



# Installation, Start-Up, and Service Instructions

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## SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when servicing or repairing this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and the National Electrical Code (NEC) for special installation requirements.

Understand the signal words — DANGER, WARNING, and CAUTION. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies hazards that could result in personal injury or death. CAUTION is used to identify unsafe practices, which would result in minor personal injury or product and property damage.

It is important to recognize safety information. These are the safety alert symbols. When you see these symbols on the unit and in instructions or manuals, be alert to the potential for personal injury.



Refrigerant  
Safety Group  
A2L



### ⚠ WARNING

#### WARNING: RISK OF FIRE

Flammable Refrigerant Used — To be repaired only by trained service personnel. DO NOT puncture refrigerant tubing.

### ⚠ WARNING

Do not use means to accelerate the defrosting process or to clean, unless recommended in these instructions.

### ⚠ WARNING

Do not pierce or burn refrigerant lines. Be aware that refrigerants may not contain an odor.

### ⚠ WARNING

#### WARNING: RISK OF FIRE

Flammable Refrigerant Used — Dispose of properly in accordance with federal or local regulations.

### ⚠ WARNING

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).

### ⚠ WARNING

Installation of auxiliary electric heaters in connecting ductwork must adhere to Carrier approved models exclusively. Carrier bears no responsibility for the installation of any alternative auxiliary devices installed in the field.

**⚠ WARNING**

Electrical shock can cause personal injury and death. Shut off all power to this equipment during installation. There may be more than one disconnect switch. Lockout/tagout all disconnect locations to alert others not to restore power until work is completed.

**IMPORTANT:** The installation of water source heat pump units and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and **MUST** conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

## GENERAL

This Installation, Start-Up and Service Instructions literature is for Aquazone™ water source heat pump systems. Water source heat pumps (WSHPs) are single-package horizontally and vertically mounted units with electronic controls designed for year-round cooling and heating.

See Fig. 1 for model number nomenclature details. See Table 1 for unit physical data.

**IMPORTANT:** Read the entire instruction manual before starting installation.

## PRE-INSTALLATION

### INSPECTION

Upon receipt of shipment, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the carton or crating of each unit, and inspect each unit for damage on both the interior and exterior. Ensure the shipping company makes proper notation of any shortages or damage on all copies of the freight bill.

Concealed damage not discovered during unloading must be reported to the shipping company within 5 days of receipt of shipment.

**NOTE:** It is the responsibility of the purchaser to file all necessary claims with the shipping company.

### STORAGE

If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean, dry area between 50 and 95°F. Units must only be stored or moved in the normal upright position as indicated by the UP arrows on each carton at all times. If unit stacking is required, stack units as follows: vertical units less than 6 tons, no more than two high; horizontal units less than 6 tons, no more than three high. Do not stack units larger than 6 tons.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
5	0	W	T	A	0	2	4	N	B	A	3	A	A	—	A

**Model Series (1-2)**  
50 = Packaged WSHP Unit

**Tier (3-4)**  
WT = 2-Stage Size 24-70

**Cabinet Configuration (5)**

ORIENTATION	FILTER ACCESS	WATER CONNECTION	
		Front Left	Front Right
Horizontal	Side Filter Access	A	B
	Bottom Filter Access	C	D
Vertical	Side Filter Access	E	F

**Nominal Capacity MBH (tons) (6-8)**

024 = 24 (2)  
036 = 36 (3)  
048 = 48 (4)  
060 = 60 (5)  
070 = 70 (6)

**Airflow Configuration (9)**

ORIENTATION	RETURN	DISCHARGE	MOTOR
			CA ECM
Horizontal	Right	Back	N
	Right	Left	P
	Left	Back	Q
	Left	Right	R
Vertical	Right	Top	S
	Left	Top	T

**Controls — Option/Transformer (10)**

B = UPM/75VA  
D = UPM + BE/75VA<sup>a</sup>  
E = UPM + TV DDC/100VA  
H = UPM + SR/75VA  
K = UPM + PR/75VA  
M = UPM + ER/75VA  
P = UPM + BE + PR/75VA<sup>a</sup>  
R = UPM + BE + SR/75VA<sup>a</sup>  
T = UPM + BE + SR + PR/75VA<sup>a</sup>  
V = UPM + SR + PR/75VA  
X = UPM + EMS + SR/75VA  
Z = UPM + EMS + PR/75VA

2 = UPM + EMS + SR + PR/75VA  
4 = UPM + EMS + BE/75VA<sup>a</sup>  
6 = UPM + EMS + BE + SR/75VA<sup>a</sup>  
8 = UPM + EMS + BE + PR/75VA<sup>a</sup>

**LEGEND**

<b>BE</b> — Boilerless Electric Heat	<b>MHGRH</b> — Modulating Hot Gas Reheat
<b>CA ECM</b> — Constant Airflow ECM	<b>PR</b> — Pump Relay
<b>CB</b> — Compressor Blanket	<b>REG</b> — Auto Flow Regulator
<b>CCF</b> — Closed Cell Foam Insulation	<b>SCCR</b> — Short Circuit Current Rating
<b>CO</b> — Cooling Only	<b>SR</b> — Compressor Status Relay
<b>DP</b> — Differential Pressure Flow Switch	<b>STD</b> — Standard
<b>ECM</b> — Electronically Commutated Motor	<b>TV DDC</b> — TruVu Direct Digital Controller
<b>EMS</b> — Energy Management Switch	<b>ULL</b> — Ultra Low Leak Cabinet
<b>EQP</b> — Extra Quiet Package	<b>UPM</b> — Unit Protection Module
<b>ER</b> — EMS Relay	<b>VLV</b> — 2-Way Solenoid Valve
<b>HGBP</b> — Hot Gas Bypass	<b>WSE</b> — Water Side Economizer
<b>HGRH</b> — Hot Gas Reheat	<b>WSHP</b> — Water Source Heat Pump
<b>HWG</b> — Hot Water Generator	
<b>LD</b> — Leak Detection	

**NOTE(S):**

- Option card board is provided with selection of HGRH/WSE/BE options and without TruVu DDC.
- ULL represents < 2% air leakage option.

**Design Revision (16)**  
A = Initial Release

**Miscellaneous Options (15)**

— = None  
A = Waterside Economizer (WSE)<sup>a</sup>  
B = A2L Leak Detection (LD)  
C = WSE + LD<sup>a</sup>

**Hydronic Options (14)**

OPTION	WATER COIL	
	Copper	Cupro-Nickel
None	A	J
2-Way Valve (VLV)	B	K
Auto-Flow Reg. (REG)	C	L
Flow Proving Switch (DP)	D	M
VLV + REG	E	N
VLV + DP	F	P
VLV + REG + DP	G	Q
REG + DP	H	R

**Sound and IAQ Options (13)**

A = None (Std Insulation)  
B = Closed Cell Foam Insulation (CCF)  
C = Extra Quiet Package (EQP)  
D = Ultra-Low-Leak Cabinet (ULL), CCF + 2 in. MERV 8<sup>b</sup>  
E = EQP, ULL, 2 in. MERV 8<sup>b</sup>  
F = 2 in. MERV 8 Filter, Std Insulation  
G = 2 in. MERV 8 Filter, CCF  
H = 2 in. MERV 13 Filter, Std Insulation  
J = 2 in. MERV 13 Filter, CCF  
K = 4 in. MERV 13 Filter, Std Insulation  
L = 4 in. MERV13 Filter, CCF  
M = ULL, CCF + 2 in. MERV 13<sup>b</sup>  
N = EQP, ULL, 2 in. MERV 13<sup>b</sup>  
P = ULL, CCF + 4 in. MERV 13<sup>b</sup>  
Q = EQP, ULL, 4 in. MERV 13<sup>b</sup>  
R = EQP, 2 in. MERV 8  
S = EQP, 2 in. MERV 13  
T = EQP, 4 in. MERV 13  
U = Compressor Blanket (CB), Std Insulation  
V = Compressor Blanket (CB), CCF  
W = CB + 2 in. MERV 8, Std Insulation  
X = CB + 2 in. MERV 8, CCF  
Y = CB + 2 in. MERV 13, Std Insulation  
Z = CB + 2 in. MERV 13, CCF  
1 = CB + 4 in. MERV 13, Std Insulation  
2 = CB + 4 in. MERV 13, CCF  
3 = ULL, CCF + CB + 2 in. MERV 8<sup>b</sup>  
4 = ULL, CCF + CB + 2 in. MERV 13<sup>b</sup>  
5 = ULL, CCF + CB + 4 in. MERV 13<sup>b</sup>

**Electrical Options (12)**

3 = 208-230/1/60  
4 = 265/1/60  
5 = 208-230/3/60  
6 = 460/3/60  
B = 208-230/1/60 with Disc.  
C = 265/1/60 with Disc.  
D = 208-230/3/60 with Disc.  
E = 460/3/60 with Disc.

G = 208-230/1/60, 65 kA SCCR  
H = 208-230/3/60, 65 kA SCCR  
J = 265/1/60, 65 kA SCCR  
N = 208-230/1/60, 15 kW E-heat (dual-point power)  
P = 208-230/1/60, 20 kW E-heat (dual-point power)  
Q = 208-230/1/60, 5 kW E-heat (dual-point power)  
S = 208-230/1/60, 10 kW E-heat (dual-point power)

**Refrigerant Circuit Options (11)**

OPTION	NON-COATED AIR COIL	COATED AIR COIL
None	A	B
Hot Gas Reheat (HGRH) <sup>a</sup>	C	D
Cooling Only (CO)	E	F
Hot Gas Bypass (HGBP)	G	H
HGRH + HGBP <sup>a</sup>	N	P
Hot Water Generator (HWG)	S	T
Modulating Hot Gas Reheat (MHGRH)	1	2

**Fig. 1 — 50WT Model Number Nomenclature**

**Table 1 — Physical Data — 50WT (024-070) Units**

UNIT SIZE	024	036	048	060	070
Compressor Type (Qty 1)	Scroll	Scroll	Scroll	Scroll	Scroll
Max Water Working Pressure (psig) <sup>a</sup>	400	400	400	400	400
<b>ECM FAN MOTOR and BLOWER</b>					
Fan Motor Type	Constant Airflow	Constant Airflow	Constant Airflow	Constant Airflow	Constant Airflow
Fan Motor (hp)	VT: 0.33 HZ: 0.50	0.75	0.75	1.00	1.00
Blower Wheel Size (Dia. x W) (in.)	10 x 8	11 x 9	11 x 9	VT: 12 x 12 HZ: 11 x 9	VT: 12 x 12 HZ: 11 x 9
<b>WATER CONNECTION SIZE (INCLUDES ECONOMIZER OPTION)</b>					
FPT (in.)	0.75	1.00	1.00	1.00	1.00
Coaxial Coil Volume (gal)	0.28	0.46	0.46	1.09	1.09
<b>VERTICAL CABINET</b>					
Refrigeration Charge (oz)	34	45	57	89	89
Air Coil Dimensions (H x W) (in.)	24 x 16.5	28 x 21	36 x 27	42 x 27	42 x 27
Standard Filter - 1" Throwaway (L x H)	19 x 27	24 x 30	18 x 30	24 x 30 and 18 x 30	24 x 30 and 18 x 30
Optional Filter - 2" MERV 8 or 13 (L x H)	19 x 27	24 x 30	18 x 30	24 x 30 and 18 x 30	24 x 30 and 18 x 30
Optional Filter - 4" MERV 13 (L x H)	19 x 27	24 x 30	18 x 30	24 x 30 and 18 x 30	24 x 30 and 18 x 30
Weight - Operating (lb)	219	255	324	397	401
Weight - Shipping (lb)	243	280	350	424	428
<b>HORIZONTAL CABINET</b>					
Refrigeration Charge (oz)	31	43	52	91	91
Air Coil Dimensions (H x W) (in.)	16 x 27.5	18 x 31	18 x 42	20 x 50	20 x 50
Standard Filter - 1" Throwaway (L x H)	18 x 30	20 x 34	20 x 20 and 20 x 24	20 x 25 (Qty 2)	20 x 25 (Qty 2)
Optional Filter - 2" MERV 8 or 13 (L x H)	18 x 30	20 x 34	20 x 20 and 20 x 24	20 x 25 (Qty 2)	20 x 25 (Qty 2)
Optional Filter - 4" MERV 13 (L x H)	18 x 30	20 x 34	20 x 20 and 20 x 24	20 x 25 (Qty 2)	20 x 25 (Qty 2)
Weight - Operating (lb)	213	263	319	366	414
Weight - Shipping (lb)	237	288	345	393	441

NOTE(S):

a. 300 psig when unit is built with the factory installed 2-way solenoid valve option.

LEGEND

**FPT** — Female Pipe Thread

## INSTALLATION

### Step 1 — Check Jobsite

Installation, operation and maintenance instructions are provided with each unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check out the system before operation. Complete the inspections and instructions listed below to prepare a unit for installation. See Table 1 for unit physical data.

#### HORIZONTAL UNITS

Horizontal units are designed for indoor installation only. Be sure to allow adequate space around the unit for installation and servicing. See Fig. 2 for overall unit dimensions.

#### VERTICAL UNITS

Vertical units are designed for indoor installations only. Vertical units are typically installed in a floor-level closet or a small mechanical room. Be sure to allow adequate space around the unit for installation and servicing. See Fig. 3 for overall unit dimensions.

#### ⚠ CAUTION

##### EQUIPMENT DAMAGE HAZARD

To avoid equipment damage, do not use these units as a source of heating or cooling during the construction process. The mechanical components and filters used in these units quickly become clogged with construction dirt and debris which may cause system damage.

to allow for the installation, maintenance, service, and removal of the unit.

**IMPORTANT:** It is the installing contractor's responsibility to ensure that all equipment is installed with proper access for service, start-up, installation of accessories, configuration of control and other components, and equipment removal in accordance with Carrier's recommended service clearances and installation instructions. Please refer to the Carrier Commercial WSHP Warranty Statement (document number 04-570008-01) for details on warranty exclusions regarding equipment, access, removal and clearances.

### Step 2 — Check Unit

Upon receipt of equipment at the jobsite, inspect the carton or crating of each unit, and inspect each unit for damage on both the interior and exterior. Note any damage and contact your local equipment sales office.

#### ⚠ CAUTION

##### EQUIPMENT DAMAGE HAZARD

DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move units in an upright position. Tilting units on their sides may cause equipment damage.

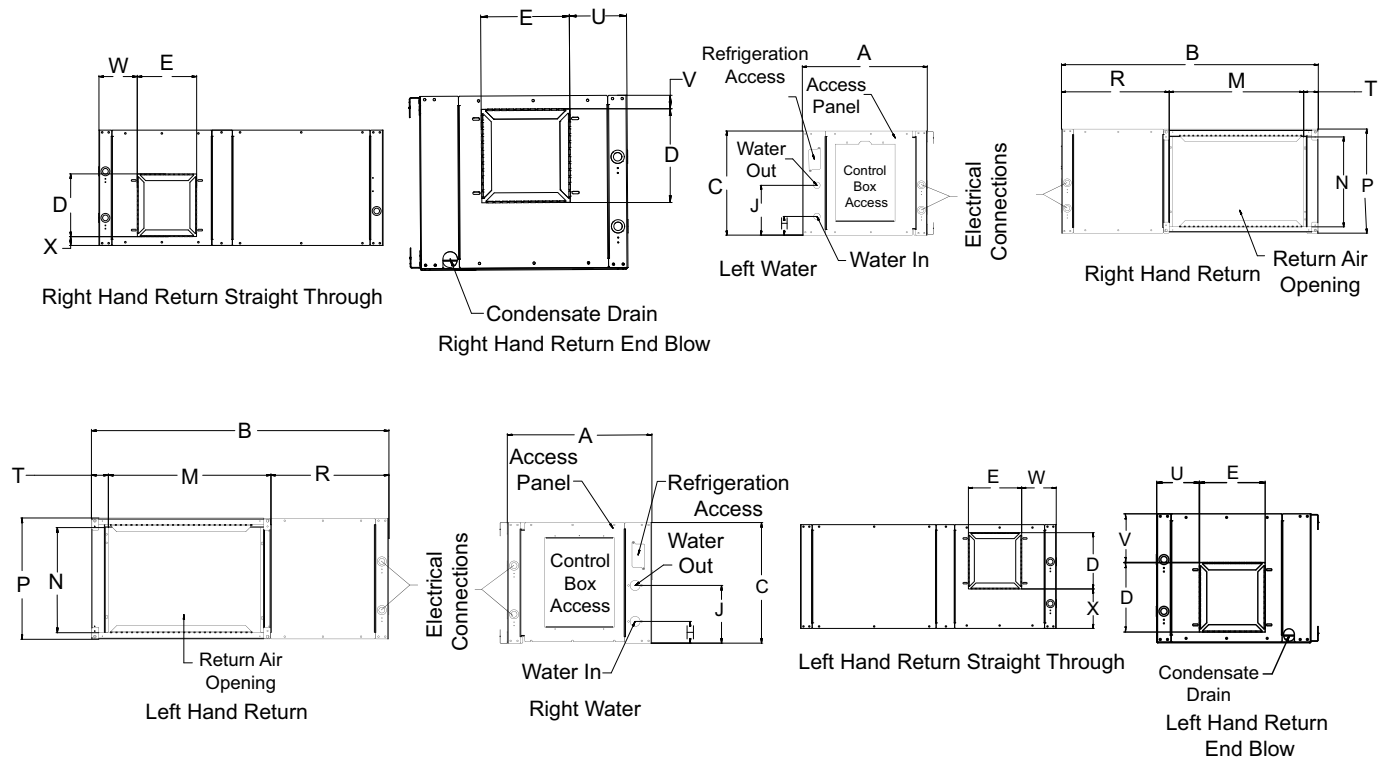
#### INSTALLATION GUIDELINES (ALL UNITS)

1. Be sure the location chosen for unit installation provides ambient temperatures maintained above freezing.
2. Be sure the installation location is isolated from sleeping areas, private offices and other acoustically sensitive spaces.
3. Be sure unit is mounted at a height sufficient to provide an adequate slope of the condensate lines. If an appropriate slope cannot be achieved, a field-supplied condensate pump may be required.
4. On horizontal units, allow adequate room below the unit for condensate drain trap and do not locate the unit above supply piping.
5. Provide sufficient space for duct connection. Do not allow the weight of the ductwork to rest on the unit.
6. Provide adequate clearance for filter replacement and drain pan cleaning. Do not allow piping, conduit, etc. to block filter access. See Fig. 4.
7. Provide sufficient access to allow maintenance and servicing of the blower and blower motor, compressor, refrigerant circuit, controls, and coils. See Fig. 4.
8. For units with free return (non-ducted), provide adequate space for proper return airflow. For units installed in closets or mechanical rooms, provide sufficient return grill area for proper airflow.
9. Provide ready access to water valves and fittings, and screwdriver access to unit side panels, discharge collar, and all electrical connections.
10. Where access to side panels is limited, pre-removal of the control box side mounting screws may be necessary for future servicing.
11. For units that are installed in enclosed spaces (such as furred in closets or behind finished ceilings), provide access panels

#### INSPECT UNIT

To prepare the unit for installation, complete the procedures listed below:

1. Verify the correct unit has been received. Check the unit capacity (tonnage), voltage, orientation, and configuration.
2. Compare the electrical data on the unit nameplate with to verify the jobsite power feed (voltage, amperage, MCA) and power protection (MOCP).
3. Remove the unit packaging, keeping the unit attached to the shipping pallet. Do not destroy packaging. Save for re-installation on the unit if the unit will not be fully installed.
4. Open a unit access panel. Verify the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
5. Check the water piping and piping connections to make sure they are free from defects, kinks, dents, and appear to be water tight. Verify system operating water pressure.
6. Inspect the blower assembly. Verify the blower has not come lose during shipping. Verify clearance between the blower wheel and the blower housing. Verify free blower rotation.
7. Inspect all electrical connections. Be sure connections are clean and tight at the terminals.
8. Check unit controls. If factory-installed TruVu controller is not provided, verify field provided thermostat is available. If TruVu DDC controller is provided, verify proper sensor has been provided and a commissioning interface will be available.
9. Horizontal Units Only: Locate the hanging bracket kit located in the compressor compartment.
10. Remove any shipping brackets from the unit.



