**

- A. **Submittal:** Submit three copies of the reports described herein, covering air and water system performance, air motion (fpm), to the Architect prior to final tests and inspection.
- B. **Instrument Records:** Include types, serial numbers, and dates calibration of instruments.
- C. **Reports:** Reports shall identify conspicuously items not conforming to contract requirements, or obvious maloperation and deficiencies.
- D. **Certification:** The reports shall be certified by an independent Registered Professional Engineer who is versed in the field of air and water balancing and who is not affiliated with any firm involved in the design or construction phases of the project.

**3.4 AIR SYSTEM DATA**

- A. **Report:** The certified report shall include for each air-handling system the data listed below:
  - 1. **Equipment (fan or factory fabricated station unit):**
    - a. **Installation Data:**
      - 1) **Manufacturer and Model**
      - 2) **Size**
      - 3) **Arrangement, Discharge, and Class**
      - 4) **Motor H.P., Voltage, Phase, Cycles, and Full Load Amps.**

- 3) R.P.M.
- 4) B.H.P. and Amps.
- c. Recorded Data:
  - 1) Discharge Pressures (Full-Flow and No-Flow)
  - 2) Suction Pressures (Full-Flow and No-Flow)
  - 3) Operating Head
  - 4) Operating G.P.M. (from pump curves if metering is not provided)
  - 5) No-Load Amps. (where possible)
  - 6) Full-Flow Amps
  - 7) No-Flow Amps
- 2. Air Heating and Cooling Equipment:
  - a. Design Data:
    - 1) Load in Btu per hr
    - 2) G.P.M.
    - 3) Entering and Leaving Water Temperature
    - 4) Entering and Leaving Air Conditions (D.B. and W.B.)
    - 5) C.F.M.
    - 6) Water Pressure Drop
  - b. Recorded Data:
    - 1) Type of Equipment and Identification (location or number designation)
    - 2) Entering and Leaving Air Conditions (D.B. and W.B.)
    - 3) Entering and Leaving Water Temperatures
    - 4) G.P.M. (if metered)
    - 5) Temperature Rise or Drop
- 3. Converters and Heat Exchangers:
  - a. Installation Data:
    - 1) Manufacturer, Model, and Type
    - 2) G.P.M.
    - 3) Inlet (entering) and Outlet (leaving) Temperatures
    - 4) Water Pressure Drop
  - b. Recorded Data:
    - 1) G.P.M. (if metered)
    - 2) Entering and Leaving Water Temperature - System
    - 3) Water pressure drop
    - 4) Heating (or Cooling) Media Steam Pressure and Temperature and Condensate Temperature, or Entering and Leaving Water Temperature
    - 5) Heating (or Cooling) Media - Flow (G.P.M. or lbs. per hour)

SECTION 23 07 00 - HVAC INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including the project manual are hereby made a part of the work of this section.

1.2 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to insulate the heating, ventilating and air conditioning systems.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Common Work Results for HVAC, apply are as follows:
  - 1. Piping insulation.
  - 2. Duct insulation.
  - 3. Equipment insulation.
  - 4. Insulation application schedule.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels, unless specifically listed below as an unfinished space.
- B. Unfinished Spaces: Mechanical rooms and Elevator machine rooms.
- C. Unconditioned Spaces: Spaces exposed to near outside ambient temperatures, such as unheated attic spaces or non-air conditioned areas.
- D. Outside: Areas beyond the exterior side of walls or above the roof, unexcavated spaces, and crawl spaces.
- E. Concealed: Not visible in finished or unfinished spaces. For example, above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.
- F. Exposed: Visible from a finished or unfinished space.

1.5 MANUFACTURER'S STAMP OR LABEL

- C. Fittings, Flanges, and Valves: Provide insulation for fittings, flanges, and valves premolded, precut, or job fabricated of the same thickness and conductivity as used on adjacent piping.
- D. Insulation Kit: Insulate exposed supply and waste piping at handicapped accessible sinks with fully molded insulation kit. McGuire Products ProWrap, 3/16" thick closed vinyl with anti-microbial additive, 1.02 Btu-in/hr-F<sup>2</sup>-°F thermal conductivity, white color.