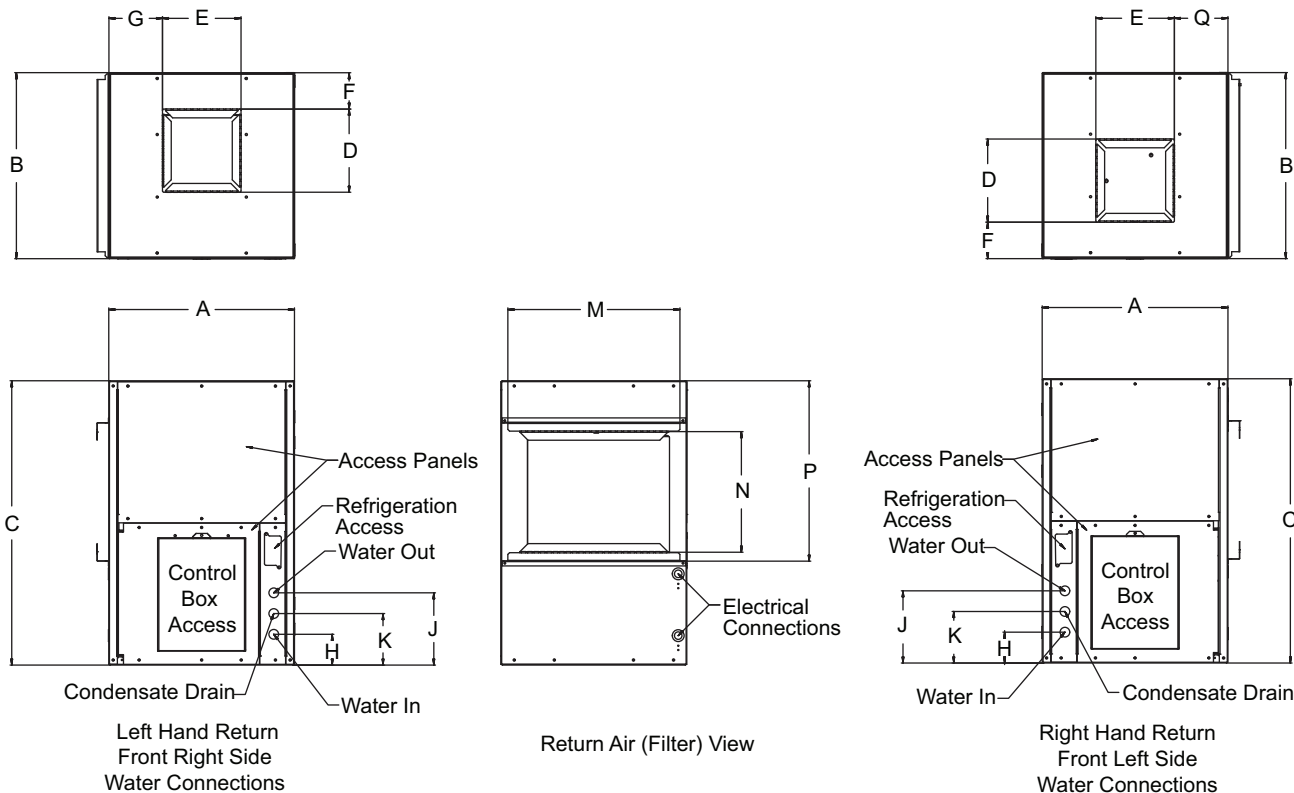
HORIZONTAL DIMENSIONS (in.)<sup>a,b,c</sup>

50WT UNIT <sup>d,e,f,g</sup>	A	B	C	D	E	H	J	M	N	P	R	T	U		V		W		X		CONDENSER WATER CONNECTIONS	RECOMMENDED REPLACEMENT NOMINAL FILTER SIZE	CONDENSATE DRAIN CONNECTION
	Width	Depth	Height	Discharge Height	Discharge Width	Water Inlet	Water Outlet	R/A Duct Width	R/A Duct Flange Height	Filter Rack Height <sup>h,i,j,k</sup>	Cabinet Front to Filter Rack	Cabinet End to Filter Rack	Side to Discharge (Left Return End Blow)	Side to Discharge (Right Return End Blow)	Top to Discharge (Left Return End Blow)	Top to Discharge (Right Return End Blow)	End to Discharge (Left Straight Through)	End to Discharge (Right Straight Through)	Bottom to Discharge (Left Straight Through)	Bottom to Discharge (Right Straight Through)			
24	21.5	47.00	19	11.25	10.50	3.25	8.75	29.25	16	18.00	15.5	2.25	5.75	5.75	6	1.75	5.75	5.75	6	1.75	3/4" FPT	18 x 30	3/4" FPT
36	24.0	54.00	21	12.50	11.75	3.25	8.50	33.25	18	20.00	19.5	1.25	5.50	5.50	7	1.50	5.50	5.50	7	1.50	3/4" FPT	20 x 34	3/4" FPT
48	24.0	65.00	21	12.50	11.75	3.00	8.25	43.50	18	20.50	16.0	5.25	5.50	5.50	7	1.50	5.50	5.50	7	1.50	1" FPT	20 x 20 and 20 x 24	3/4" FPT
60	24.0	75.25	21	12.50	11.75	3.00	8.25	49.50	18	20.25	22.5	3.00	5.50	5.50	7	1.50	4.75	4.75	7	1.50	1" FPT	20 x 25 (2)	3/4" FPT
70	24.0	75.25	21	12.50	11.75	3.00	8.25	49.50	18	20.25	22.5	3.00	5.50	5.50	7	1.50	4.75	4.75	7	1.50	1" FPT	20 x 25 (2)	3/4" FPT

NOTE(S):

- Specifications subject to change without notice.
- Overall unit dimensions do not include filter rack or duct flanges.
- All dimensions within  $\pm 0.125$  in. Dimensions in inches.
- Front of the unit is determined by the location of the control box panel.
- When DDC controller is installed, control box panel extends 3.0 in. beyond the front of the unit.
- When disconnect switch is installed, increase width by 2.0 in. beyond side of unit.
- The local electric codes may require 36 in. or more clearance at the electrical control box.
- The 1 in. filter rack extends 1.25 in. beyond the side of the unit (not including flange).
- The 2 in. filter rack extends 3.0 in. beyond the side of the unit (not including flange). This filter rack is 4-sided with a filter access door on both ends (front/back) and can accept either a 1 in. or 2 in. filter.
- The 4 in. filter rack extends 4.75 in. beyond the side of the unit (not including flange). This filter rack is 4-sided with a filter access door on both ends (front/back) and can accept either a 2 in. or 4 in. filter.
- The 4 in. filter rack extends 4.75 in. beyond the side of the unit (not including flange). This filter rack is 4-sided with a filter access door on both ends (front/back) and can accept either a 2 in. or 4 in. filter.

Fig. 2 — 50WT 024-070 Horizontal Unit Dimensions



VERTICAL UNIT DIMENSIONS (in.) <sup>a,b,c</sup>																	
MODEL <sup>d,e,f,g</sup>	A Width	B Depth	C Height	D Discharge Depth	E Discharge Width	F Cabinet Edge to Discharge	G Cabinet Edge to Discharge (Left Hand Return)	H Water Inlet	J Water Outlet	K Condensate Drain	M R/A Duct Width	N R/A Duct Flange Height	P Filter Rack Height <sup>h,i,j</sup>	Q Cabinet Edge to Discharge (Right Hand Return)	Condenser Water Connections	Recommended Replacement Nominal Filter Size	Condensate Drain Connection
50WD-007	21.50	21.50	33.00	4.00	6.75	7.25	7.50	3.50	8.50	5.75	17.50	15.00	17.25	7.50	3/4" FPT	17 x 19	3/4" FPT
50WD-009	21.50	21.50	33.00	4.00	6.75	7.25	7.50	3.50	8.50	5.75	17.50	15.00	17.25	7.50	3/4" FPT	17 x 19	3/4" FPT
50WD-012	21.50	21.50	33.00	4.00	6.75	7.25	7.50	3.50	8.50	5.75	17.50	15.00	17.25	7.50	3/4" FPT	17 x 19	3/4" FPT
50WD-015	21.50	21.50	33.00	9.50	9.25	4.25	6.25	3.00	8.50	5.75	17.50	15.00	17.25	6.25	3/4" FPT	17 x 19	3/4" FPT
50WD-018	21.50	21.50	39.00	9.50	9.25	4.25	6.25	3.25	8.50	6.00	18.00	20.00	22.25	6.25	3/4" FPT	18 x 22	3/4" FPT
50WD-024	21.50	21.50	39.00	9.50	9.25	4.25	6.25	3.25	8.50	6.25	18.00	20.00	22.25	6.25	3/4" FPT	18 x 22	3/4" FPT
50WD-030	21.50	21.50	39.00	10.50	9.75	2.25	6.52	3.25	8.50	5.84	16.25	24.75	22.25	6.52	3/4" FPT	19 x 27	3/4" FPT
50WD-036	21.50	26.00	44.00	10.50	9.75	5.75	5.50	3.25	8.50	5.75	24.00	28.00	30.00	5.58	3/4" FPT	24 x 30	3/4" FPT
50WD-042	24.00	26.00	44.00	10.50	10.50	5.00	6.75	3.25	8.50	5.75	23.75	28.00	31.25	6.75	3/4" FPT	24 x 30	3/4" FPT
50WD-048	24.00	26.00	44.00	10.50	10.50	5.00	6.75	3.25	8.50	5.75	23.75	28.00	31.25	6.75	1" FPT	24 x 30	3/4" FPT
50WD-060	24.00	33.00	51.00	12.50	11.75	9.00	6.25	3.00	8.25	5.75	27.25	34.00	37.25	6.25	1" FPT	18x30 (2)	3/4" FPT
50WD-070	24.00	33.00	51.00	12.50	11.75	9.00	6.25	3.00	8.25	5.50	27.25	34.00	37.25	6.25	1" FPT	18x30 (2)	3/4" FPT

NOTE(S):

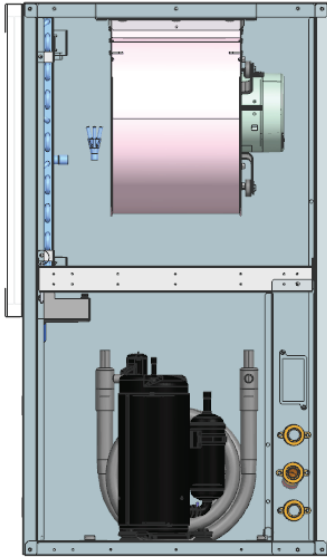
- Specifications subject to change without notice.
- Overall unit dimensions do not include filter rack or duct flanges.
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- When DDC controller is installed, control box panel extends 3.0 in. beyond the front of the unit.
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- The 4 in. filter rack extends 4.75 in. beyond the side of the unit (not including flange). This filter rack is 4-sided with a filter access door on both ends (front/back) and can accept either a 2 in. or 4 in. filter.

**Fig. 3 — 50WT 024-070 Vertical Unit Dimensions**



## Vertical Unit

Left Return, Top Discharge



Front View

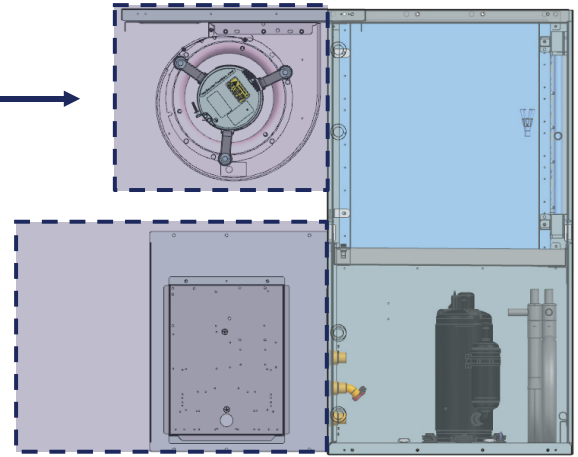
**Blower Front Access**

18 in. Minimum  
24 in. Optimum

**Compressor and Electrical Front Access**

24 in. Minimum  
36 in. Optimum

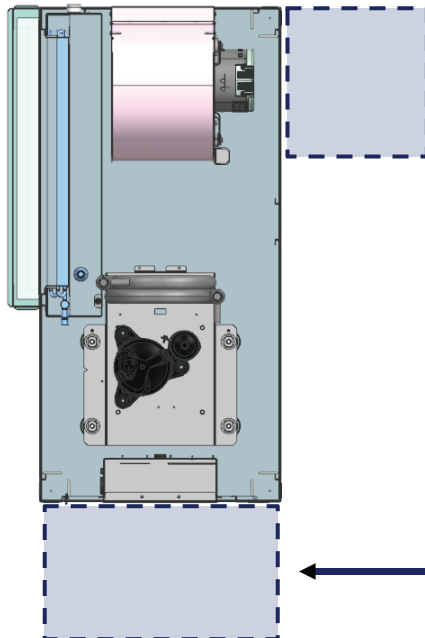
Left Return, Top Discharge



Side View

## Horizontal Unit

Left Return, Back Discharge



Top View

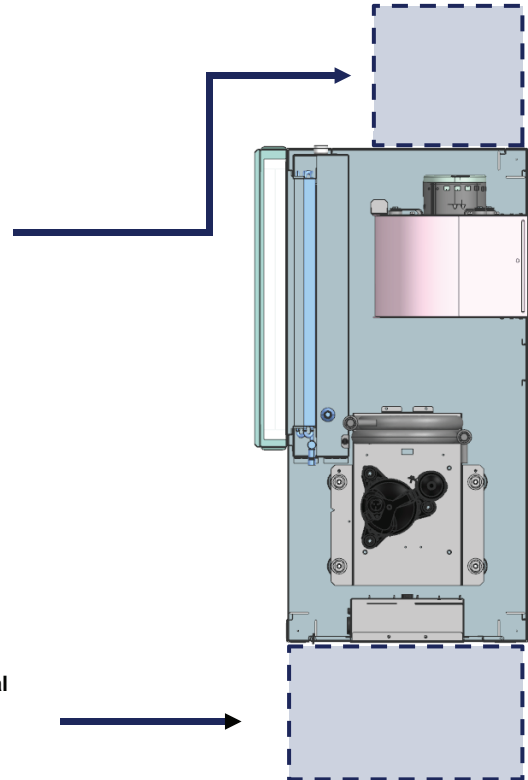
**Blower Access**

18 in. Minimum  
24 in. Optimum

**Compressor and Electrical Front Access**

24 in. Minimum  
36 in. Optimum

Left Return, Right Discharge



Top View

**Fig. 4 — 50WT Service Clearance**

### Step 3 — Locate Unit

Locate the unit in an indoor area that allows easy removal of the filter and access panels, and has enough room for service personnel to perform maintenance or repair. Provide sufficient room to make fluid, electrical, and duct connection(s). If the unit is located in a confined space such as a closet, provisions must be made for return air to freely enter the space. See minimum service clearances in Fig. 4.

Horizontal units condensate drains are not internally trapped. Allow room below the unit base for horizontal models for an adequate condensate trap.

These units are not approved for outdoor installation; therefore, they must be installed inside the structure being conditioned. Do not locate units in areas that are subject to freezing. Units must be installed in conditioned space that is not subject to extremes of temperature or humidity to avoid cabinet sweating and/or equipment damage.

#### PROTECTION

**IMPORTANT:** Care must be taken to prevent the introduction of dust, pain, debris, or chemicals into the unit, which can cause damage to the unit, delay start-up, and may impact unit longevity.

Do not use units for temporary heating, air conditioning or ventilation during construction or remodeling, especially when plastering, sanding or painting or when replacing carpet or flooring. Dust and debris can clog the coil and blower. Chemical vapors can lead to formicary corrosion and damage the coil. Ensure adequate ventilation and debris collection during construction or remodeling.

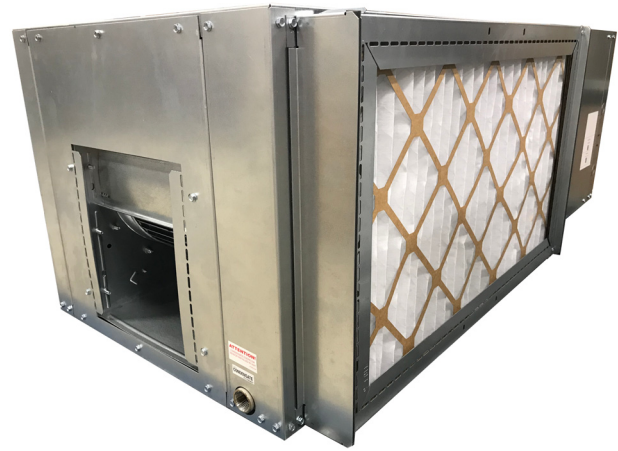
Once the units are properly positioned on the jobsite, cover them with either a shipping carton, vinyl film, or an equivalent protective covering. Cap open ends of pipes stored on the jobsite. This precaution is especially important in areas where painting, plastering, or spraying of fireproof material, etc. is not yet complete. Foreign material that accumulates within the units can prevent proper start-up and require costly clean-up operations. Before installing any of the system components, be sure to examine each pipe, fitting, and valve, and remove any dirt or foreign material found in or on these components.

### Step 4 — Mount the Unit

#### DUCT FLANGES

The unit heat pumps feature foldout return and supply air duct flanges. These fold-out flanges allow the heat pumps to more easily fit through doorways and other tight spaces, and also prevent damage in shipping and handling.

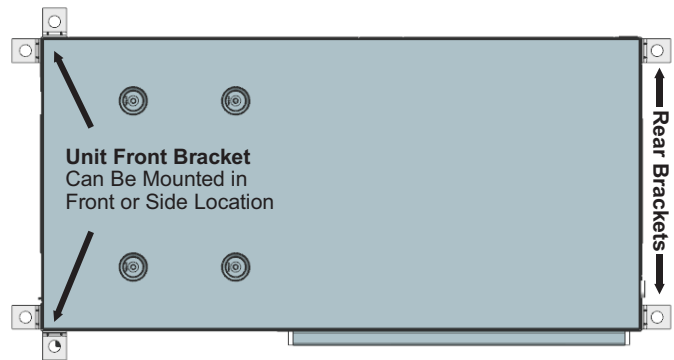
It is recommended that all fold-out flanges be folded out once the heat pump is installed to ensure that return and supply airflow is not obstructed. These flanges can be easily folded using standard or duckbill pliers. Once folded out these flanges can be used to support light ductwork loads. See Fig. 5.



**Fig. 5 — Foldout Flanges**

#### HORIZONTAL UNITS

While horizontal units may be installed on any level surface strong enough to hold their weight, they are typically suspended above a ceiling by threaded rods. All horizontal units come with a Hanging Bracket Kit to facilitate suspended unit mounting. Hanging brackets are installed as shown in Fig. 6.



**Fig. 6 — Hanging Bracket Locations**

The hanging bracket kit includes the following:

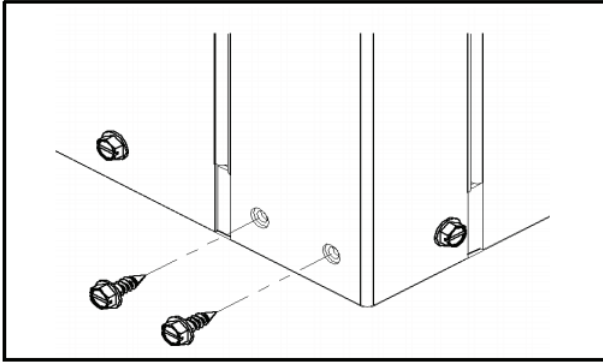
- (5) brackets
- (5) rubber vibration isolators
- (8) screws no. 10 x 1/2 in.
- (10) bolts 1/4 – 28 x 1/2 in. hex bolt (not used on this model)

The following additional materials are needed and must be field supplied:

- threaded rod (3/8 in. maximum diameter)
- hex nuts
- washers (1-3/4 in. minimum O.D.)

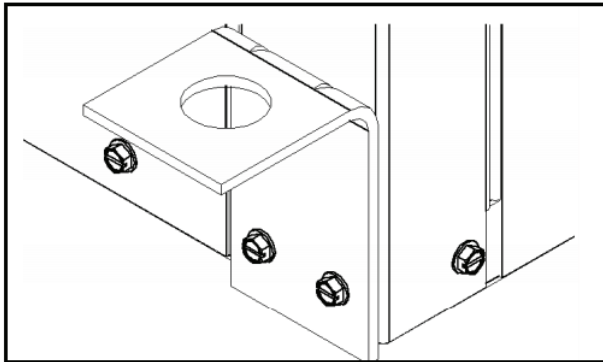
### Hanging Bracket Installation

1. Remove and discard factory-provided screws from location where hanging brackets will be installed. (see Fig. 7).



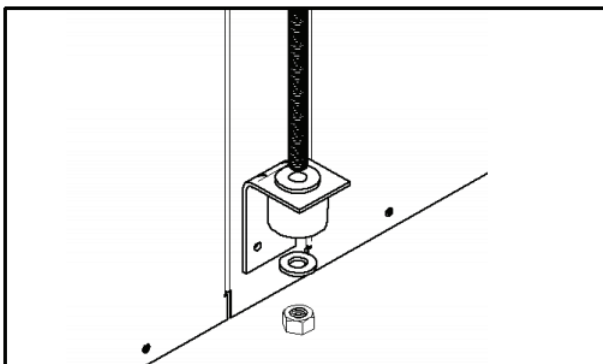
**Fig. 7 — Removing Factory Screws**

2. Mount 4 brackets to unit corner post using the bolts provided in the kit, as shown in Fig. 8. DO NOT re-use the screws removed from the unit during Step 1 to mount the hanging brackets on the unit.



**Fig. 8 — Mounting Brackets**

3. Install rubber grommet on the bracket as shown in Fig. 9.
4. Hang the unit and assemble the field-provided threaded rod, nuts, and washers on the brackets as shown in Fig. 9.



**Fig. 9 — Hanging the Unit**

**IMPORTANT:** Units larger than six tons include an integral angle iron frame with mounting holes present.

Horizontal units installed above the ceiling must conform to all local codes. An auxiliary drain pan, if required by code, should be at least 4 in. larger than the bottom of the heat pump.

Plumbing connected to the heat pump must not come in direct contact with joists, trusses, walls, etc. Some applications require an attic floor installation of the horizontal unit. In this case the unit

should be set in a full size secondary drain pan on top of a vibration absorbing mesh.

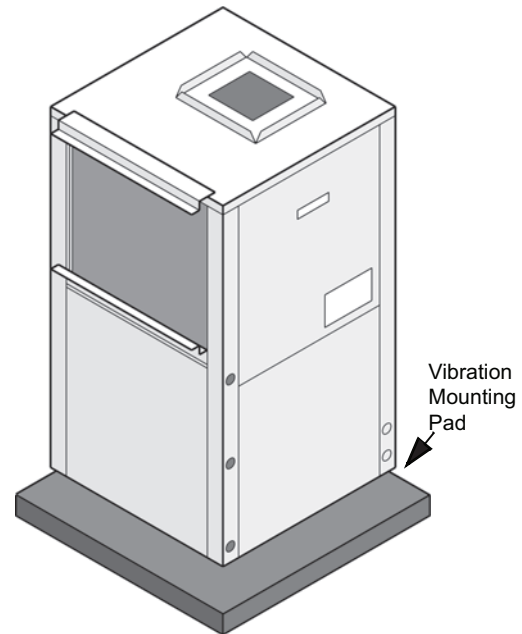
The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling. The secondary drain pan is usually placed on a plywood base isolated from the ceiling joists by additional layers of vibration absorbing mesh. In both cases, a 3/4 in. drain connected to this secondary pan should be run to an eave at a location that will be noticeable.

### CAUTION

If the unit is located in a crawl space, the bottom of the unit must be at least 4-in. above grade to prevent flooding of the electrical parts due to heavy rains.

### VERTICAL UNITS

Vertical units should be mounted level on a vibration absorbing pad slightly larger than the unit base in order to minimize vibration transmission from the unit to the building structure (see Fig. 10). It is generally not necessary to anchor the unit unless required by local code.



**Fig. 10 — Mounting Vertical Units**

All major service access for the vertical models is from the front side of the unit. When installing the unit in a confined space such as a closet, ensure the service panel screws are accessible, that the filter can be replaced without damage and that water and electrical connections are accessible. For models with a unit-mounted disconnect switch, make sure the switch can be easily seen and operated.

To reduce sound transmission, units should be installed using flexible electrical conduit and hose kits. Care should be taken to ensure that no part of the unit cabinet is touching part of the building structure. For ducted return applications, a flexible duct connection should be used. Mount the unit on a vibration absorption pad slightly larger than the entire base to minimize vibration transmission. It is not necessary to mount the unit on the floor.

### Step 5 — Check Duct System

All units are provided with a return air duct flange and supply air duct connections. Refer to unit dimensional drawings (Fig. 2 and 3) for physical dimensions of the collar and flange.

A flexible connector is recommended for supply and return air duct connections on metal duct systems. All metal ducting should be insulated with a minimum of 1 in. duct insulation to avoid heat loss or gain and prevent condensate from forming during the cooling operation. Application of the unit to uninsulated ductwork is not recommended as the unit's performance will be adversely affected.

### ⚠ CAUTION

Do not connect discharge ducts directly to the blower outlet. The factory filter rack should be left in place on a free return system.

If the unit will be installed in a new installation with new ductwork, the installation should be designed using current ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) procedures for duct sizing. If the unit will be connected to an existing duct system, a check should be made to assure that the duct system has the capacity to handle the air required for the unit application. If the duct system is too small, larger ductwork must be installed. Be certain to check for existing leaks and repair. The duct system and all diffusers should be sized to handle the designed airflow quietly. To maximize sound attenuation of the unit blower, the supply and return air plenums should be insulated. There should be no direct straight air path through the air grille into the heat pump. The return air inlet to the heat pump must have at least one 90-degree turned away from the space return air grille. If air noise or excessive airflow are a problem, the blower speed can be changed to a lower speed to reduce airflow.

### HORIZONTAL SUPPLY AIR CONFIGURATION CONVERSION

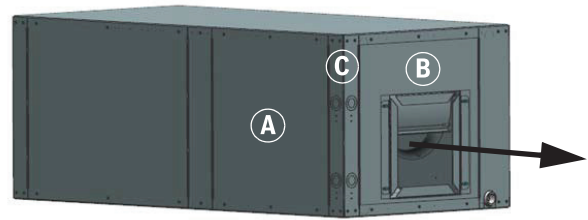
The supply air location can be field converted from end blow (back discharge) to straight through or vice-versa.

NOTE: Blower configuration changes should be done prior to unit being installed in the final location.

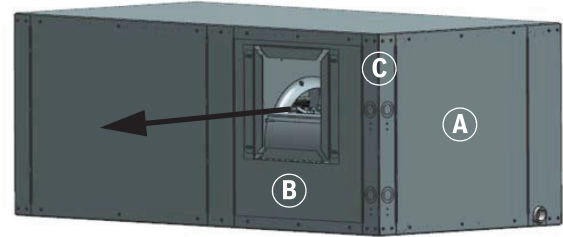
To convert the supply air direction, follow the steps below (Fig. 11-13):

1. If the unit is connected to power, shut Off the unit and disconnect switch or circuit breaker.
2. Locate the motor access panel (A). Remove the three screws at top and the three screws at the bottom of the panel. Remove the access panel and place it aside.
3. Be careful not to damage the refrigerant coils or any other internal unit components.
4. Locate blower panel (B). Remove the three screws from top and the three screws from bottom of the panel. Leave the blower panel in place on the base pan.
5. Locate access panel corner post (C). Remove the four screws from top and the four screws from the bottom. Remove the corner post and set it aside.
6. Locate blower support bracket (D). Remove the one screw and set it aside.
7. Move blower panel (B) with blower to desired location, rotating it 180°. (See Fig. 13.) The motor power and control harness can be unplugged to facilitate blower relocation.
8. Reinstall access panel corner post (C) using the eight screws previously removed.
9. Fasten blower panel (B) using the six screws previously removed.
10. Reinstall and fasten blower support bracket (D) using the one screw previously removed.

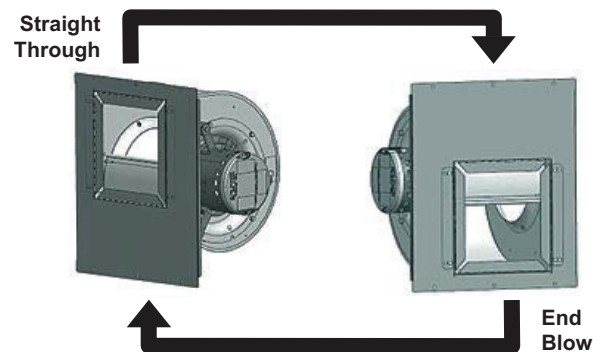
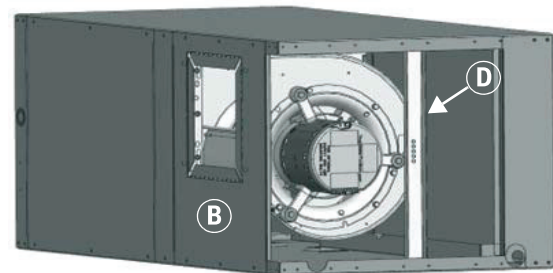
11. Reattach the motor power and control harness if disconnected earlier.
12. Reinstall and fasten motor access panel (A) using the six screws previously removed.



**Fig. 11 — End Blow (back discharge) Orientation**



**Fig. 12 — Straight Through Orientation**



**Fig. 13 — Blower Configuration**

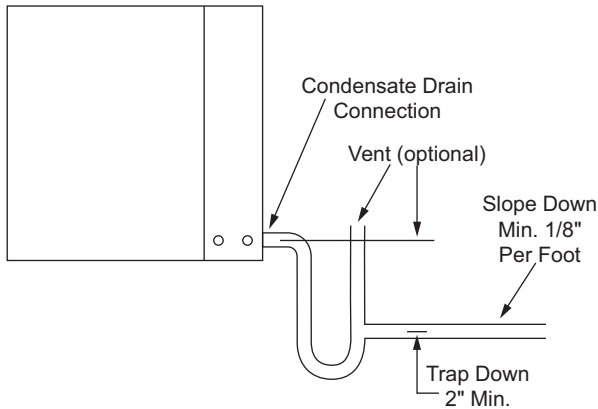
## Step 6 — Install Condensate Drain

All units include a condensate drain pan under the evaporator coil. Units with waterside economizer have an additional condensate drain pan under the economizer coil.

### HORIZONTAL UNITS

A drain line must be connected to each drain pan and pitched away from the unit a minimum of 1/8 in. per foot to allow the condensate to flow away from the unit.

This connection must be in conformance with local plumbing codes. A trap must be installed in the condensate line to ensure free condensate flow. (Heat pumps are not internally trapped.) A vertical air vent is sometimes required to avoid air pockets. See Fig. 14.



**Fig. 14 — Condensate Drain (Horizontal Units)**

The depth of the trap depends on the amount of positive or negative pressure on the drain pan. A second trap must not be included. The horizontal unit should be pitched approximately 1/4 in. towards the drain in both directions, to facilitate condensate removal. See Fig. 15.

### VERTICAL UNITS

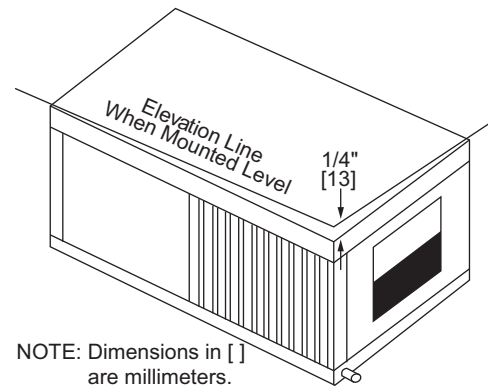
Vertical configuration units are internally trapped from the factory. A second trap must NOT be included.

## Step 7 — Pipe Connections

All WSHP units use female pipe thread fittings for water connections. Refer to Fig. 2 and 3 for connection sizes. When making piping connections, consider the following:

- Use a backup wrench when making screw connections to unit to prevent internal damage to piping.
- Insulation may be required on piping to avoid condensation in the case where fluid in loop piping operates at temperatures below dew point of adjacent air.
- Flexible hoses should be used between the unit and the rigid system to avoid possible vibration.
- Supply and return piping must be as large as the unit connections on the heat pump. Never use flexible hoses of a smaller inside diameter than that of the water connections on the unit.
- Piping systems that contain steel pipes or fittings may be subject to galvanic corrosion. Dielectric fittings may be used to isolate the steel parts of the system to avoid galvanic corrosion.

- Teflon tape thread sealant is recommended when connecting water piping connections to the units to ensure against leaks and possible heat exchanger fouling.
- Balancing valve and supply/return manual isolation valves must be provided for unit isolation and water flow balancing.
- Ensure unit receives the appropriate water flow during operation. To verify the correct water flow, utilize pressure/temperature ports positioned at the supply and return water lines. Refer to Table 15 and Fig. 35 for water pressure drop across water to refrigerant heat exchanger.
- Avoid all plastic to metal threaded fittings due to the potential to leak. Use a flange fitted substitute.
- Route piping to avoid service access areas to unit.
- Flush the piping system prior to operation to remove dirt and foreign materials from the system.



**Fig. 15 — Pitched Unit**

### WATER QUALITY GUIDELINES

Units are supplied with either a copper or optional cupronickel coaxial water coil. Copper is adequate for ground water that is not high in mineral content.

Carrier recommends proper testing to assure the well water quality is suitable for use with water source equipment. In conditions anticipating moderate scale formation or in brackish water a cupronickel heat exchanger is recommended. Additional considerations are described below.

A secondary heat exchanger (plate frame between the unit and the open cooling tower or open loop ground water system) may also be used. It is imperative that all air is eliminated from the closed loop side of the heat exchanger to prevent condenser fouling.

In all applications, the quality of the water circulated through the heat exchanger must fall within the ranges listed in Table 2, Water Quality Guidelines. Consult a local water treatment firm, independent testing facility, or local water authority for specific recommendations to maintain water quality within the published limits.

### **CAUTION**

Water piping exposed to extreme, low ambient temperatures is subject to freezing.



**Table 2 — Water Quality Guidelines**

CONDITION	HX MATERIAL <sup>a</sup>	CLOSED RECIRCULATING <sup>b</sup>	OPEN LOOP AND RECIRCULATING WELL <sup>c</sup>		
Scaling Potential — Primary Measurement Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below.					
pH/Calcium Hardness Method	All	N/A	pH < 7.5 and Ca Hardness, <100 ppm		
Index Limits for Probable Scaling Situations (Operation outside these limits is not recommended.)					
Scaling indexes should be calculated at 150°F for direct use and at 90°F for indirect HX use. A monitoring plan should be implemented.					
Ryznar Stability Index	All	N/A	6.0 to 7.5 If >7.5 minimize steel pipe use.		
Langelier Saturation Index	All	N/A	-0.5 to +0.5 If <=0.5 minimize steel pipe use. Based upon 150°F direct well, 85°F indirect well HX.		
Iron Fouling					
Iron Fe <sup>2+</sup> (Ferrous) (Bacterial Iron Potential)	All	N/A	<0.2 ppm (Ferrous) If Fe <sup>2+</sup> (ferrous) >0.2 ppm with pH 6 to 8, O <sub>2</sub> <5 ppm, check for iron bacteria.		
Iron Fouling	All	N/A	<0.5 ppm of Oxygen Above this level deposition will occur.		
Corrosion Prevention <sup>d</sup>					
pH	All	6 - 8.5 Monitor/treat as needed.	6 to 8.5 Minimize steel pipe below 7 and no open tanks with pH <8.		
Hydrogen Sulfide (H <sub>2</sub> S)	All	N/A	<0.5 ppm At H <sub>2</sub> S>0.2 ppm, avoid use of copper and cupronickel piping or HXs. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are acceptable to <0.5 ppm.		
Ammonia Ion as Hydroxide, Chloride, Nitrate and Sulfate Compounds	All	N/A	<0.5 ppm		
Maximum Chloride Levels	Copper Cupronickel 304 SS 316 SS Titanium	N/A N/A N/A N/A N/A	Maximum allowable at maximum water temperature.		
			50°F (10°C)	75°F (24°C)	100°F (38°C)
			<20 ppm	NR	NR
			<150 ppm	NR	NR
			<400 ppm	<250 ppm	<150 ppm
			<1000 ppm	<550 ppm	<375 ppm
			>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging					
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size.	<10 ppm (<1 ppm “s and free” for reinjection) of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size. Any particulate that is not removed can potentially clog components.		
Brackish	All	N/A	Use cupronickel heat exchanger when concentrations of calcium or sodium chloride are greater than 125 ppm are present. (Seawater is approximately 25,000 ppm.)		

NOTE(S):

- Heat exchanger materials considered are copper, cupronickel, 304 SS (stainless steel), 316 SS, titanium.
- Closed recirculating system is identified by a closed pressurized piping system.
- Recirculating open wells should observe the open recirculating design considerations.
- If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists.  
Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling. A low pH and high alkalinity cause system problems, even when both values are within ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water registers a pH of 7.0.  
To convert ppm to grains per gallon, divide by 17. Hardness in mg/l is equivalent to ppm.

LEGEND

- HX** — Heat Exchanger  
**N/A** — Design Limits Not Applicable Considering Recirculating Potable Water  
**NR** — Application Not Recommended  
**SS** — Stainless Steel

## INSTALLING SUPPLY AND RETURN HOSE KIT

Follow these piping guidelines:

1. Install a drain valve at the base of each supply and return riser to facilitate system flushing.
2. Install shutoff/balancing valves and unions at each unit to permit unit removal for servicing.
3. Place strainers at the inlet of each system circulating pump.
4. Select the proper hose length to allow slack between connection points. Hoses may vary in length by +2% to -4% under pressure.
5. Do not exceed the minimum bend radius for the hose selected. Refer to Table 3. Exceeding the minimum bend radius may cause the hose to collapse, which reduces water flow rate. Install an angle adapter to avoid sharp bends in the hose when the radius falls below the required minimum.

NOTE: Piping must comply with all applicable codes.

**Table 3 — Metal Hose Minimum Bend Radii**

HOSE DIAMETER (in.)	MINIMUM BEND RADII (in.)
1/2	3-9/16
3/4	3-9/16
1	4-3/8

Insulation is not required on loop water piping except where the piping runs through unheated areas or outside the building or when the loop water temperature is below the minimum expected dew point of the pipe ambient. Insulation is required if loop water temperature drops below the dew point.

**IMPORTANT:** Do not bend or kink supply lines or hoses.

Pipe joint compound is not necessary when Teflon threaded tape is pre-applied to hose assemblies or when flared-end connections are used. If pipe joint compound is preferred, use compound only in small amounts on the male pipe threads of the fitting adapters. Prevent sealant from reaching the flared surfaces of the joint.

NOTE: When anti-freeze is used in the loop, assure that it is compatible with Teflon tape or pipe joint compound employed.

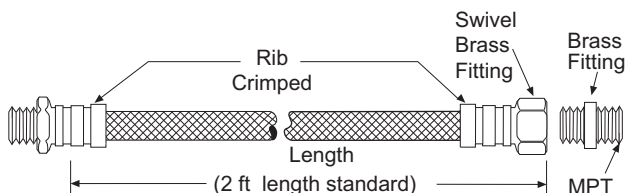
Maximum allowable torque for brass fittings is 30 ft-lb. If a torque wrench is not available, tighten finger-tight plus one quarter turn. Tighten steel fittings as necessary.

Optional pressure-rated hose assemblies designed specifically for use with Carrier units are available. Similar hoses can be obtained from alternate suppliers. Supply and return hoses are fitted with swivel-joint fittings at one end to prevent kinking during installation.

### CAUTION

Backup wrench is required when tightening water connections to prevent water line damage. Failure to use a backup wrench could result in equipment damage.

Male adapters secure hose assemblies to the unit and risers. Install hose assemblies properly and check them regularly to avoid system failure and reduced service life. See Fig. 16.



**Fig. 16 — Supply/Return Hose Kit**

## UNITS WITH BOILERLESS HEAT CONTROL

Units with Boilerless Heat Control include entering water temperature sensor that is factory installed on the incoming water piping.

Refer to see Step 9 — “Configure Unit Control Components” on page 21 for boilerless control configuration for units with Option Card (units without factory installed TruVu™ controller).

Refer to the TruVu™ controller section of this manual for configuring the entering water temperature set point for boilerless control operation for units with TruVu™ controller.

## UNITS WITH HOT WATER GENERATOR OPTION (HEAT RECOVERY PACKAGE/DESUPERHEATER)

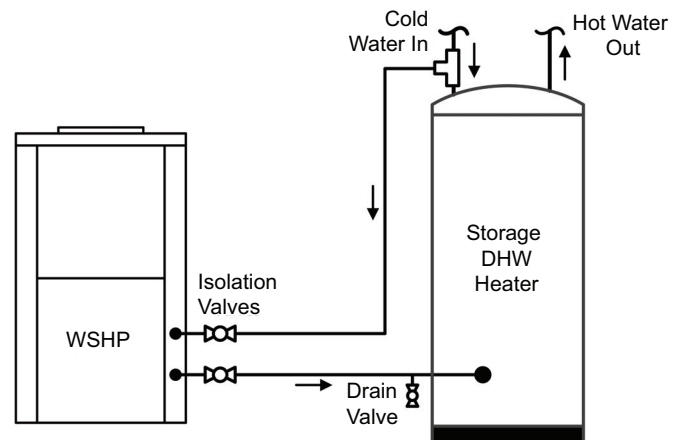
The hot water generator (HWG) is a factory-installed option capable of providing hot water in the range of 110 to 120°F as a supplemental domestic hot water source. The HWG is a desuperheater that uses recovered heat from the hot discharge gas leaving the compressor. Included with the HWG is a vented, double wall coil, circulating pump, high water temperature limit switch (set at 120°F), discharge gas temperature limit switch, and an ON/OFF switch with built-in circuit breaker. The generator operates independently and is not factory wired to the unit controller.

NOTE: The HWG will reduce the amount of heat available to the space and it is recommended to deactivate the HWG in heating mode via the ON/OFF switch.

### Water Tank Preparation

1. Turn off electrical or fuel supply to the water heater.
2. Attach garden hose to water tank drain connection and run other end of hose outdoors or to an open drain.
3. Close cold water inlet valve to water heater tank.
4. Drain tank by opening drain valve on the bottom of the tank, then open pressure relief valve or hot water faucet.
5. Once drained the tank should be flushed with cold water until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.
7. Install HWG water piping. All hot water piping should be a minimum of 3/8 in. OD copper tube to a maximum distance of fifteen feet. For distances beyond fifteen feet but not exceeding sixty feet use 1/2 in. copper tube. Separately insulate all exposed surface of both connecting water lines with 3/8 in. wall closed cell insulation. Install isolation valves on supply and return to the hot water generator. See Fig. 17.

NOTE: Diagram is for illustration purposes only. Ensure access to heat pump is not restricted. All plumbing and piping connections must comply with local plumbing codes.