## 2.2 DUCT INSULATION

- A. Fiberglass (Ductwrap): Fiberglass duct wrap with foil-scrim-kraft facing/vapor barrier, 1.0 lb/cu.ft. density (0.75 lb/cu.ft. for 3" thickness only), 0.29 Btu-in/hr-ft<sup>2</sup>-°F conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A & B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.
- B. Fiberglass (Ductboard): Fiberglass insulation board with foil-scrim-kraft facing/vapor barrier, 3.0 lb./CF density, 0.25 Btu-in/hr-ft<sup>2</sup>-°F conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A and B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.

## 2.3 EQUIPMENT INSULATION

- A. Fiberglass (Hot Equipment): Semi-rigid fiberglass board conforming to Fed. Spec. HH-I-558B, Form B, Type I. Thermal conductivity shall be 0.32 Btu-in/hr-ft<sup>2</sup>-°F at 150°F mean temperature (ASTM C177), insulation shall be suitable for 650°F service. Insulation jacket shall be "all service" type conforming to Fed. Spec. HH-I-100B Type I or II. Jacket permeability shall not exceed 0.02 perms (ASTM E96).
- B. Flexible Unicellular (Cold Equipment): Flexible unicellular with thermal conductivity of 0.27 Btu-in/hr-ft<sup>2</sup>-°F at 75°F mean temperature. Insulation shall conform to ASTM C534, Type II, sheet and shall be suitable for 200°F service. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.

## PART 3 EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Inspection:
  - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  - 2. Verify that the insulation systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

### 3.2 GENERAL

- E. Hangers and Anchors: Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide MSS SP-58, Type 40 galvanized steel shields (16 gage maximum). For fiberglass insulation systems on pipe sizes 2 inches through 3", provide insulation inserts at points of hangers and supports. Insulation inserts shall be of molded glass fiber (minimum 12 pcf). Insulation inserts shall cover the bottom half of the pipe circumference, 180 degrees, and be not less than 4" long. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation. Insulation inserts for pipe sizes 4" and larger shall be welded pipe saddles. Install insulation in void area of saddle of same material used on adjacent insulation. For pipe sizes 2" and smaller, insulation inserts for flexible unicellular insulation systems shall be wooden doweling set on end of length equal to insulation thickness. Seal dowel to insulation with adhesive.
- F. PVC or Metal Jackets: Provide over insulation. Machine cut jacket to smooth edge of circumferential joints. Overlap metal jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9 inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by insulation manufacturer for weatherproofing. Solvent weld PVC jacket system to provide continuous watertight seal.

### 3.4 DUCT INSULATION

- A. Rigid Insulation: Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from joint edges of boards, spaced not more than 12 inches on centers and secure with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Each pin or anchor shall be capable of supporting a 20-pound load. Cut off protruding ends of pins. After installing washers, provide foil-scrim-kraft (FSK) tape to seal break in vapor barrier, tape shall extend 1" minimum around pin. Apply insulation with joints tightly butted. Bevel insulation around name plates and access plates and doors. Seal joints with FSK tape. Provide additional adhesive or staples to assist tape adhesion in difficult applications.
- B. Flexible Blanket Insulation: Apply insulation with joints tightly butted. Staple laps of jacket with outward clinching staples and seal with foil scrim kraft (FSK) tape. Sagging of flexible duct insulation shall not be permitted. For ductwork over 24-inches wide on horizontal duct runs, provide pins, washers and clips. Install speed washers with pins and pin trimmed to washer. Cut off protruding ends of pins after clips are secured. Seal with FSK tape, extend tape 1" minimum around pin. Use pins on sides of vertical ductwork being insulated. Space pins and clips on 18 inch centers and not more than 18 inches from duct corners. Carry insulation over standing seams and trapeze-type hangers.
- C. Exterior ductwork insulation shall be made watertight with an EPDM covering.

### 3.5 EQUIPMENT INSULATION

- A. General Procedures: Apply equipment insulation suitable for temperature and service to fit as closely as possible to equipment. Join sections of insulation with adhesive. Bevel insulation around nameplates, ASME Stamp, and access plates. For insulation on equipment that must be opened periodically for inspection,



Supply and Return Ductwork (rectangular) From "AC" units in <u>unconditioned</u> spaces (Such as mechanical rooms and ceiling cavities of unconditioned spaces)	2"	Duct wrap, FSK
Supply and Return Ductwork (Round or Flat Oval) in unconditioned spaces (Such as mechanical rooms)	2"	Ductwrap, FSK
Outside Air Intake Ductwork (Rectangular) from the intake louver to the "AC" and "ERV" Units	2"	Ductwrap, FSK
Outside Air Intake Ductwork (Round or Flat Oval) from the intake louver to the Air Handling Unit	2"	Duct wrap, FSK
Plenums at Intake and Exhaust louvers	2"	Ductboard, FSK