**Fig. 17 — Typical Hot Water Generator Installation**

### Water Tank Refill

1. Open the cold water supply to the tank.
2. Open a hot water faucet to vent air from the system until water flows from the faucet, then close.
3. Depress the hot water tank pressure relief valve handle to ensure there is no air remaining in the tank.
4. Carefully inspect all plumbing for water leaks. Correct as required.
5. Purge all air from HWG by depressing the Schrader valve on the HR unit. Allow all air to bleed out until water appears at the valve.
6. Before restoring the power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to ensure maximum utilization of heat available from the refrigeration system and to conserve the most energy. On tanks with thermostats and both upper and lower elements, the lower element should be turned down to 100°F, while the upper element should be adjusted to 120°F. Depending upon the specific needs of the customer, you may need to adjust the upper element differently. On tanks with a single thermostat, lower the thermostat setting to 120°F or the “LOW” position. After thermostat adjustments are completed, replace access cover and restore electrical or fuel supply to water heater.

### INITIAL START-UP

1. Turn on the heat pump. The circulating pump should not run if the compressor is not running.
2. Turn HWG switch to the “ON” position. The pump will operate if entering water temperature to HWG is below 120°F.

3. Ensure the temperature difference between the water entering and leaving the heat recovery is 5 to 15°F.
4. Allow the unit to operate for 20 to 30 minutes to ensure it is functioning properly. The pump should shut off when the water temperature entering the generator reaches 120°F.

### UNITS WITH WATERSIDE ECONOMIZER

The optional waterside economizer (pre-cooling coil) is factory installed and piped internally, in series with the condenser water circuit (see Fig. 18). A diverting 3-way motorized valve, entering water temperature sensor, drain pan with condensate overflow switch, and factory controls are included with the option.

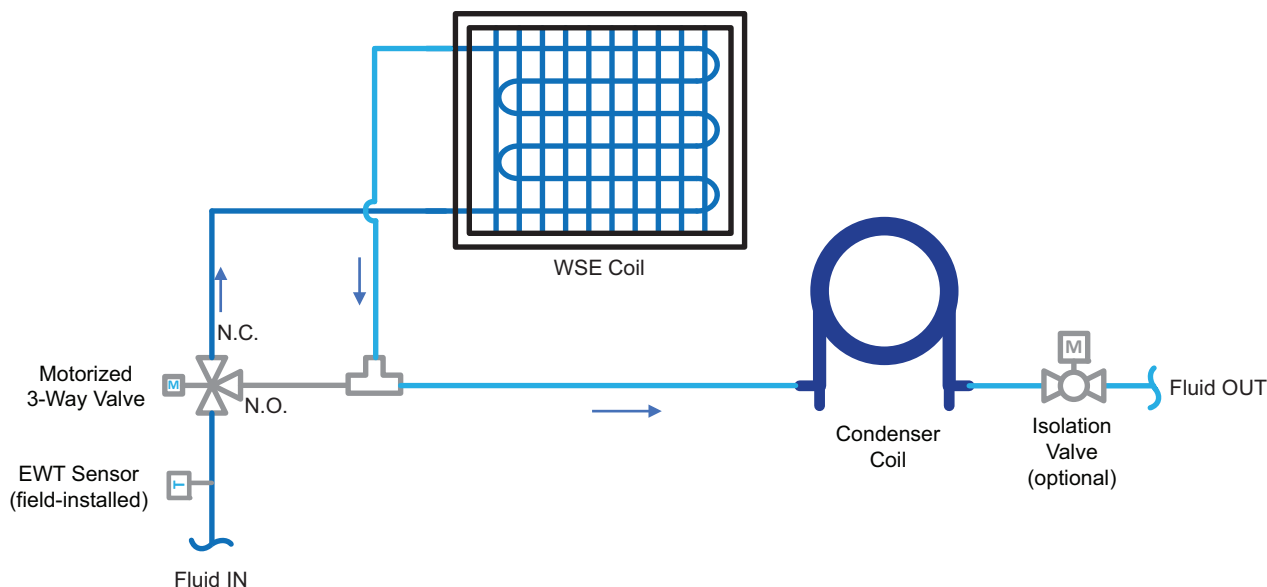
The remote bulb (EWT sensor) is shipped internal to the unit and requires to be installed on straight incoming water line to the unit/ 3-way diverting valve (see Fig. 18). Care should be taken not to dent the bulb or mis-calibration may occur. The remote sensing bulb must be installed on a straight section of uninsulated pipe that provides a good measurement of the entering water temperature. It is recommended to insulate the sensing bulb after installation for better water temperature sensing.

When unit is shipped with economizer option, the economizer drain must be connected to a separate trap. Follow the same steps for the economizer drain as described for evaporator condensate drain Step 6 — “Install Condensate Drain” on page 13.

Refer to Step 9 — “Configure Unit Control Components” on page 21 for Economizer configuration for units with Option Card (units without factory installed TruVu™ controller).

Refer to the TruVu controller section of this manual for configuring the entering water temperature set point for economizer operation for units with TruVu DDC controller.

See Table 1 for connection sizes. Refer to the unit's performance report for economizer performance and additional water and air pressure drop.



**Fig. 18 — Waterside Economizer Diagram**



## Step 8 — Wire Field Power Supply

See Fig. 26-34 for typical wiring diagrams. See Tables 4-9 for additional electrical data. Please refer to the unit wiring diagram attached to the control panel for field installation.

### WARNING

To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

### CAUTION

All power connections must be properly torqued to avoid the risk of overheating.

#### HIGH VOLTAGE WIRING

All field-installed wiring must comply with the National Electric Code as well as all applicable local codes. Refer to the unit electrical data on the unit nameplate for wire and branch circuit protection sizing. Supply power voltage and phasing should match the required voltage and phasing shown on the unit nameplate. Operating the unit below the minimum voltage, above the maximum voltage or with incorrect phasing can result in poor system performance or damage to the heat pump. All field wiring should be installed by qualified and trained personnel. Refer to the unit wiring diagram for field connection requirements.

Power wiring to the heat pump should be enclosed in flexible conduit to minimize the transmission of vibration from the unit cabinet to the building.

For heat pumps with unit mounted disconnect switches, field power should be connected to the marked terminals on the disconnect switch. For heat pumps without unit-mounted

disconnect switches (except units with dual power supply), power is connected to the line (L) side of the compressor contactor and the ground lug in the unit electrical box.

For units with the 65 kA SCCR option, the power supply must be connected to the fuse block located in a dedicated fuse box.

460-v heat pumps with constant airflow motors require five power supply wires: the standard three high-voltage wires, the ground wire, and a neutral wire. These units employ a 265-v motor that requires power from one phase of the 460-v supply and the neutral wire.

### CAUTION

The power supply ground wire should never be used as a neutral wire.

#### *Transformer Settings for 208/230-v Units*

As factory built, all 208/230-v units are wired for 230-v operation. For jobsites with a 208-v power supply, the primary leads on the unit transformer will need to be changed from 230-v to 208-v. Refer to the unit wiring diagram for details.

#### ELECTRIC HEATER

Factory-installed internal electric heater is available for selection with units. Two power supplies are required when electric heater is provided with the unit. The power supply for the electric heater (located in the electric heater package control box) provides power for the heater elements, the blower motor, and the control circuit for the unit. The power supply for the unit provides power for the compressor. This allows the electric heaters to continue to operate along with the blower motor in the case of unit compressor and/or compressor power supply failure. See data plates for minimum circuit capacities and maximum fuse/breaker sizing. See Tables 4-9 for additional electrical data.

**Table 4 — 50WT without Electric Heat — Constant Airflow ECM Blower Motor Electrical Data**

UNIT SIZE	VOLTAGE/ PHASE/Hz	VOLTAGE MIN/MAX	COMPRESSOR			BLOWER MOTOR		TOTAL UNIT FLA	MCA	MOP
			Quantity	RLA	LRA	FLA	HP			
<b>024 VT</b>	208-230/1/60	197 / 253	1	10.3	62.0	4.4	0.3	14.7	17.3	25.0
	265/1/60	238 / 292	1	7.8	52.0	4.7	0.3	12.5	14.5	20.0
	208-230/3/60	197 / 253	1	6.3	56.0	4.4	0.3	10.7	12.3	15.0
	460/3/60	414 / 506	1	3.8	29.0	4.7	0.3	8.5	9.7	15.0
<b>024 HZ</b>	208-230/1/60	197 / 253	1	10.3	62.0	5.0	0.5	15.3	17.9	25.0
	265/1/60	238 / 292	1	7.8	52.0	5.0	0.5	12.8	14.8	20.0
	208-230/3/60	197 / 253	1	6.3	56.0	5.0	0.5	11.3	12.9	15.0
	460/3/60	414 / 506	1	3.8	29.0	5.0	0.5	8.8	10.1	15.0
<b>036</b>	208-230/1/60	197 / 253	1	14.6	14.6	90.0	0.8	23.0	26.6	40.0
	265/1/60	238 / 292	1	12.6	12.5	79.0	0.8	20.0	23.2	35.0
	208-230/3/60	197 / 253	1	9.9	9.9	82.0	0.8	18.3	20.7	30.0
	460/3/60	414 / 506	1	4.8	4.8	44.3	0.8	12.3	14.2	20.0
<b>048</b>	208-230/1/60	197 / 253	1	18.3	18.3	138.0	0.8	26.7	31.3	45.0
	208-230/3/60	197 / 253	1	11.9	11.9	112.0	0.8	20.3	23.3	35.0
	460/3/60	414 / 506	1	6.8	6.8	61.8	0.8	14.3	16.2	20.0
<b>060</b>	208-230/1/60	197 / 253	1	25.2	25.2	147.3	1.0	34.3	40.6	60.0
	208-230/3/60	197 / 253	1	13.8	13.8	150.0	1.0	22.9	26.3	40.0
	460/3/60	414 / 506	1	6.9	6.9	58.0	1.0	16.0	18.2	25.0
<b>070</b>	208-230/1/60	197 / 253	1	28.0	28.0	166.0	1.0	37.1	44.1	70.0
	208-230/3/60	197 / 253	1	18.9	19.2	162.3	1.0	28.3	32.7	50.0
	460/3/60	414 / 506	1	9.1	9.1	70.8	1.0	18.2	20.5	25.0

**LEGEND**

**FLA** — Full Load Amps  
**Hp** — Horsepower  
**HZ** — Horizontal  
**LRA** — Locked Rotor Amp  
**RLA** — Rated Load Amps  
**MCA** — Minimum Circuit Amp  
**MOP** — Maximum Overcurrent Protection  
**VT** — Vertical

**Table 5 — First Data Plate for Units with Electric Heater (EH) Option — Compressor Power Connection**

50WT UNIT SIZE	VOLTAGE/ PHASE/Hz	VOLTAGE MIN/MAX	COMPRESSOR			FLA	MCA	MOP
			Quantity	RLA	LRA			
024 VT/HZ	208-230/1/60	197 / 253	1	10.3	62.0	10.3	12.9	20.0
036	208-230/1/60	197 / 253	1	14.6	90.0	14.6	18.3	30.0
048	208-230/1/60	197 / 253	1	18.3	138.0	18.3	22.9	40.0
060	208-230/1/60	197 / 253	1	25.2	147.3	25.2	31.5	50.0
070	208-230/1/60	197 / 253	1	28.0	166.0	28.0	35.0	60.0

**Table 6 — Second Data Plate for Units 5 kW Electric Heater (EH) Option and Constant Airflow ECM Motor**

50WT UNIT SIZE	VOLTAGE/ PHASE/Hz	VOLTAGE MIN/MAX	BLOWER MOTOR		5 kW ELECTRIC HEATER							
					Heater Element				Unit Data Plate Values			
			FLA	Hp	Watts		Amps		MCA		MOP	
					208-v	240-v	208-v	240-v	208-v	240-v	208-v	240-v
024 VT	208-230/1/60	197 / 253	4.4	0.33	3.6 k	4.8 k	17.3	20	27.1	30.5	30	35
024 HZ	208-230/1/60	197 / 253	4.4	0.33	3.6 k	4.8 k	17.3	20	27.9	31.3	30	35
036	208-230/1/60	197 / 253	8.4	0.75	3.6 k	4.8 k	17.3	20	32.1	35.5	35	40
048	208-230/1/60	197 / 253	8.4	0.75	3.6 k	4.8 k	17.3	20	32.1	35.5	35	40
060	208-230/1/60	197 / 253	9.1	1.00	3.6 k	4.8 k	17.3	20	33.0	36.4	35	40
070	208-230/1/60	197 / 253	9.1	1.00	3.6 k	4.8 k	17.3	20	33.0	36.4	35	40

**Table 7 — Second Data Plate for Units 10 kW Electric Heater (EH) Option and Constant Airflow ECM Motor**

50WT UNIT SIZE	VOLTAGE/ PHASE/Hz	VOLTAGE MIN/MAX	BLOWER MOTOR		10 kW ELECTRIC HEATER							
					Heater Element				Unit Data Plate Values			
			FLA	Hp	Watts		Amps		MCA		MOP	
					208-v	240-v	208-v	240-v	208-v	240-v	208-v	240-v
024 VT	208-230/1/60	197 / 253	4.4	0.33	7.2 k	9.6 k	34.7	40	48.9	55.5	50	60
024 HZ	208-230/1/60	197 / 253	4.4	0.33	7.2 k	9.6 k	34.7	40	49.6	56.3	50	60
036	208-230/1/60	197 / 253	8.4	0.75	7.2 k	9.6 k	34.7	40	53.9	60.5	60	70
048	208-230/1/60	197 / 253	8.4	0.75	7.2 k	9.6 k	34.7	40	53.9	60.5	60	70
060	208-230/1/60	197 / 253	9.1	1.00	7.2 k	9.6 k	34.7	40	54.8	61.4	60	70
070	208-230/1/60	197 / 253	9.1	1.00	7.2 k	9.6 k	34.7	40	54.8	61.4	60	70

**Table 8 — Second Data Plate for Units 15 kW Electric Heater (EH) Option and Constant Airflow ECM Motor**

50WT UNIT SIZE	VOLTAGE/ PHASE/Hz	VOLTAGE MIN/MAX	BLOWER MOTOR		15 kW ELECTRIC HEATER							
					Heater Element				Unit Data Plate Values			
			FLA	Hp	Watts		Amps		MCA		MOP	
					208-v	240-v	208-v	240-v	208-v	240-v	208-v	240-v
036	208-230/1/60	197 / 253	8.4	0.75	10.8 k	14.4 k	52.0	60	75.5	85.5	80	90
048	208-230/1/60	197 / 253	8.4	0.75	10.8 k	14.4 k	52.0	60	75.5	85.5	80	90
060	208-230/1/60	197 / 253	9.1	1.00	10.8 k	14.4 k	52.0	60	76.4	86.4	80	90
070	208-230/1/60	197 / 253	9.1	1.00	10.8 k	14.4 k	52.0	60	76.4	86.4	80	90

**Table 9 — Second Data Plate for Units 20 kW Electric Heater (EH) Option and Constant Airflow ECM Motor**

50WT UNIT SIZE	VOLTAGE/ PHASE/Hz	VOLTAGE MIN/MAX	BLOWER MOTOR		20 kW ELECTRIC HEATER							
					Heater Element				Unit Data Plate Values			
			FLA	HP	Watts		Amps		MCA		MOP	
					208-v	240-v	208-v	240-v	208-v	240-v	208-v	240-v
048	208-230/1/60	197 / 253	8.4	0.75	14.4 k	19.2 k	69.3	80	97.1	110.5	100	125
060	208-230/1/60	197 / 253	9.1	1.0	14.4 k	19.2 k	69.3	80	98.0	111.4	100	125
070	208-230/1/60	197 / 253	9.1	1.0	14.4 k	19.2 k	69.3	80	98.0	111.4	100	125

## LOW VOLTAGE, CONTROL WIRING

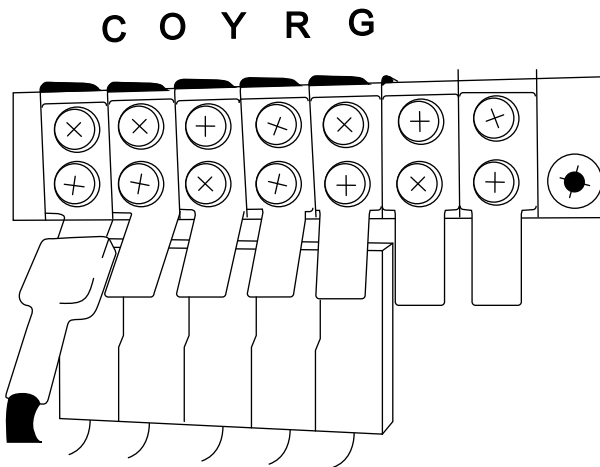
### ⚠ WARNING

To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

### ⚠ CAUTION

Never route control wiring through the same conduit as power supply wiring. Electrical noise and transients from the power wiring can cause communication issues or damage to the control wiring and connected control components.

Units without factory installed TruVu DDC controller can be controlled using the included thermostat inputs (R, O, Y1, C, G) for single stage heat pump thermostat or field-installed DDC (Direct Digital Controls) controls. Note that the reversing valve on the unit is energized when the unit is in the cooling mode. See Fig. 19 for typical thermostat connections.



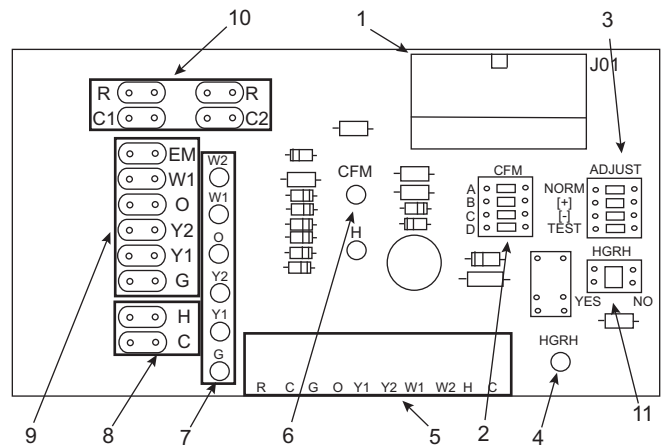
**Fig. 19 — Typical Thermostat Connections**

Control wiring for units with constant airflow ECM blower motors is routed through a constant airflow ECM interface board. Thermostat input wiring is connected to the 10-pin screw type terminal block on the lower center portion of the ECM Interface Board. In addition to providing a connecting point for thermostat wiring, the interface board also translates thermostat inputs into control commands for the Electronic Commutated Motor (ECM) DC fan motor and displays an LED indication of operating status. Refer to the unit wiring diagrams for complete details. See Fig. 20. The thermostat connections and their functions are as follows.

#### ECM INTERFACE THERMOSTAT CONNECTIONS

- **Y1** First Stage Compressor Operation
- **Y2** Second Stage Compressor Operation
- **G** Fan

- **O** Reversing Valve (energized in cooling)
- **W1** Auxiliary Electric Heat (runs with compressor)
- **EM/W2** Emergency Heat (electric heat only)
- **NC** Transformer 24 vac Common (extra connection)
- **C1** Transformer 24 vac Common (primary connection)
- **R** Transformer 24 vac Hot
- **H** Dehumidification Mode



#### LEGEND

- 1 Motor harness plug
- 2 Blower CFM Adjustment
- 3 Motor Settings
- 4 Dehumidification Indication
- 5 Thermostat Digital Contact Inputs
- 6 Cfm Count Indicator
- 7 Thermostat Input Status Indication
- 8 Reheat digital outputs
- 9 Thermostat Outputs
- 10 24 Vac
- 11 Dehumidification Method Selector

**Fig. 20 — ECM Interface Board Physical Layout**

#### THERMOSTAT AND DDC SENSORS

Thermostats or DDC space sensors should be located on an interior wall away from supply ducts. Avoid locations subject to direct sunlight or drafts, or external walls. Thermostat wiring should be 18 AWG (American Wire Gauge). Refer to the installation instructions for the thermostat for further details.

**IMPORTANT:** Exceptionally long runs of thermostat wire should be avoided to prevent voltage drops in the control circuit.

#### ADDITIONAL CONTROLS OPTIONS WIRING

##### *Hot Gas Reheat Control*

Units with hot gas reheat (HGRH) will include an additional H terminal on the input terminal board for dehumidification control. To enable a call for dehumidification, a 24-v signal must be sent to the H terminal with no voltage applied to the Y1 or O terminals. Any call for cooling (Y1 and O) will override the dehumidification call.

### Pump Relay

Units with selected Pump Relay option can be field wired to enable a field provided loop pump or solenoid valve when there is a call for compressor operation. Represented as AUX relay on Wiring Diagrams (see Fig. 26-34).

### Energy Management Switch

Units with selected energy management switch (EMS) can be field wired to disable unit operation when a 24-v signal is removed from the relay. Removing the 24-v signal causes the relay to open, which cuts 24-v power to the unit control circuit. All unit components will be disabled at when the EMS is deactivated. Represented as EMS relay on Wiring Diagrams (see Fig. 26-34).

### Alarm Output (All Units)

If the unit is being connected to a thermostat or DDC control with an alarm indicator, this connection is made at the unit malfunction output on the Unit Protection Module (UPM). See the Unit Protection Module heading in Step 9 — “Configure Unit Control Components” on page 21 section for further details.

### TruVu DDC Controller

TruVu is a factory installed DDC control that requires the use of Carrier ZS or non-communicating sensors or the Carrier TruVu Equipment touch interface for space temperature sensing. TruVu DDC is not compatible with thermostats.

All units equipped with TruVu DDC controller include factory-installed EWT, LWT, SAT, and RAT sensors. Additional field-installed sensors should be provided and wired as needed. Please refer to the Operation section of the Installation, Operation, and Maintenance (IOM) manual for available inputs for optional field-installed components.

**IMPORTANT:** Relocate the factory installed supply air temperature sensor (SAT) when using a field-installed electric heater. The Supply Air Temperature (SAT) sensor should be downstream of any external heating device for effective control.

All TruVu wiring is completed at the TruVu control board. See Fig. 34 for details.

### Control Transformer

All units without factory installed TruVu DDC include 75VA transformer. All units with TruVu™ DDC controller include a 100VA transformer.

#### ⚠ CAUTION

Exceeding the transformer capacity can result in low control voltage, erratic unit operation or damage to the heat pump.

The VA capacity of the transformer should be considered when applying low voltage accessories, such as shut off valves, thermostats, or DDC controls. Table 10 shows the VA draw of factory-mounted components in the low voltage heat pump.

The total VA draw of the heat pump internal components plus any attached accessories must be lower than the VA capacity of the unit control transformer.

**Table 10 — Low Voltage VA Draw**

STANDARD CONSTRUCTION	
Component	VA
Reversing Valve Solenoid	12
Compressor Contactor Single Phase	10
UPM Board	5
Total VA Draw	27
OPTION CARD	
Component	VA
Total from 'Standard'	31
Option Card	5
Hot Gas Reheat Solenoid	9
Economizer Valve	3
Total VA Draw	44
OPTIONAL COMPONENTS	
Component	VA
Compressor Monitor Relay	4
Blower Monitor Relay	4
Energy Management Relay	4
Fire Alarm Relay	4
Heater Contactor	10
AUX Relay	10
Electric Heating/Blower Relay	4
683 TruVu™ DDC	37
CA ECM Board	1
Leaving Water Valve	7
Compressor Contactor 3 Phase	10

## Step 9 — Configure Unit Control Components

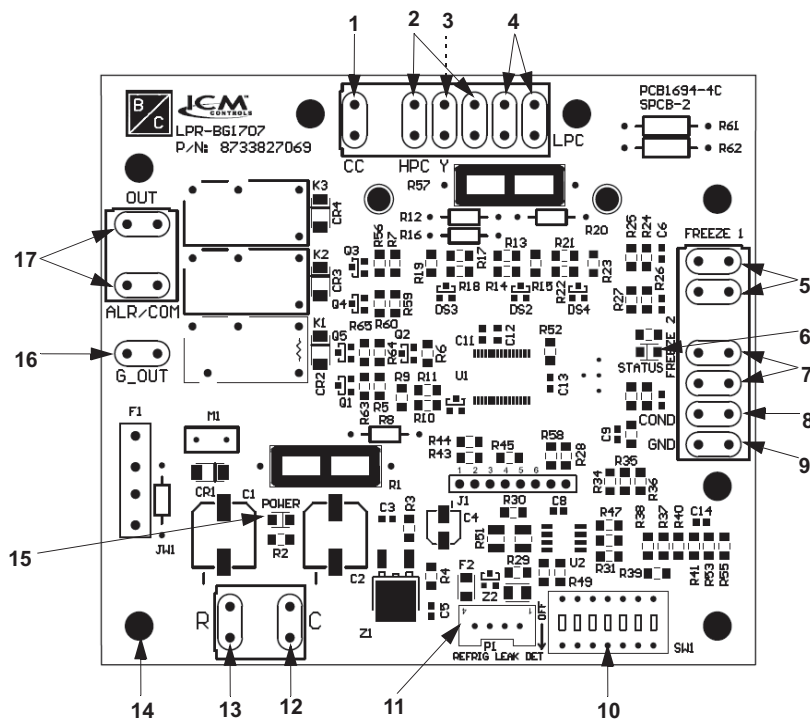
#### ⚠ WARNING

To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

### UNIT PROTECTION MODULE (UPM)

The Unit Protection Module (UPM) as shown in Fig. 21 is a printed circuit board (PCB) included in all units, that interfaces with the thermostat or the digital direct controller.

The main purpose of this device is to protect the compressors by monitoring the different states of switches and sensors of each refrigerant circuit. This device provides time delays and protects the unit against freezing of the water and refrigerant heat exchangers as well as condensate overflow when the appropriate sensors are installed.



#### LEGEND

- 1 — Compressor Contact Output
- 2 — High-Pressure Switch Connection
- 3 — Call for Compressor (Y1)
- 4 — Low Pressure Switch Connection
- 5 — Water Coil Freeze Connection (Freeze 1)
- 6 — UPM Status LED Indicator (Fault Status)
- 7 — Air Coil Freeze Connection (Freeze 2)
- 8 — Condensate Overflow Sensor Connection
- 9 — Ground
- 10 — UPM Settings DIP Switch (SW1)
- 11 — A2L Sensor
- 12 — 24 Vac Power Common
- 13 — 24 Vac Power Input
- 14 — UPM Standoff
- 15 — Power LED
- 16 — Fan
- 17 — Dry Contact

**Fig. 21 — Unit Protection Module (UPM)**

### UPM Standard Safeties and Alarms

#### HI AND LOW REFRIGERANT PRESSURE PROTECTION

- High-pressure switch located in the refrigerant discharge line and wired across the HPC (High-Pressure Switch Connection) terminals on the UPM.
- Low-pressure switch located in the unit refrigerant suction line and wired across the LPC (Low-Pressure Switch Connection) terminals (LPC1 and LPC2) on the UPM.

#### WATER COIL FREEZE PROTECTION

Waterside freeze protection sensor, mounted close to condensing water coil, monitors refrigerant temperature between condensing water coil and thermal expansion valve (see Fig. 22.)

If temperature drops below or remains at freeze limit trip for 120 seconds, the controller will shut down the compressor and enter into a soft-lockout condition. The default freeze limit trip is 25°F; however, this can be changed to 15°F by flipping DIP switch SW1 (see Fig. 21, Item 10, Fig. 24, and Table 11).

NOTE: The UPM Board Dry Contacts are Normally Open (NO).

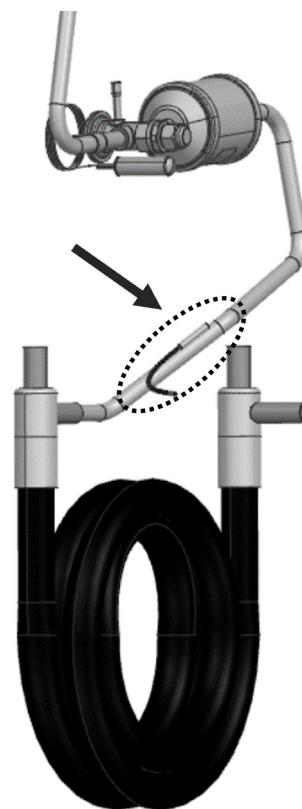
**IMPORTANT:** The freeze sensor will not guard against the loss of water. A flow switch is recommended to prevent the unit from running if water flow is lost or reduced.

**IMPORTANT:** If the unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze 1 set to 25°F (DIP Switch SW1 set to Off) in order to shut down the unit at the appropriate leaving water temperature and protect your heat pump from freezing if a freeze sensor is included.

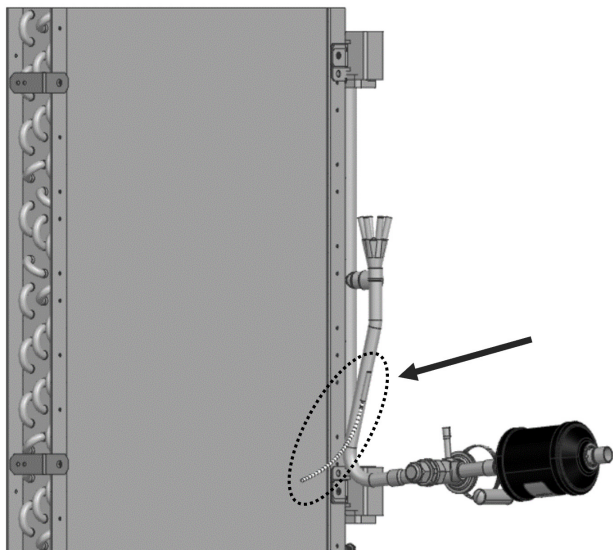
#### AIR COIL FREEZE PROTECTION

Air coil freeze protection sensor, mounted between the thermal expansion device and the evaporator, monitors refrigerant temperature between the evaporator coil and thermal expansion valve (see Fig. 23). If temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut down the compressor

and enter into a soft-lockout condition. The default freeze limit trip is 25°F, this can be changed to 15°F by flipping DIP switch SW1 (see Fig. 21, Item 10, Fig. 24, and Table 11.)



**Fig. 22 — Waterside Freeze Sensor Location (FREEZE 1) — Vertical Configuration Shown**



**Fig. 23 — Air Coil Freeze Sensor Location (FREEZE 2) — Vertical Configuration Shown**

#### HIGH CONDENSATE LEVEL SHUTDOWN

The condensate overflow protection sensor is located in the drain pan of the unit and connected to the “COND” terminal on the UPM board (see Fig. 21, item 8).

#### Anti-Short Cycle Timer

Five minute delay on break timer to prevent compressor short cycling.

#### Random Start Time Delay

Each controller has an unique random start delay ranging from 270 to 300 seconds on initial power up to reduce the chance of multiple units simultaneously starting at the same time after power up or after a power interruption, in order to avoid creating a large electrical spike.

#### Low-Pressure Bypass Timer

If the compressor is running and the low pressure switch opens, the controller will keep the compressor On for 120 seconds. After two minutes if the low-pressure switch remains open, the controllers will shut down the compressor and enter a soft lockout. The compressor will not be energized until the low-pressure switch closes and the anti-short cycle time delay expires. If the low-pressure switch opens two or four times in one hour, the unit will enter a hard lockout. In order to exit hard lockout power to the unit would need to be reset. The reset signal is either a Y or R signal depending on the position of the DIP switch as shown in Table 11. If the reset is set to R, the board must be manually powered off and powered back on to exit the hard lockout.

#### Brownout/Surge/Power Interruption Protection

The brownout protection in the UPM board will shut down the compressor if the incoming power falls below 18 vac. The compressor will remain Off until the voltage is above 18 vac and Anti-Short Cycle Timer (300 seconds) times out. The unit will not go into a hard lockout.

#### Alarm Output

Alarm output is Normally Open (NO) dry contact. If pulse is selected the alarm output will be pulsed. The fault output will depend on the DIP switch setting for “Alarm”. If it is set to “CONST”, a constant signal will be produced to indicate a fault has occurred and the unit requires inspection to determine the type of fault. If it is set to “PULSE” a pulse signal is produced and a fault code is detected by a remote device indicating the fault. (For blink code explanation, see Table 12). The remote device must have a analog input with malfunction detection capability to interpret PULSE signal when the UPM board is set to “PULSE”.

**IMPORTANT:** If 24 vac output is needed R must be wired to ALR-COM terminal; 24 vac will be available to the ALR-OUT terminal when the unit is in the alarm condition.

#### Test Mode

A test DIP switch is provided to reduce all time delays settings to 10 seconds during troubleshooting or verification of unit operation.

**IMPORTANT:** Operation of unit in test mode can lead to accelerated wear and premature failure of components. The “TEST” switch must be set back to “NO” after troubleshooting/servicing.

#### INTELLIGENT ALARM RESET

If a fault condition is initiated, the five minute delay on break time period is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition still exists or occurs two or four times (depending on “2” or “4” settings for Lockout DIP Switch) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset. See Fig. 24.

#### HARD LOCKOUT RESET

A hard lockout can be reset by turning the unit thermostat off and then back on when the “RESET” DIP switch is set to “Y” or by shutting off unit power at the circuit breaker when the “RESET” DIP switch is set to “R”.

**NOTE:** The blower motor will remain active during a lockout condition.

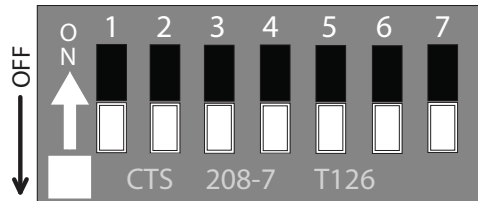
**Table 11 — UPM DIP Switch Selectable Positions**

TOGGLE	FUNCTION	ON	OFF	FACTORY DEFAULT
1	Lockout	4	2	2
2	Reset	R	Y	Y
3	Alarm	Cont	Pulse	Pulse
4	Test	Yes	No	No
5	Freeze 1	15°F	25°F	25°F
6	Freeze 2	15°F	25°F	25°F
7	Pump	ON	OFF	OFF

**Table 12 — UPM Fault Blink Codes**

BLINKS	FAULT	FAULT CRITERIA
None	None	All fault conditions normal.
1	High Pressure	Refrigerant discharge pressure has exceeded 600 psig.
2	Low Pressure	Refrigerant suction pressure has fallen below 40 psig.
3	Water Coil Freeze Condition	Refrigerant temperature to the water coil has fallen below 25°F for 120 seconds.
4	Condensate Overflow	Condensate levels in the unit drain pan are too high.
5	Brown Out	Control voltage has fallen below 18 VAC
6	Air Coil Freeze Condition	Refrigerant temperature to the air coil has fallen below 25°F for 120 seconds.
7	Refrigerant Leak Fault	Refrigerant LFL% is more than 15%.





**Fig. 24 — UPM Settings DIP Switch (SW1)**

#### OPTION CARD

Units ordered with the water side economizer or hot gas reheat factory installed options and no factory installed DDC controller will include the Option Card as standard (see Fig. 25).

The card has three primary functions:

#### ***“Boilerless” Electric Heat Control***

Boilerless heat control is a means to control an auxiliary electric heater on units that are connected to a water loop without a reliable heat injection source. The option card features a potentiometer to configure a water loop heat setpoint (Item 2, Fig. 25, Heat Set

Point Potentiometer). When the water loop (EWT) drops below the specified setpoint and there is a call for heating the compressor will be disabled and the option card sends a 24-v output to enable the electric heater.

#### ***On/Off Hot Gas Reheat Control***

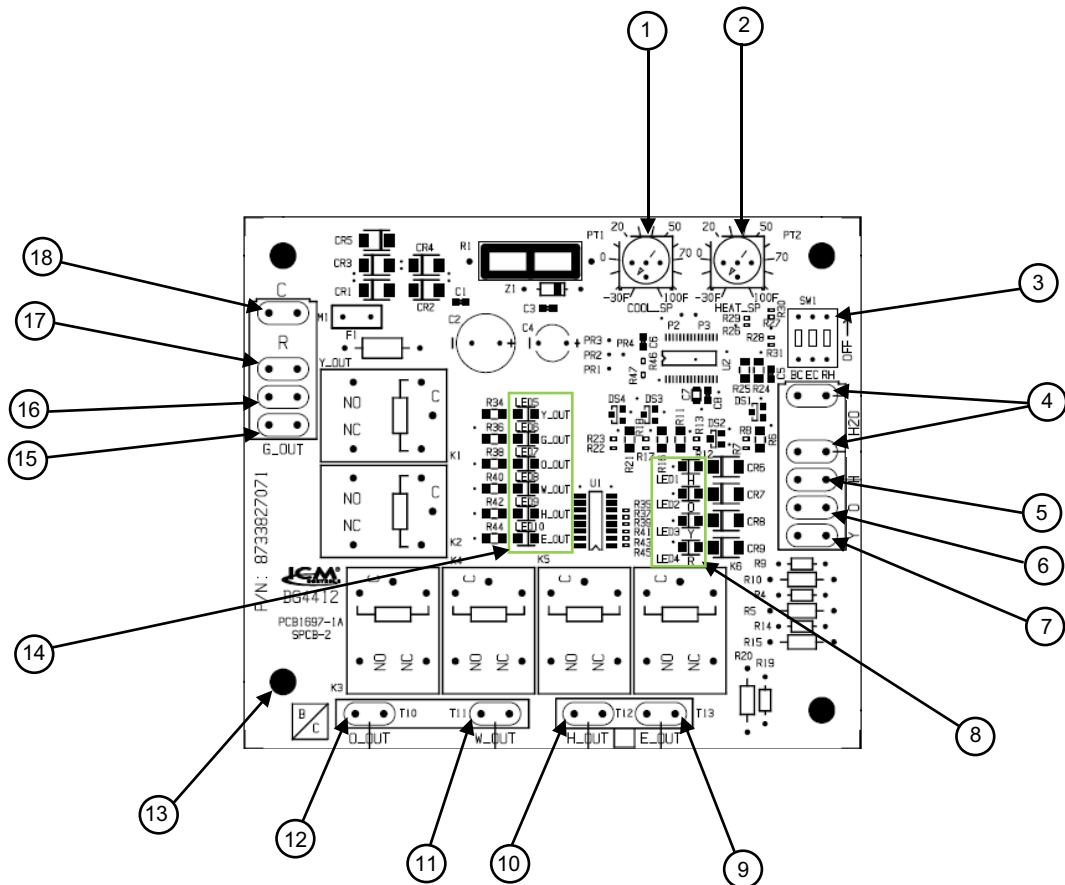
Hot gas reheat control is an active means of dehumidification control. HGRH is enabled when the space temperature is satisfied but the space humidity is above the desired setpoint. The Option card energizes the fan, reversing valve, HGRH valve and compressor.

#### ***Water Side Economizer Control***

Water side economizer control allows for cooling directly with the source water when the source water temperature is below a configurable setpoint. The expansion card features a potentiometer to configure a water loop cool setpoint (Item 1, Fig. 25, Cool Set Point Potentiometer). When the water loop drops below the specified setpoint and there is a call for cooling the WSE diverting valve will divert water through the water side economizer coil. If a cooling call remains for a period of > 10 min the compressor will be enabled to assist the WSE in meeting the cooling demand.

See Fig. 26-34 for wiring diagrams.





1	Cool Set Point Potentiometer
2	Heat Set Point Potentiometer
3	Operating Mode Dip Switch
4	Entering Water Temperature
5	H Signal Input
6	O Signal Input
7	Y Call Input
8	LED Input Status
9	Economizer Output "E_OUT"
10	Hot Gas Reheat Output "H_OUT"
11	Boilerless Control "W_OUT"
12	Reversing Valve Output "O_OUT"
13	Option Card Standoff
14	LED Output Status
15	FAN Output "G_OUT"
16	Y Call Output "Y_OUT"
17	24 VAC Power Input
18	24 VAC Power Common

**Fig. 25 — Option Card**

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GN	GREEN
OR	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW
GY	GREY

FACTORY WIRE ———  
FIELD WIRE - - - - -

#### STANDARD COMPONENTS LEGEND:

BM — BLOWER MOTOR  
CAP — COMPRESSOR CAPACITOR  
CBR — 24V CIRCUIT BREAKER  
CC — COMPRESSOR CONTACTOR  
CS — CONDENSATE SENSOR (IN DRAIN PAN)  
FS — FREEZE SENSOR  
HPS — HIGH PRESSURE SWITCH  
LPS — LOW PRESSURE SWITCH  
RV — REVERSING VALVE (HEAT PUMPS)  
Y2S — COMPRESSOR 2ND STAGE

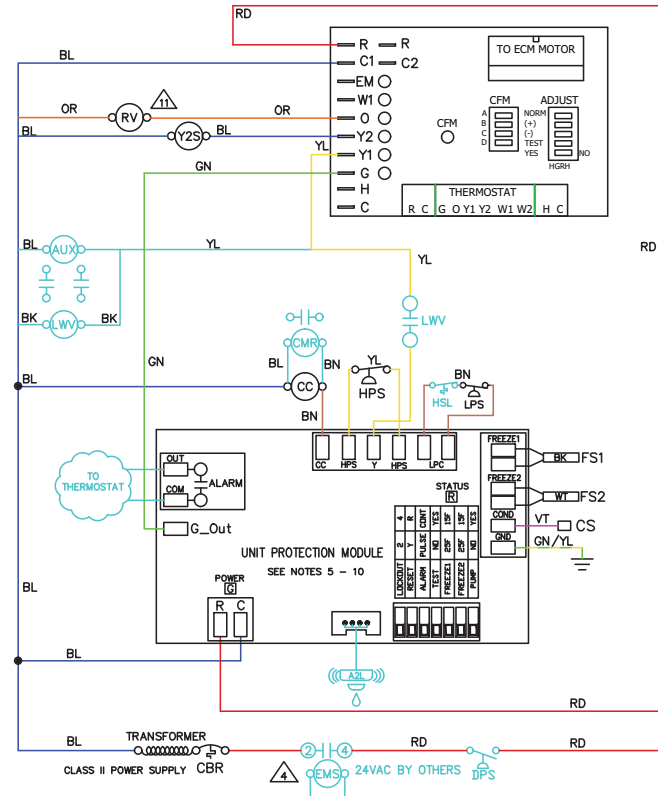
#### OPTIONAL COMPONENTS LEGEND:

[ ] A2L — AIR TO LIQUID REFRIGERANT LEAK SENSOR  
[ ] AUX — AUXILIARY RELAY (FOR LOOP PUMP, ETC)  
[ ] CMR — COMPRESSOR MONITOR RELAY  
[ ] DPS — DIFFERENTIAL PRESSURE SWITCH  
[ ] DS — DISCONNECT SWITCH  
[ ] EMS — ENERGY MGMT SYSTEM RELAY  
[ ] FB — FUSE BLOCK (FOR 100KA SCCR RATING)  
[ ] HRP — HEAT RECOVERY PACKAGE:  
HRPM — HEAT RECOVERY PUMP MOTOR  
HWL — HOT WATER LIMIT (120F)  
LGL — LOW GAS TEMPERATURE LIMIT (100F)  
SWT — ON/OFF SWITCH AND OVERLOAD  
[ ] HSL — HIGH TEMPERATURE SUCTION LIMIT (WITH HOT GAS BYPASS ONLY)  
[ ] LWV — LEAVING WATER VALVE

#### NOTES:

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- 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE PRIMARY LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
- FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.
- UPM-I INCLUDES BUILT IN: 270–300 SECOND RANDOM START  
300 SECOND DELAY ON BREAK  
120 SECOND LOW PRESSURE BYPASS
- "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
- "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F OPERATION BY DEFAULT, IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
- "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED OR IF DDC CONNECTION IS AVAILABLE. CONT FOR NON BLINKING THERMOSTAT CONNECTION.
- DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
- ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM TERMINAL BLOCK TO ALR-COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
- REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
- UNIT WILL HAVE OPTIONAL DISCONNECT SWITCH OR FUSE PROTECTION, UNIT WILL NOT HAVE BOTH.