<u>SERVICE</u>	<u>THICKNESS</u>	<u>MATERIAL/JACKET</u>
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DUCTWORK:

Exhaust Ductwork from a point three (3) feet interior of the motorized control damper or backdraft damper to the exterior wall, roof, or louver.	2"	Ductwrap, FSK
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EQUIPMENT

Heating System Air Separators	1½"	Fiberglass, ASJ
Heat Exchangers	1½"	Fiberglass, ASJ
Suction Diffusers, Air Separators, Flexible Connectors, Valves	1/2"	Flexible Unicellular

3.8 FIELD INSPECTION

- A. Visually inspect to ensure that materials used conform to specifications. Inspect installations progressively for compliance with requirements.

SECTION 23 30 00 - HVAC FOR DISTRIBUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.

1.2 DESCRIPTION OF WORK

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the ductwork systems indicated.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00 "Common Work Results for HVAC", apply are as follows:
  - 1. Ductwork.
  - 2. Ductwork accessories.
  - 3. Air devices.
  - 4. Acoustical duct liner.
  - 5. Firestopping materials and methods.
  - 6. Louvers and dampers.
  - 7. Ductwork sealing products.
  - 8. Dryer Booster Fans (DBF)

PART 2 PRODUCTS

2.1 DUCTWORK

- A. Classification of Ductwork: Low pressure ductwork: up to 2" W.G. static pressure. Medium pressure ductwork: 2" to 6" W.G. static pressure. All flat oval and round ductwork shall be of medium pressure construction. The duct pressure class shall be determined by multiplying the total static pressure scheduled in the fan schedules by 1.2.
- B. Materials: Unless otherwise indicated low pressure ductwork shall be galvanized steel. Galvanized sheet metal shall be new galvanized steel sheets of lock forming quality with zinc coating that will not flake or peel under forming operation.
- C. Construction for Low Pressure Round and Rectangular Ductwork:
  - 1. Material: Galvanized steel conforming to ASTM A527, weight of galvanized coating shall be not less than 1-1/4 ounces total for both sides of one sq.ft. of

permits) or vaned type mitered elbow where space is restricted. Unless specifically indicated (and field-verified) as 5 piece construction, use vaned 90° elbows. Vanes shall be single thickness, solid-welded in place. Straight tees and shop or field-installed saddle taps are prohibited.

- c. Joints on round spiral ductwork shall be slip type, coupling type, Van Stone flanges, or factory fabricated flange system type connectors, as standard with the manufacturer. Flat oval joints shall be Van Stone flanges (gasketed) or factory fabricated flange system type connectors. Joints shall be made up with joint sealer applied in strict accordance with the manufacturer's recommendations. Joint sealer shall be as recommended by the manufacturer.
  - d. Duct and fittings shall have been tested for air friction loss and leakage in an independent testing laboratory. Test results shall be submitted with the Shop Drawings for review.
  - e. External reinforcing angles shall be provided in accordance with the manufacturer's recommendations. External reinforcing angles shall be galvanized or painted with a rust inhibiting aluminum paint. Include reinforcing data with Shop Drawing submittal. Duct and reinforcing shall be designed for a positive static pressure of 6 inches of water gage.
  - f. No internal tie rod reinforcing will be allowed.
  - g. Hangers shall be of the clamp-on or trapeze type. Exposed ductwork shall use clamp-on hangers only. Holes shall not be drilled through the ducts.
- F. Acoustical duct liner for rectangular ductwork shall be Type AP Armaflex SA duct liner with "Microban" antimicrobial protection. The liner shall be elastomeric unicellular (closed cell) and have a thermal conductivity of 0.27 Btuh/°F.-sf-in. and be cleanable and suitable for duct velocities of 4000 FPM. Duct liner thickness shall be 1" unless indicated otherwise. The installation shall include 100% coverage of the manufacturer's recommended adhesive and protective Z-strips at all exposed upstream edges. Mechanical fasteners shall be used in addition to adhesive. Insulation shall comply with NFPA 90A and NFPA 90B and be approved by Factory Mutual. All ductwork downstream of variable air volume boxes shall have 1/2" thick duct liner. Duct dimension are net inside of liner.