#### USE CLASS II FIELD WIRING



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Fig. 26 — Single Phase, Constant Airflow ECM Motor, Standard Unit

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GN	GREEN
OR	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW
GY	GREY

FACTORY WIRE —————  
FIELD WIRE - - - - -

#### STANDARD COMPONENTS LEGEND:

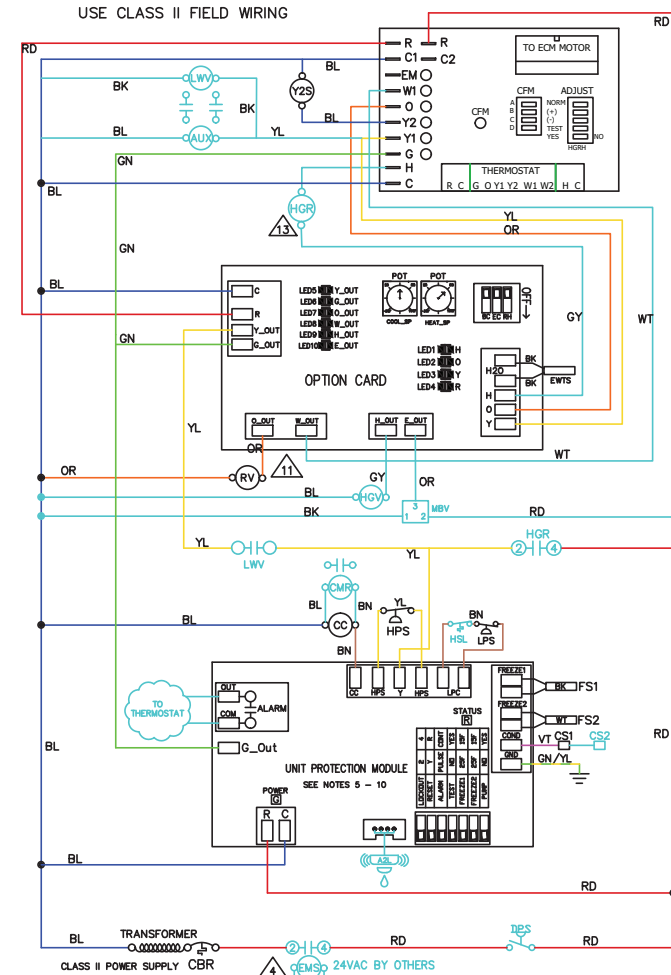
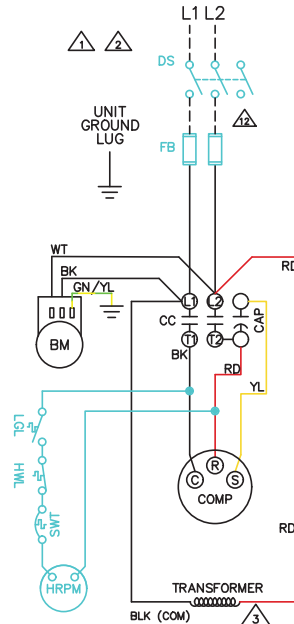
BM — BLOWER MOTOR  
CAP — COMPRESSOR CAPACITOR  
CBR — 24V CIRCUIT BREAKER  
CC — COMPRESSOR CONTACTOR  
CS1 — CONDENSATE SENSOR (IN UNIT DRAIN PAN)  
FS — FREEZE SENSOR  
HPS — HIGH PRESSURE SWITCH  
LPS — LOW PRESSURE SWITCH  
RV — REVERSING VALVE (HEAT PUMPS)  
Y2S — COMPRESSOR 2ND STAGE

#### OPTIONAL COMPONENTS LEGEND:

[ ] A2L — AIR TO LIQUID REFRIGERANT LEAK SENSOR  
[ ] AUX — AUXILIARY RELAY  
(FOR LOOP PUMP, ETC)  
[ ] CMR — COMPRESSOR MONITOR RELAY  
[ ] CS2 — CONDENSATE SENSOR (IN ECONOMIZER DRAIN PAN)  
[ ] DPS — DIFFERENTIAL PRESSURE SWITCH  
[ ] DS — DISCONNECT SWITCH  
[ ] EMS — ENERGY MGMT SYSTEM RELAY  
[ ] FB — FUSE BLOCK (FOR 100KA SCCR RATING)  
[ ] HGR — HOT GAS REHEAT RELAY  
[ ] HGV — HOT GAS VALVE SOLENOID  
[ ] HRP — HEAT RECOVERY PACKAGE:  
[ ] HRP-M — HEAT RECOVERY PUMP MOTOR  
[ ] HWL — HOT WATER LIMIT (120F)  
[ ] LGL — LOW GAS TEMPERATURE LIMIT (100F)  
[ ] SWT — ON/OFF SWITCH AND OVERLOAD  
[ ] HSL — HIGH TEMPERATURE SUCTION LIMIT  
(WITH HOT GAS BYPASS ONLY)  
[ ] LWV — LEAVING WATER VALVE  
[ ] MBV — MOTORIZED BALL VALVE

#### NOTES:

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300 SECOND DELAY ON BREAK  
120 SECOND LOW PRESSURE BYPASS
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- "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED OR IF DDC CONNECTION IS AVAILABLE. CONT FOR NON BLINKING THERMOSTAT CONNECTION.
- DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
- ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM TERMINAL BLOCK TO ALR-COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
- REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
- UNIT WILL HAVE OPTIONAL DISCONNECT SWITCH OR FUSE PROTECTION, UNIT WILL NOT HAVE BOTH.
- HOT GAS REHEAT RELAY WILL ONLY BE USED WHEN HOT GAS REHEAT AND ECONOMIZER OPTIONS ARE SELECTED.



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**Fig. 27 — Single Phase, Constant Airflow ECM Motor, Option Card (WSE, HGRH, Boilerless Heat)**

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
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VT	VIOLET
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FACTORY WIRE —————  
FIELD WIRE - - - - -

#### STANDARD COMPONENTS LEGEND:

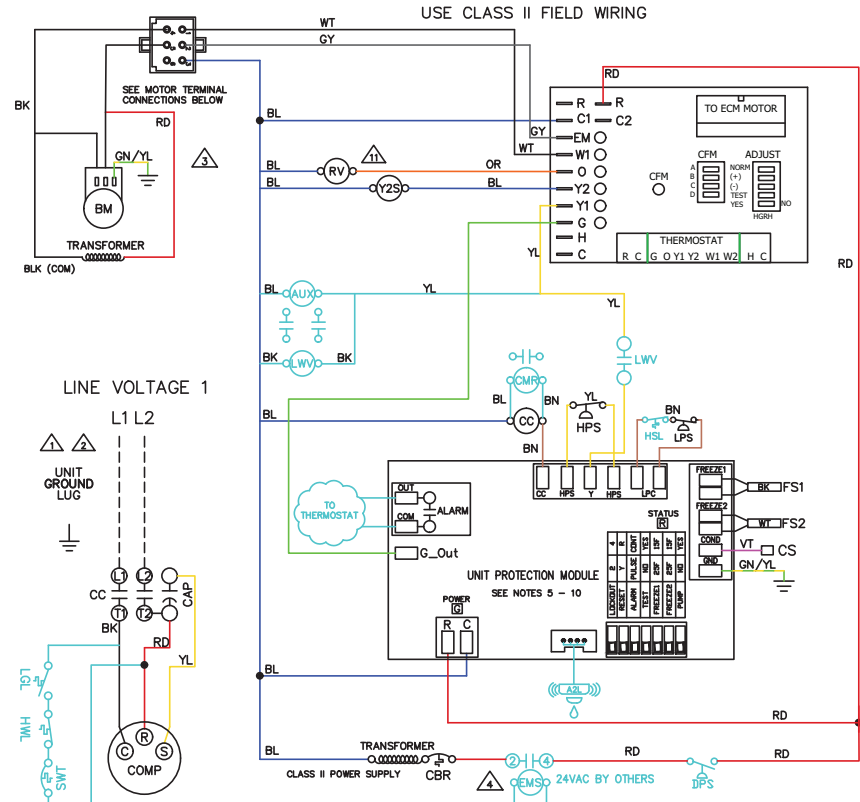
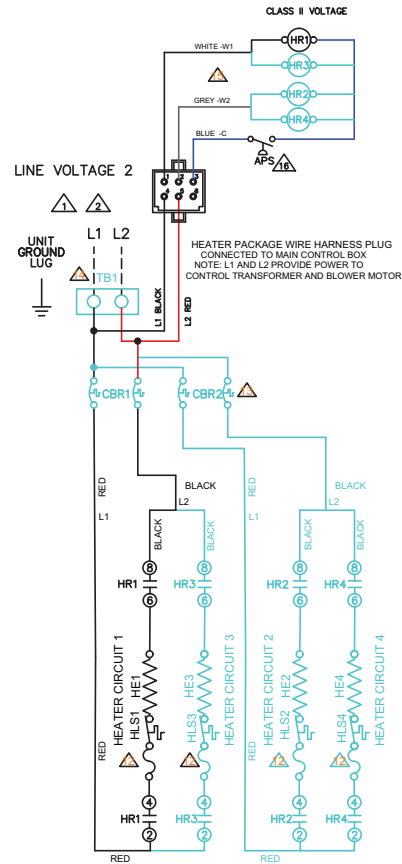
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CBR — 24V CIRCUIT BREAKER  
CC — COMPRESSOR CONTACTOR  
CS — CONDENSATE SENSOR (IN DRAIN PAN)  
FS — FREEZE SENSOR  
HR1 — HEATING RELAY  
HE1 — HEATING ELEMENT  
HLS1 — HEATING LIMIT SWITCH  
HPS — HIGH PRESSURE SWITCH  
LPS — LOW PRESSURE SWITCH  
RV — REVERSING VALVE (HEAT PUMPS)  
Y2S — COMPRESSOR 2ND STAGE

#### OPTIONAL COMPONENTS LEGEND:

[ ] AZL — AIR TO LIQUID REFRIGERANT LEAK SENSOR  
[ ] AUX — AUXILIARY RELAY (FOR LOOP PUMP, ETC)  
[ ] CBR1 — CIRCUIT BREAKERS (1 — 2)  
[ ] CBR2  
[ ] CMR — COMPRESSOR MONITOR RELAY  
[ ] DPS — DIFFERENTIAL PRESSURE SWITCH  
[ ] EMS — ENERGY MGMT SYSTEM RELAY  
[ ] HR2 — HEATING RELAY 2,3,4  
[ ] HR3,HR4  
[ ] HE2 — HEATING ELEMENT (2 — 4)  
[ ] HE3,HE4  
[ ] HLS2 — HEATING LIMIT SWITCH  
[ ] HLS3,HLS4  
[ ] HRP — HEAT RECOVERY PACKAGE:  
[ ] HRP — HEAT RECOVERY PUMP MOTOR  
[ ] HWL — HOT WATER LIMIT (120F)  
[ ] LGL — LOW GAS TEMPERATURE LIMIT (100F)  
[ ] SWT — ON/OFF SWITCH AND OVERLOAD  
[ ] HSL — HIGH TEMPERATURE SUCTION LIMIT (WITH HOT GAS BYPASS ONLY)  
[ ] LWV — LEAVING WATER VALVE  
[ ] TB1 — POWER TERMINAL BLOCK

#### NOTES:

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- FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.
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300 SECOND DELAY ON BREAK  
120 SECOND LOW PRESSURE BYPASS
- "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
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- REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
- 5kW,10kW,15kW:DUAL RESET PRIMARY CONTACTS WILL OPEN AT 155F (+/-5F) AND CLOSE AT 125F (+/-7F). BACK UP CONTACTS WILL OPEN AT 180F (+/-8F). BACK-UP CONTACTS WILL NOT RESET.  
20kW:DUAL RESET PRIMARY CONTACTS WILL OPEN AT 140F (+/-5F) AND CLOSE AT 110F (+/-7F). BACK UP CONTACTS WILL OPEN AT 180F (+/-8F). BACK-UP CONTACTS WILL NOT RESET.
- ONLY HEATERS 15 — 20 KW HAVE CIRCUIT BREAKERS.
- TERMINAL BLOCK USED ON 5KW/10KW UNITS ONLY.
- THERMOSTATS USING W2/E AS EMERGENCY HEAT SIGNAL MUST TERMINATE GREY W2 WIRE ON HC1 COIL FOR 5KW UNITS.
- AIR PRESSURE SWITCH IS NORMALLY OPEN AND WILL CLOSE WHEN THE FAN IS ON.



ELECTRIC HEAT ELEMENTS				
kW	HE1	HE2	HE3	HE4
5	5.00			
10	5.00	5.00		
15	5.00	5.00	5.00	
20	5.00	5.00	5.00	5.00

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Fig. 28 — Single Phase, Constant Airflow ECM Motor, E-Heat, Dual Point Power, Standard Unit

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

FACTORY WIRE —————  
FIELD WIRE - - - - -

#### STANDARD COMPONENTS LEGEND:

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CAP - COMPRESSOR CAPACITOR  
CBR - 24V CIRCUIT BREAKER  
CC - COMPRESSOR CONTACTOR  
CSI - CONDENSATE SENSOR (IN UNIT DRAIN PAN)  
FS - FREEZE SENSOR  
HR1 - HEATING RELAY  
HE1 - HEATING ELEMENT  
HLS1 - HEATING LIMIT SWITCH  
HPS - HIGH PRESSURE SWITCH  
LPS - LOW PRESSURE SWITCH  
RV - REVERSING VALVE (HEAT PUMPS)  
Y2S - COMPRESSOR 2ND STAGE

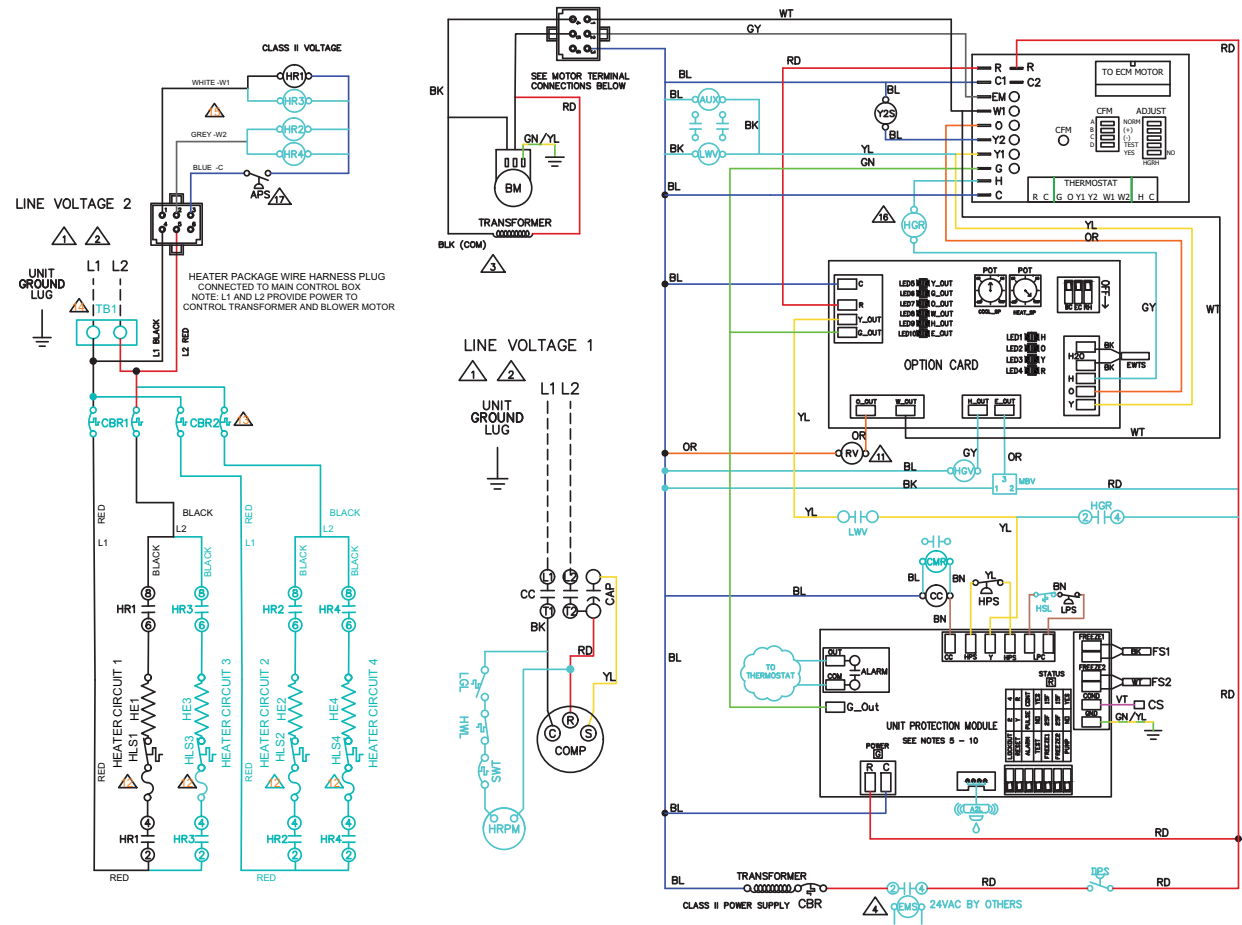
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[ ] CS2 - CONDENSATE SENSOR (IN ECONOMIZER DRAIN PAN)  
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[ ] EMS - ENERGY MGMT SYSTEM RELAY  
[ ] HR2 - HEATING RELAY 2,3,4  
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[ ] HE2 - HEATING ELEMENT (2 - 4)  
[ ] HE3,HE4  
[ ] HLS2 - HEATING LIMIT SWITCH  
[ ] HLS3,HLS4  
[ ] HGR - HOT GAS REHEAT RELAY  
[ ] HGV - HOT GAS VALVE SOLENOID  
[ ] HRP - HEAT RECOVERY PACKAGE:  
[ ] HRP-M - HEAT RECOVERY PUMP MOTOR  
[ ] HWL - HOT WATER LIMIT (120°F)  
[ ] LGL - LOW GAS TEMPERATURE LIMIT (100°F)  
[ ] SWT - ON/OFF SWITCH AND OVERLOAD  
[ ] HSL - HIGH TEMPERATURE SUCTION LIMIT (WITH HOT GAS BYPASS ONLY)  
[ ] LWV - LEAVING WATER VALVE  
[ ] MBV - MOTORIZED BALL VALVE  
[ ] TB1 - POWER TERMINAL BLOCK

#### NOTES:

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- UPM-I INCLUDES BUILT IN: 270-300 SECOND RANDOM START  
300 SECOND DELAY ON BREAK  
120 SECOND LOW PRESSURE BYPASS
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- "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED OR IF DDC CONNECTION IS AVAILABLE. CONT FOR NON BLINKING THERMOSTAT CONNECTION.
- DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
- ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM TERMINAL BLOCK TO ALR-COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
- REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
- 5kW,10kW,15kW: DUAL RESET PRIMARY CONTACTS WILL OPEN AT 155°F (+/-5°F) AND CLOSE AT 125°F (+/-7°F). BACK UP CONTACTS WILL OPEN AT 180°F (+/-8°F). BACK-UP CONTACTS WILL NOT RESET.  
20kW: DUAL RESET PRIMARY CONTACTS WILL OPEN AT 140°F (+/-5°F) AND CLOSE AT 110°F (+/-7°F). BACK UP CONTACTS WILL OPEN AT 180°F (+/-8°F). BACK-UP CONTACTS WILL NOT RESET.
- ONLY HEATERS 15 - 20 KW HAVE CIRCUIT BREAKERS.
- TERMINAL BLOCK USED ON 5kW/10kW UNITS ONLY.
- THERMOSTATS USING W2/E AS EMERGENCY HEAT SIGNAL MUST TERMINATE GRAY W2 WIRE ON HC1 COIL FOR 5kW UNITS.
- HOT GAS REHEAT RELAY WILL ONLY BE USED WHEN HOT GAS REHEAT AND ECONOMIZER OPTIONS ARE SELECTED.
- AIR PRESSURE SWITCH IS NORMALLY OPEN AND WILL CLOSE WHEN THE FAN IS ON.