## 2.2 DUCTWORK ACCESSORIES

### A. Access Doors:

1. Medium Pressure Duct Systems: Ruskin Model ADHP-3, 12"x12" size, 16 gauge galvanized steel, foam gasket, insulated door, spring latches.
2. Low Pressure Duct Systems: Ruskin Model ADC2, 12"x12" size, 24 gauge galvanized steel, steel on both sides of door, foam gasket seals, 1" insulation, 2 cam locks, no hinge.

1. Hardcast DT tape and FTA-20 activator.
  2. Provide waterproof sealer where watertight seal is specified.
- K. Louvers (L): Ruskin Model ELF6375DX, Greenheck, or American Warming and Ventilating. Extruded aluminum construction, 0.081" thick, aluminum extrusions, drainable blade, 1/2" expanded metal bird screen, size and performance as scheduled. AMCA certified leakage rate shall be a maximum of 0.02 ounces of water per square foot of free area at 1000 FPM free area velocity. Provide Kynar 500 finish, color selected by Architect. Provide frame styles compatible with building construction, see architectural details. Provide concealed architectural or standard visible mullions in multi-panel louver assemblies as indicated on the drawings. Inactive / blanked-off louvers shall have a double wall sheetmetal closure on the interior face of the louver. The closure shall have a 2" thickness of 1.5 pcf rigid fiberglass board insulation with a foil face. Both sides of the sheetmetal shall be painted flat black.

2.3 AIR DEVICES (Krueger, Halton, Price, Anemostat, Metal Aire, Titus) ONLY

- A. Material and Finishes: Construct diffusers, registers, and grilles of aluminum. Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. Steel parts shall be factory zinc-phosphate treated prior to priming and painting or have a baked-on enamel finish. Aluminum parts shall be finish painted. Provide frame style compatible with ceiling or wall type. Colors shall be selected by Architect. Devices to be installed on exposed duct installations shall be furnished in primer suitable for field application of color coat.
- B. Sound Pressure Level: Manufacturer certified sound pressure level rating of inlets and outlets in accordance with ADC 1062 R4. Conform with the permissible room sound pressure level for each device as scheduled.
- C. Throw: Defined as distance from the diffuser, register, or grille to the point which the resultant room air velocity is 50 to 35 feet per minute.
- D. Ceiling Diffusers: Equip with core styles required to provide air distribution pattern indicated. Internal parts shall be removable through the diffuser-neck for access to the duct and without the use of special tools. Construct each diffuser of four or more concentric elements designed to deliver air in a generally horizontal direction. The interior elements of square and rectangular ceiling diffusers may be square or rectangular as manufacturer's standard. Screws or bolts in exposed face of frames or core elements are not acceptable. Diffusers shall have an opposed blade volume damper in the diffuser neck. Diffusers shall have a 24"x24" lay-in panel for areas with acoustical ceilings and surface-mount frame for GWB ceilings. Ceiling diffusers shall be Metalaire Series 5000 with induction vane (IV) option.
- E. Grilles and Registers: Construction and finish as indicated, 1/2" louver spacing, 45° curved blade. Registers shall have opposed-blade volume dampers with screwdriver adjuster. Unless otherwise indicated, registers shall be provided.
- F. Linear Diffusers and Bar Grilles: Linear bar grilles/registers and linear slot diffusers shall be as scheduled and indicated. Bar grilles shall have a 1" border with face screws. Provide opposed blade volume dampers for each diffuser and adjustable

- E. Access Doors: Provide access doors for concealed apparatus requiring service and inspection in the duct system including but not limited to dampers, sensors and motors, and upstream and downstream from duct coils.
- F. Duct Sleeves and Prepared Openings: Install duct sleeves and prepared openings for duct mains, duct branches, and ducts passing through walls, roofs, and ceilings. Insure the proper size and location of sleeves and prepared openings. Allow one-inch clearance between duct and sleeve or one-inch clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.
- G. Duct Supports: Unless otherwise indicated, provide one-inch wide by 16 gage galvanized steel sheet metal strips on each side of ducts. Anchor risers in the center of the vertical run to allow ends or riser free vertical movements. Attach supports only to structural framing members. Do not anchor supports to metal decking unless a means is provided (architectural review required) for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C clamps are used, use retainer clips.
- H. Flexible Collars and Connections: Provide flexible collars between fans and ducts or casings and where ducts are of dissimilar metals, as indicated or required. For round ducts, securely fasten flexible connections using stainless steel clinch-type draw-band. Nylon drawbands may be used if installed using the drawband manufacturer's lever-action tightening tool. For rectangular ducts, lock flexible connections to metal collars.
- I. Flexible Ducts: Provide where indicated. No fiberglass shall be exposed or in contact with air flow. Flexible duct length shall not be more than 4'-0". Install with metal band hangers and without excess length, provide maximum extension of flex duct. Securely fasten flexible ducts to metal collars using a stainless steel or tool-tightened nylon drawband on the duct core and a second drawband on the insulation vapor barrier. If the duct exceeds 12 inches diameter, position the drawband behind a bead on the metal collar. Taping in lieu of drawbands is not allowed.
- J. Any deviation in the duct system must be submitted as a shop drawing and stamped. CAUTION: Any deviation not submitted and favorably reviewed will be ordered removed from the system and replaced with that which is shown on the Drawings.
- K. Discrepancies between actual field conditions and the Contract Documents shall be brought to the attention of the Architect prior to fabrication.
- L. Field Changes to Ductwork: Field changes of ducts such as those required to suit the sizes of factory-fabricated equipment actually furnished shall be designed to minimize expansion and contraction. Use 4:1 transitions in field changes as well as modifications to connecting ducts.
- M. Transitions with a slope greater than 4 to 1 shall be ordered removed from the system and replaced with a transition which meets this criteria.

3.6 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner. In addition to the prime Mechanical Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

3.7 FIRESTOPPING

- A. All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped.

\* END OF SECTION \*

## PART 2 PRODUCTS

## 2.1 PIPING MATERIALS AND ACCESSORIES

- A. Hot Water Heating Piping (HWS/R), Chilled Water Piping (CHWS?R): Schedule 40 carbon steel pipe with threaded joints and malleable iron fittings (2½" pipe size and under) or Type "L" copper with soldered joints. Steel pipe sizes 3" and larger shall be butt-welded with flanged connections. All 90 degree elbows shall be long radius type.
- B. Condensate Piping: Type L hard copper tubing and cast bronze or wrought copper solder fittings.
- C. Watertight Roof Penetrations: Piping penetrations thru the roof shall be made watertight with a curbed opening by Portals Plus or ConnFab.

## 2.2 FITTINGS FOR STEEL PIPE

- A. Fittings in sizes ½" through 2½": Steel or malleable iron with requirements as follows:
  - 1. Steel fittings socket welding or screwed type conforming to ANSI B16.11.
  - 2. Malleable iron fittings screwed type conforming to ANSI B16.3.
- B. Fittings in sizes 3" and larger:
  - 1. Butt welding type conforming to ANSI B16.9.
  - 2. Flanged type conforming to ANSI B16.5.
- C. Steel Flanges: Forged steel, welding type conforming to ANSI B16.5. Bolting and gaskets shall be as follows:
  - 1. Bolting: Material used for bolts and studs shall conform to ASTM A 307, Grade B, and material for nuts shall conform to ASTM A 194, Grade 2. Dimensions of bolts, studs, and nuts shall conform to ANSI B18.2.1 and ANSI B18.2.2 with threads conforming to ANSI B1.1 coarse type, with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt-studs shall extend completely through the nuts.
  - 2. Gaskets: Gaskets shall be of a material that resists attack by the fluid or gas in the pipeline and shall be suitable for the pressure and temperature ranges encountered. Gaskets shall be as thin as the finish of surfaces will permit. Raised-face steel flanges shall have ring gaskets with an outside diameter extending to the inside of the bolt holes. Gaskets shall have an inside diameter equal to or larger than the port openings.
- D. Butt Weld Joints: Shall conform to ANSI B31.1. The use of backing rings shall conform to ANSI B31.1. Ferrous rings shall be of weldable quality and shall not exceed 0.05 percent sulfur. Backing rings shall be of the continuous machined or split band type.



# CITY OF PORTLAND, MAINE

Department of Building Inspections

## Original Receipt

9.24 2009

Received from

PEP

Location of Work

645 Congress

Cost of Construction

\$

514,000

Building Fee:

Permit Fee

\$

Site Fee:

Certificate of Occupancy Fee:

Total:

5,160.00

Building (IL)

Plumbing (I5)

Electrical (I2)

Site Plan (U2)

Other

HVAC

CBL:

46-D-22

Check #:

3538

Total Collected \$

5,160.00

**No work is to be started until permit issued.  
Please keep original receipt for your records.**

Taken by:

S. J. D. L.

WHITE - Applicant's Copy

YELLOW - Office Copy

PINK - Permit Copy