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GN	GREEN
OR	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW
GY	GREY



ELECTRIC HEAT ELEMENTS				
kW	HE1	HE2	HE3	HE4
5	5.00			
10	5.00	5.00		
15	5.00	5.00	5.00	
20	5.00	5.00	5.00	5.00

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**Fig. 29 — Single Phase, Constant Airflow ECM Motor, E-Heat, Dual Point Power, Option Card (WSE, HGRH, Boilerless Heat)**

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GN	GREEN
OR	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW
GY	GREY

FACTORY WIRE \_\_\_\_\_  
FIELD WIRE - - - - -

STANDARD COMPONENTS LEGEND:

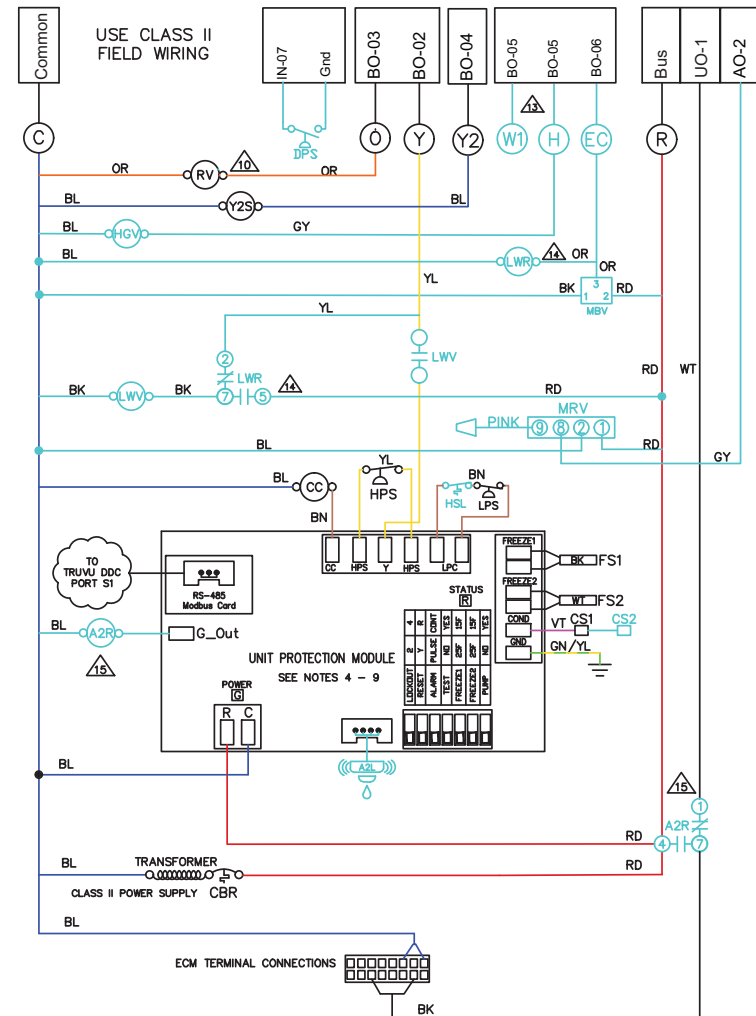
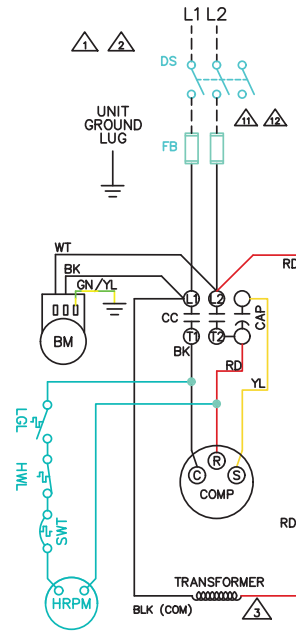
BM – BLOWER MOTOR  
CAP – COMPRESSOR CAPACITOR  
CBR – 24V CIRCUIT BREAKER  
CC – COMPRESSOR CONTACTOR  
CS1 – CONDENSATE SENSOR (IN UNIT DRAIN PAN)  
FS – FREEZE SENSOR  
HPS – HIGH PRESSURE SWITCH  
LPS – LOW PRESSURE SWITCH  
RV – REVERSING VALVE (HEAT PUMPS)  
Y2S – COMPRESSOR 2ND STAGE

OPTIONAL COMPONENTS LEGEND:

[	A2L	-	AIR TO LIQUID REFRIGERANT LEAK SENSOR
[	A2R	-	A2L BLOWER RELAY
[	CS2	-	CONDENSATE SENSOR (IN ECONOMIZER DRAIN PAN)
[	DPS	-	DIFFERENTIAL PRESSURE SWITCH
[	DS	-	DISCONNECT SWITCH
[	FB	-	FUSE BLOCK (FOR 65KA SCCR RATING)
[	HGV	-	HOT GAS VALVE SOLENOID
[	HRP	-	HEAT RECOVERY PACKAGE:
[	HRPM	-	HEAT RECOVERY PUMP MOTOR
[	HWL	-	HOT WATER LIMIT (120F)
[	LGL	-	LOW GAS TEMPERATURE LIMIT (100F)
[	SWT	-	ON/OFF SWITCH AND OVERLOAD
[	HSL	-	HIGH TEMPERATURE SUCTION LIMIT (WITH HOT GAS BYPASS ONLY)
[	LWV	-	LEAVING WATER VALVE
[	LWR	-	LEAVING WATER RELAY
[	MBV	-	MOTORIZED BALL VALVE

NOTES:

2. SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.—N.F.P.A. #70, COPPER CONDUCTORS ONLY — CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE PRIMARY LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
4. UPM—I INCLUDES BUILT IN: 270—300 SECOND RANDOM START  
300 SECOND DELAY ON BREAK  
120 SECOND LOW PRESSURE BYPASS
5. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
6. "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F OPERATION BY DEFAULT, IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
7. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T—STAT SERVICE LIGHT IS DESIRED OR IF DDC CONNECTION IS AVAILABLE. CONT FOR NON BLINKING THERMOSTAT CONNECTION.
8. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
9. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM TERMINAL BLOCK TO ALR—COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR—OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
10. REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
11. UNIT WILL HAVE OPTIONAL DISCONNECT SWITCH OR FUSE PROTECTION, UNIT WILL NOT HAVE BOTH.



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**Fig. 30 — Single Phase, Constant Airflow ECM Motor, TruVu™ DDC**



UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GN	GREEN
OR	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW
GY	GREY

FACTORY WIRE ————  
FIELD WIRE - - - - -

#### STANDARD COMPONENTS LEGEND:

BM — BLOWER MOTOR  
CBR — 24V CIRCUIT BREAKER  
CC — COMPRESSOR CONTACTOR  
CS — CONDENSATE SENSOR (IN DRAIN PAN)  
FS — FREEZE SENSOR  
HPS — HIGH PRESSURE SWITCH  
LPS — LOW PRESSURE SWITCH  
RV — REVERSING VALVE (HEAT PUMPS)  
Y2S — COMPRESSOR 2ND STAGE

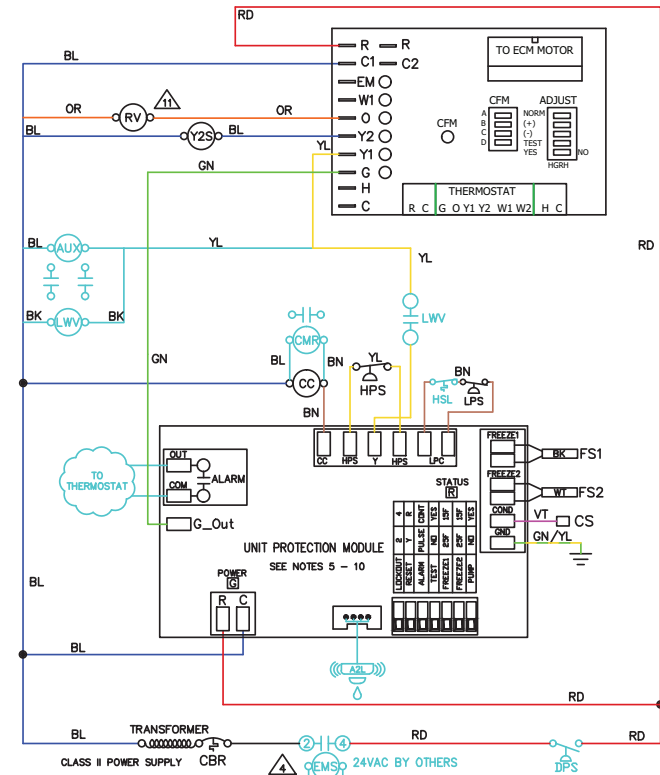
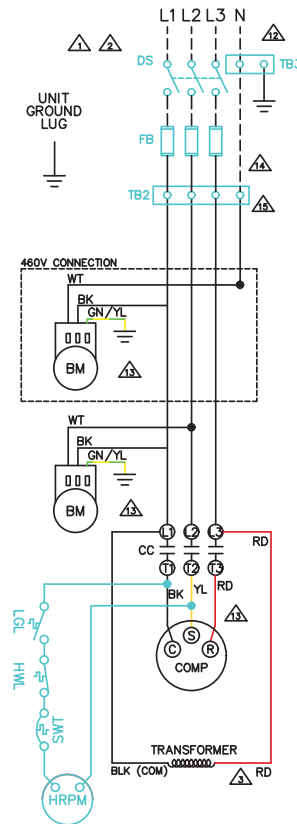
#### OPTIONAL COMPONENTS LEGEND:

[ ] A2L — AIR TO LIQUID REFRIGERANT LEAK SENSOR  
[ ] AUX — AUXILIARY RELAY  
(FOR LOOP PUMP, ETC)  
[ ] CMR — COMPRESSOR MONITOR RELAY  
[ ] DPS — DIFFERENTIAL PRESSURE SWITCH  
[ ] DS — DISCONNECT SWITCH  
[ ] EMS — ENERGY MGMT SYSTEM RELAY  
[ ] FB — FUSE BLOCK (FOR 65KA SCCR RATING)  
[ ] HRP — HEAT RECOVERY PACKAGE:  
HRPM — HEAT RECOVERY PUMP MOTOR  
HWL — HOT WATER LIMIT (120F)  
LGL — LOW GAS TEMPERATURE LIMIT (100F)  
SWT — ON/OFF SWITCH AND OVERLOAD  
[ ] HSL — HIGH TEMPERATURE SUCTION LIMIT  
(WITH HOT GAS BYPASS ONLY)  
[ ] LWV — LEAVING WATER VALVE  
[ ] TB2 — MAIN TERMINAL BLOCK (460V UNITS ONLY)  
[ ] TB3 — TERMINAL BLOCK DISCONNECT SWITCH  
(460V UNITS ONLY)

#### NOTES:

- SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
- ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.—N.F.P.A. #70, COPPER CONDUCTORS ONLY — CONDUCTEURS EN CUIVRE SEULEMENT.
- 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE PRIMARY LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
- FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.
- UPM-I INCLUDES BUILT IN: 270–300 SECOND RANDOM START  
300 SECOND DELAY ON BREAK  
120 SECOND LOW PRESSURE BYPASS
- "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
- "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F OPERATION BY DEFAULT, IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
- "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED OR IF DDC CONNECTION IS AVAILABLE. CONT FOR NON BLINKING THERMOSTAT CONNECTION.
- DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
- ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM TERMINAL BLOCK TO ALR-COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
- REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
- TERMINAL BLOCK TB3 LOCATED IN SIDE DISCONNECT SWITCH BOX.
- EON MOTOR IS WIRED BETWEEN LINE AND NEUTRAL FOR 380–460VAC UNITS. FOR 208/230VAC UNITS EON MOTOR IS WIRED BETWEEN LINES.
- UNIT WILL HAVE OPTIONAL DISCONNECT SWITCH OR FUSE PROTECTION, UNIT WILL NOT HAVE BOTH.
- SCCR OPTION IS NOT AVAILABLE ON 460 UNITS.

USE CLASS II FIELD WIRING



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**Fig. 31 — Three Phase, Constant Airflow ECM Motor, Standard Unit**

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

FACTORY WIRE \_\_\_\_\_

FIELD WIRE - - - - -

#### STANDARD COMPONENTS LEGEND:

BM - BLOWER MOTOR  
 CBR - 24V CIRCUIT BREAKER  
 CC - COMPRESSOR CONTACTOR  
 CS1 - CONDENSATE SENSOR (IN UNIT DRAIN PAN)  
 FS - FREEZE SENSOR  
 HPS - HIGH PRESSURE SWITCH  
 LPS - LOW PRESSURE SWITCH  
 RV - REVERSING VALVE (HEAT PUMPS)  
 Y2S - COMPRESSOR 2ND STAGE

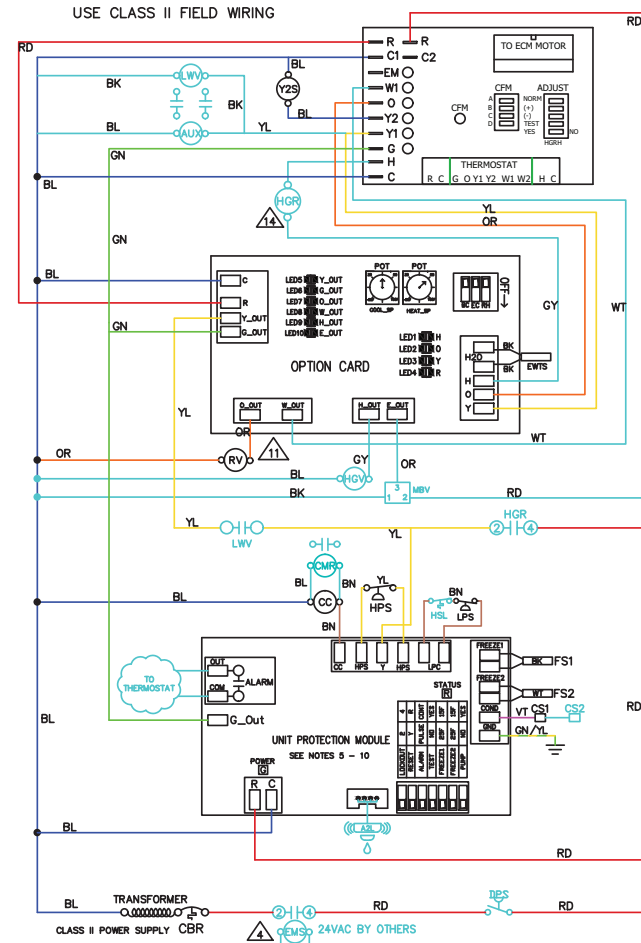
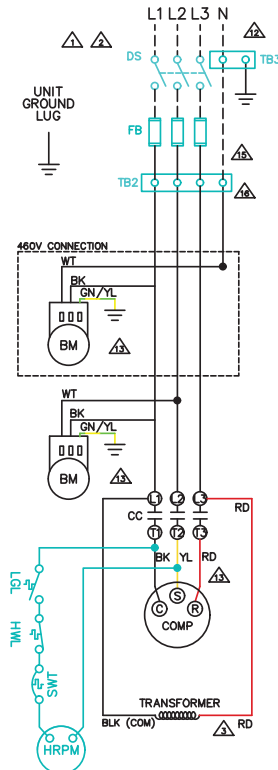
#### OPTIONAL COMPONENTS LEGEND:

[ ] A2L - AIR TO LIQUID REFRIGERANT LEAK SENSOR  
 [ ] AUX - AUXILIARY RELAY (FOR LOOP PUMP, ETC)  
 [ ] CMR - COMPRESSOR MONITOR RELAY  
 [ ] CS2 - CONDENSATE SENSOR (IN ECONOMIZER DRAIN PAN)  
 [ ] DPS - DIFFERENTIAL PRESSURE SWITCH  
 [ ] DS - DISCONNECT SWITCH  
 [ ] EMS - ENERGY MGMT SYSTEM RELAY  
 [ ] FB - FUSE BLOCK (FOR 65KA SCCR RATING)  
 [ ] HGR - HOT GAS REHEAT RELAY  
 [ ] HGV - HOT GAS VALVE SOLENOID  
 [ ] HRP - HEAT RECOVERY PACKAGE:  
 [ ] HRP - HEAT RECOVERY PUMP MOTOR  
 [ ] HWL - HOT WATER LIMIT (120F)  
 [ ] LGL - LOW GAS TEMPERATURE LIMIT (100F)  
 [ ] SWT - ON/OFF SWITCH AND OVERLOAD  
 [ ] HSL - HIGH TEMPERATURE SUCTION LIMIT (WITH HOT GAS BYPASS ONLY)  
 [ ] LWV - LEAVING WATER VALVE  
 [ ] MBV - MOTORIZED BALL VALVE  
 [ ] TB2 - MAIN TERMINAL BLOCK (460V UNITS ONLY)  
 [ ] TB3 - TERMINAL BLOCK DISCONNECT SWITCH (460V UNITS ONLY)

#### NOTES:

- SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
- ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.-N.F.P.A. #70, COPPER CONDUCTORS ONLY - CONDUCTEURS EN CUIVRE SEULEMENT.
- 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE PRIMARY LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
- FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.
- UPM-I INCLUDES BUILT IN: 270-300 SECOND RANDOM START  
 300 SECOND DELAY ON BREAK  
 120 SECOND LOW PRESSURE BYPASS
- "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
- "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25F OPERATION BY DEFAULT, IF 15F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15F POSITION
- "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED OR IF DDC CONNECTION IS AVAILABLE. CONT FOR NON BLINKING THERMOSTAT CONNECTION.
- DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
- ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM TERMINAL BLOCK TO ALR-COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
- REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
- TERMINAL BLOCK TB3 LOCATED IN SIDE DISCONNECT SWITCH BOX.
- EON MOTOR IS WIRED BETWEEN LINE AND NEUTRAL FOR 380-460VAC UNITS. FOR 208/230VAC UNITS EON MOTOR IS WIRED BETWEEN LINES.
- HOT GAS REHEAT RELAY WILL ONLY BE USED WHEN HOT GAS REHEAT AND ECONOMIZER OPTIONS ARE SELECTED.
- UNIT WILL HAVE OPTIONAL DISCONNECT SWITCH OR FUSE PROTECTION, UNIT WILL NOT HAVE BOTH.
- SCCR OPTION IS NOT AVAILABLE ON 460 UNITS.

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GN	GREEN
OR	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW
GY	GREY



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**Fig. 32 — Three Phase, Constant Airflow ECM Motor, Option Card (WSE, HGRH, Boilerless Heat)**



UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

COLOR CHART LEGEND	
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RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW
GY	GREY

FACTORY WIRE ———  
FIELD WIRE - - - - -

#### STANDARD COMPONENTS LEGEND:

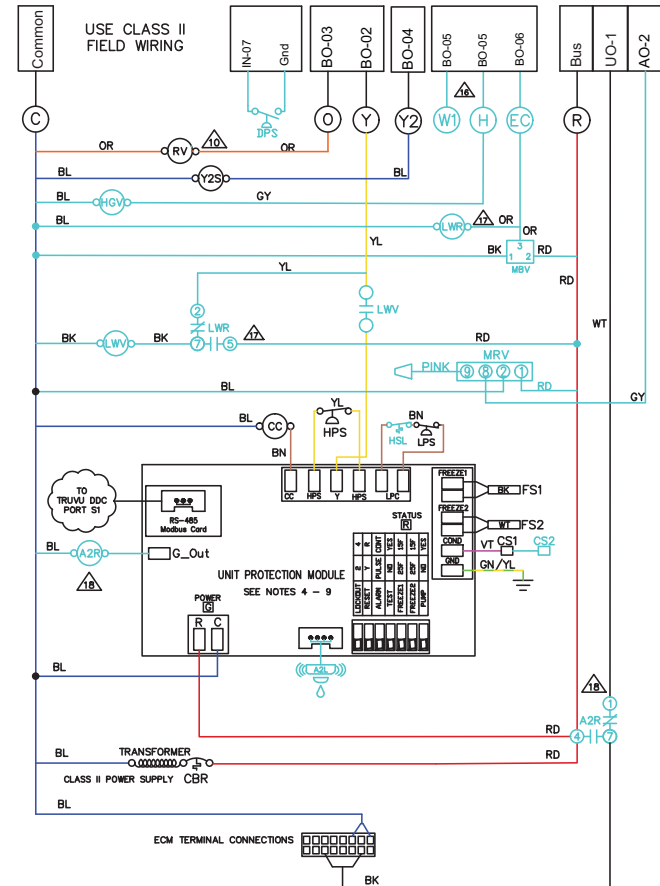
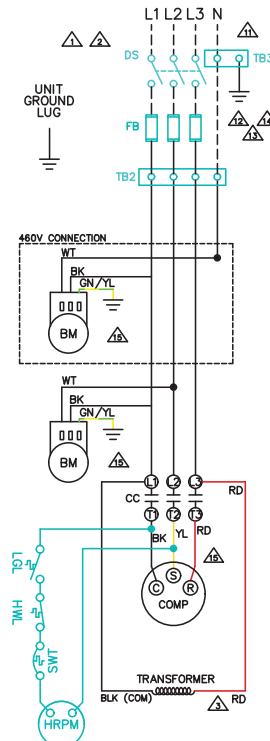
BM — BLOWER MOTOR  
CBR — 24V CIRCUIT BREAKER  
CC — COMPRESSOR CONTACTOR  
CS1 — CONDENSATE SENSOR (IN UNIT DRAIN PAN)  
FS — FREEZE SENSOR  
HPS — HIGH PRESSURE SWITCH  
LPS — LOW PRESSURE SWITCH  
RV — REVERSING VALVE (HEAT PUMPS)  
Y2S — COMPRESSOR 2ND STAGE

#### OPTIONAL COMPONENTS LEGEND:

A2L — AIR TO LIQUID REFRIGERANT LEAK SENSOR  
A2R — A2L BLOWER RELAY  
CS2 — CONDENSATE SENSOR (IN ECONOMIZER DRAIN PAN)  
DPS — DIFFERENTIAL PRESSURE SWITCH  
DS — DISCONNECT SWITCH  
FB — FUSE BLOCK (FOR 65KA SCCR RATING)  
HSL — HIGH TEMPERATURE SUCTION LIMIT  
HGV — HOT GAS VALVE SOLENOID  
HRP — HEAT RECOVERY PACKAGE:  
HRPM — HEAT RECOVERY PUMP MOTOR  
HWL — HOT WATER LIMIT (120F)  
LGL — LOW GAS TEMPERATURE LIMIT (100F)  
SWT — ON/OFF SWITCH AND OVERLOAD  
(WITH HOT GAS BYPASS ONLY)  
LWV — LEAVING WATER VALVE  
LWR — LEAVING WATER RELAY  
MBV — MOTORIZED BALL VALVE  
TB2 — MAIN TERMINAL BLOCK (460V UNITS ONLY)  
TB3 — TERMINAL BLOCK DISCONNECT SWITCH  
(460V UNITS ONLY)

#### NOTES:

- SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
- ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.—N.F.P.A. #70, COPPER CONDUCTORS ONLY — CONDUCTEURS EN CUIVRE SEULEMENT.
- 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE PRIMARY LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
- UPM— INCLUDES BUILT IN: 270–300 SECOND RANDOM START  
300 SECOND DELAY ON BREAK  
120 SECOND LOW PRESSURE BYPASS
- "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
- "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25F OPERATION BY DEFAULT, IF 15F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15F POSITION.
- "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T–STAT SERVICE LIGHT IS DESIRED OR IF DDC CONNECTION IS AVAILABLE. CONT FOR NON BLINKING THERMOSTAT CONNECTION.
- DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
- ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM TERMINAL BLOCK TO ALR–COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR–OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
- REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
- TERMINAL BLOCK TB3 LOCATED IN SIDE DISCONNECT SWITCH BOX.
- UNIT WILL HAVE OPTIONAL DISCONNECT SWITCH OR FUSE PROTECTION, UNIT WILL NOT HAVE BOTH.
- OPTIONAL 65KA SCCR FUSE PROTECTION AVAILABLE ON 2 THROUGH 5 TON SIZES ONLY.
- SCCR OPTION IS NOT AVAILABLE ON 460 UNITS.
- EON MOTOR IS WIRED BETWEEN LINE AND NEUTRAL FOR 380–460VAC UNITS. FOR 208/230VAC UNITS EON MOTOR IS WIRED BETWEEN LINES.
- UNIT WILL HAVE OPTIONAL HOT GAS REHEAT OR FACTORY INSTALLED ELECTRIC HEAT, UNIT WILL NOT HAVE BOTH.
- LWR WILL ONLY BE USED IF FACTORY LEAVING WATER VALVE AND ECONOMIZER ARE SELECTED.
- A2R WILL ONLY BE PRESENT IF A2L SENSOR OPTION IS SELECTED. IF A2L SENSOR OPTION IS NOT SELECTED, JUMPER PWM1 AND PWM2 CONNECTIONS TOGETHER.



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Fig. 33 — Three Phase, Constant Airflow ECM Motor, TruVu™ DDC

**FACTORY INSTALLED COMPONENTS (OUTPUTS):****UO-1 - UNIVERSAL OUTPUT 1:**

- [ ] G1 - FAN ON (PSC & CT ECM)
- [ ] ECM - FAN MODULATION (CA ECM PWM)
- [ ] VFD - FAN MODULATION (VFD 0-10VDC)

**AO-2 - ANALOG OUTPUT 2:**

- [ ] MRV - MODULATING REHEAT VALVE

**BO-2 - BINARY OUTPUT 2:**

- [ ] Y1 - COMPRESSOR

**BO-3 - BINARY OUTPUT 3:**

- [ ] O - REVERSING VALVE

**BO-4 - BINARY OUTPUT 4:**

- [ ] Y2 - COMPRESSOR (TWO STAGE/SPEED)
- [ ] WSE - WATER-SIDE ECONOMIZER VALVE (SINGLE STAGE)
- [ ] W1 - AUX HEAT 1ST STAGE (SINGLE STAGE)

**BO-5 - BINARY OUTPUT 5:**

- [ ] H - DEHUMIDIFICATION (HGRH)
- [ ] W1 - AUX HEAT 1ST STAGE (SINGLE OR TWO STAGE/SPEED)

**BO-6 - BINARY OUTPUT 6:**

- [ ] G2 - FAN ON (CT ECM)
- [ ] WSE - WATER-SIDE ECONOMIZER VALVE (TWO STAGE)
- [ ] W2 - AUX HEAT 2ND STAGE (TWO STAGE/SPEED)

**BO-7 - BINARY OUTPUT 7:**

- [ ] G3 - FAN ON (CT ECM)
- [ ] VFD - VFD ENABLE/DISABLE

**STANDARD FACTORY INSTALLED COMPONENTS (INPUTS):****IN-2 - UNIVERSAL INPUT 2:**

- [ ] LWTS - LEAVING WATER TEMPRATURE SENSOR

**IN-3 - UNIVERSAL INPUT 3:**

- [ ] EWTS - ENTERING WATER TEMPRATURE SENSOR

**STANDARD FACTORY PROVIDED COMPONENTS (INPUTS):****IN-1 - UNIVERSAL INPUT 1:**

- [ ] SATS - SUPPLY AIR TEMPRATURE SENSOR

**IN-6 - UNIVERSAL INPUT 6:**

- [ ] RATS - RETURN AIR TEMPRATURE SENSOR

**OPTIONAL FACTORY INSTALLED COMPONENTS (INPUTS):****IN-7 - UNIVERSAL INPUT 7:**

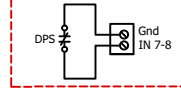
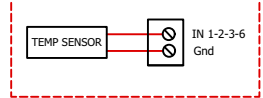
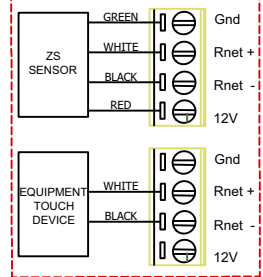
- [ ] DPS - DIFFERENTIAL PRESSURE SWITCH

**OPTIONAL FIELD INSTALLED COMPONENTS (INPUTS):****IN-6 - UNIVERSAL INPUT 6:**

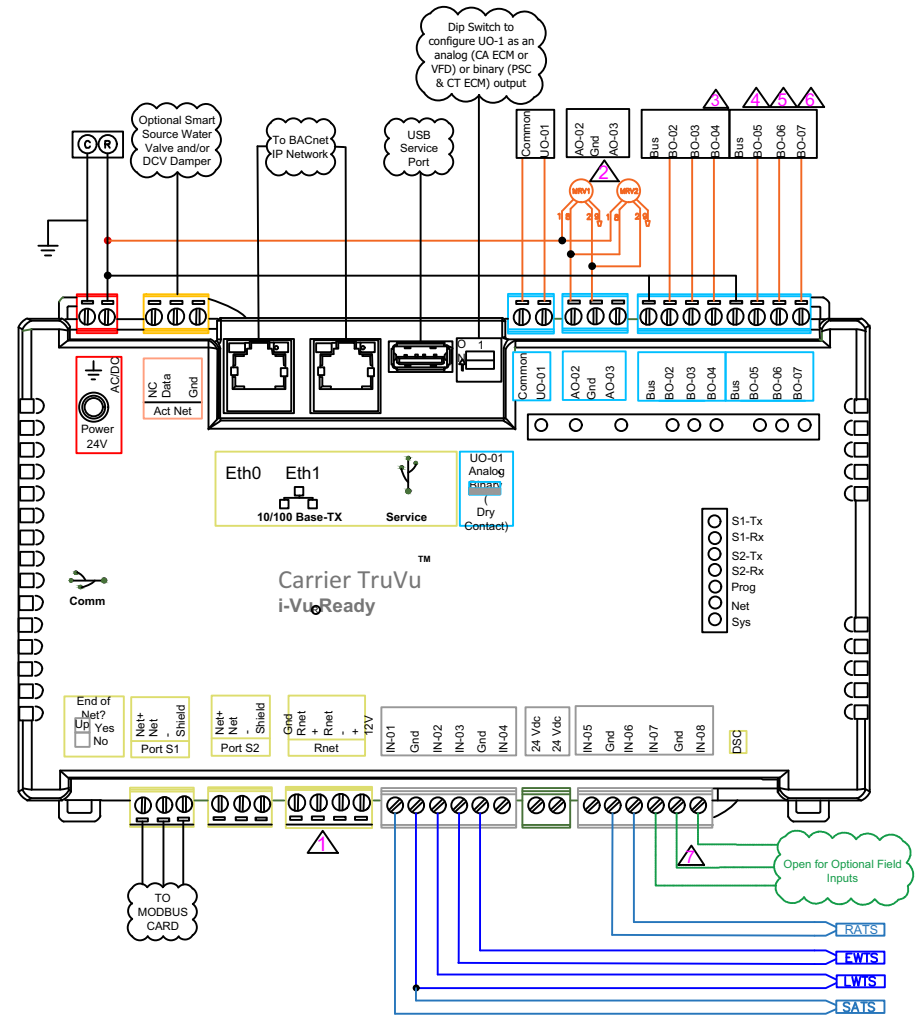
- [ ] SPT - SPACE TEMPRATURE SENSOR

**IN-7 OR 8 - UNIVERSAL INPUT 7 OR 8:**

- [ ] EMSD - EMERGENCY SHUTDOWN
- [ ] OCC - REMOTE OCCUPANCY
- [ ] SCO - SECONDARY CONDENSATE OVERFLOW
- [ ] FS - FLOW SWITCH
- [ ] FM - WATER FLOW METER

**TERMINATION DETAIL****IN-7-8: DRY CONTACT (N/C)****TERMINATION DETAIL****IN 1-2-3-6: TEMP SENSOR (77F/25C @ 10k-OHM)****TERMINATION DETAIL****Rnet****FACTORY WIRE****FIELD WIRE**

- △ EQUIPMENT TOUCH DEVICE OR OPTIONAL ZS COMBINATION WALL SENSOR CAPABLE OF TEMPERATURE, HUMIDITY, AND CO2 READINGS.
- △ OPTIONAL MODULATING REHEAT VALVE (MRV)
- △ **TWO STAGE/SPEED UNITS:** BO-4 IS ONLY AVAILABLE FOR OUTPUT SIGNAL (Y2)  
**SINGLE STAGE/SPEED UNITS:** BO-4 IS AVAILABLE FOR WSE
- △ H SIGNAL IS USED ON REHEAT APPLICATIONS
- △ **TWO STAGE/SPEED UNITS:** BO-6 IS AVAILABLE FOR WSE OUTPUT SIGNAL  
**SINGLE STAGE/SPEED UNITS:** BO-6 IS AVAILABLE FOR FAN ON G2 OUTPUT SIGNAL
- △ IN-07 UTILIZED FOR OPTIONAL FACTORY INSTALLED DIFFERENTIAL PRESSURE FLOW SWITCH WHEN EQUIPPED



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**Fig. 34 — TruVu™ DDC Controller Wiring Diagram**

## PRE-START-UP

### System Checkout

After completing the installation, and before energizing the unit, the following system checks should be made prior to initial start-up:

1. Verify the supply voltage to the heat pump is in accordance with the nameplate ratings.
2. Verify the control transformer is set to the correct voltage for 208/230-v units (factory setting is 230-v).
3. Make sure that all electrical connections are tight and secure.
4. Check the electrical fusing/breaker and wiring for the correct size.
5. Verify the low voltage wiring between the thermostat or DDC controls and the unit is correct.
6. Verify the water piping is complete and correct.
7. Verify there are no leaks in the external piping or in the internal unit piping. Correct as necessary.
8. Verify the isolation or flow control valves are open and that any automatic flow control valve or balancing valve are set to the correct setting.
9. Check the water flow is correct and adjust if necessary.
10. Check the blower for free rotation, and that it is secured to the shaft.
11. Verify the foam blower shipping support has been removed.
12. Vertical Units Only - Verify vibration isolation has been provided and that the unit has been installed on a solid structure.
13. Horizontal Units Only - Verify the hanging brackets have been installed and that the unit is secured to an adequate support structure.
14. Verify the unit has proper service clearance. Be certain that all access panels are secured in place.
15. Verify ductwork has been properly fastened to supply and return duct collars.
16. Verify the ductwork is free from obstruction and that all dampers or registers are open.
17. Make sure return air filters are positioned correctly in the filter rack if removed during installation.

18. Verify the unit is not in TEST mode.
19. Verify all control components have been properly configured and that all control components have been wired.
20. For units with TruVu DDC controller, verify a space temperature input is provided via ZS sensor, or non-communication zone sensor (10K thermistor), or over the network and that a commissioning interface is available.

### CLEAN AIR COIL

To obtain maximum performance, clean the air coil before starting the unit. A ten percent solution of dishwasher detergent and water is recommended for both sides of the coil. Rinse thoroughly with water.

### CONSTANT AIRFLOW (ECM) MOTOR

The 50WT units in 208/230-v, 265-v, or 460-v are available with a constant airflow ECM blower motor. These motors dynamically adjust their power output to precisely match the desired airflow on a pre-programmed fan curve. See Tables 13-14 for blower performance by speed setting, and for the factory default motor setting. These motors include the following features:

1. **Three Speed Settings:** Units are factory set to "NORM" but can be field adjusted to "+" to increase CFM by 15% or to "-" to reduce CFM by 15%. See the constant airflow ECM motor blower performance table for complete details on available CFM for each unit size (refer to the Wire Control Connections section of this manual).
2. **Low CFM Ventilation:** Units circulate air at 70% of full airflow rate when there is a call for fan only.
3. **Passive Dehumidification:** Reduces airflow during a cooling call when dehumidification is also required. This reduces the sensible heat ratio of the cooling coil and extends cooling run time to dehumidify more effectively (refer to the Wire Control Connections section of this manual).
4. **Test Mode:** Operates the motor at a 70% torque setting. This setting can be used to diagnose programming problems in the motor itself (refer to the Wire Control Connections section of this manual).
5. **CFM Indicator Light:** indicator light blinks for each 100 CFM of air delivered.

NOTE: This blink code is approximate and should not replace test and balance.

**Table 13 — 50WT Vertical Units — Constant Airflow Motor Performance<sup>a,b,c</sup>**

UNIT SIZE	FAN SPEED	DEFAULT FACTORY MOTOR SETTING	AIRFLOW (cfm) AT EXTERNAL STATIC PRESSURE (in. wg)											
			0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20
<b>024 Full Load</b>	A -		680	680	680	680	680	680	680	680	—	—	—	—
	A Norm (Full)	X	800	800	800	800	800	800	800	800	—	—	—	—
	A +		920	920	920	920	920	920	920	920	—	—	—	—
<b>024 Part Load</b>	A -		553	553	553	553	553	553	553	553	—	—	—	—
	A Norm (Part)	X	650	650	650	650	650	650	650	650	—	—	—	—
	A +		748	748	748	748	748	748	748	748	—	—	—	—
<b>036 Full Load</b>	A -		1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	—	—
	A Norm (Full)	X	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	—	—
	A +		1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	—	—
<b>036 Part Load</b>	A -		829	829	829	829	829	829	829	829	829	829	—	—
	A Norm (Part)	X	975	975	975	975	975	975	975	975	975	975	—	—
	A +		1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	—	—
<b>048 Full Load</b>	A -		1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	—	—
	A Norm (Full)	X	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	—	—
	A +		1,955	1,955	1,955	1,955	1,955	1,955	1,955	1,955	1,955	1,955	—	—
<b>048 Part Load</b>	A -		1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	—	—
	A Norm (Part)	X	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	—	—
	A +		1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	—	—
<b>060 Full Load</b>	A -		1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
	A Norm (Full)	X	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
	A +		2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300
<b>060 Part Load</b>	A -		1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360
	A Norm (Part)	X	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
	A +		1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840
<b>070 Full Load</b>	A -		1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828
	A Norm (Full)	X	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150
	A +		2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473
<b>070 Part Load</b>	A -		1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530
	A Norm (Part)	X	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
	A +		2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070

NOTE(S):

- a. During fan only operation air flow is 70% of tabulated value.
- b. When passive dehumidification mode is enabled, air flow is 85% of tabulated value.
- c. Cfm airflow is based on wet coil and 1 in. disposable MERV 5 filter.

**Table 14 — 50WT Horizontal Units — Constant Airflow Motor Performance<sup>a,b,c</sup>**

UNIT SIZE	FAN SPEED	DEFAULT FACTORY MOTOR SETTING	AIRFLOW (cfm) AT EXTERNAL STATIC PRESSURE (in. wg)											
			0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20
<b>024 Full Load</b>	A -		808	808	808	808	808	808	808	808	—	—	—	—
	A Norm (Full)	X	950	950	950	950	950	950	950	950	—	—	—	—
	A +		1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	—	—	—	—
<b>024 Part Load</b>	A -		680	680	680	680	680	680	680	680	—	—	—	—
	A Norm (Part)	X	800	800	800	800	800	800	800	800	—	—	—	—
	A +		920	920	920	920	920	920	920	920	—	—	—	—
<b>036 Full Load</b>	A -		1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	—	—
	A Norm (Full)	X	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	—	—
	A +		1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	—	—
<b>036 Part Load</b>	A -		829	829	829	829	829	829	829	829	829	829	—	—
	A Norm (Part)	X	975	975	975	975	975	975	975	975	975	975	—	—
	A +		1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	—	—
<b>048 Full Load</b>	A -		1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	—	—
	A Norm (Full)	X	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	—	—
	A +		1,955	1,955	1,955	1,955	1,955	1,955	1,955	1,955	1,955	1,955	—	—
<b>048 Part Load</b>	A -		1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	—	—
	A Norm (Part)	X	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	—	—
	A +		1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	1,495	—	—
<b>060 Full Load</b>	A -		1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
	A Norm (Full)	X	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
	A +		2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300
<b>060 Part Load</b>	A -		1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360
	A Norm (Part)	X	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
	A +		1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840
<b>070 Full Load</b>	A -		1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828
	A Norm (Full)	X	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150	2,150
	A +		2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473	2,473
<b>070 Part Load</b>	A -		1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530
	A Norm (Part)	X	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
	A +		2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070

NOTE(S):

- a. During fan only operation air flow is 70% of tabulated value.
- b. When passive dehumidification mode is enabled, air flow is 85% of tabulated value.
- c. Cf<sub>m</sub> airflow is based on wet coil and 1 in. disposable MERV 5 filter.

## System Flushing and Filling

Once the piping is complete, units require final purging and loop charging. A flush cart pump of at least 1.5 hp is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop. Flush the loop in both directions with a high volume of water at a high velocity. Follow the steps below to properly flush the loop:

1. Verify power is off.
2. Fill loop with water from hose through flush cart before using flush cart pump to ensure an even fill. Do not allow the water level in the flush cart tank to drop below the pump inlet line to prevent air from filling the line.
3. Maintain a fluid level in the tank above the return tee to avoid air entering back into the fluid.
4. Shutting off the return valve that connects into the flush cart reservoir will allow 50 psig surges to help purge air pockets. This maintains the pump at 50 psig.
5. To purge, keep the pump at 50 psig until maximum pumping pressure is reached.
6. Open the return valve to send a pressure surge through the loop to purge any air pockets in the piping system.
7. A noticeable drop in fluid level will be seen in the flush cart tank. This is the only indication of air in the loop.  
NOTE: If air is purged from the system while using a 10 in. PVC flush tank, the level drop will only be 1 to 2 in. since liquids are incompressible. If the level drops more than this, flushing should continue since air is still being compressed in the loop. If level is less than 1 to 2 in., reverse the flow.
8. Repeat this procedure until all air is purged.
9. Restore power.

Antifreeze may be added before, during or after the flushing process. However, depending on when it is added in the process, it can be wasted. Refer to the Antifreeze section on page 39 for more detail.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the warmer months.

This fluctuation is normal and should be considered when charging the system initially. Run the unit in either heating or cooling for several minutes to condition the loop to a homogeneous temperature.

When complete, perform a final flush and pressurize the loop to a static pressure of 40 to 50 psig for winter months or 15 to 20 psig for summer months.

After pressurization, be sure to remove the plug from the end of the loop pump motor(s) to allow trapped air to be discharged and to ensure the motor housing has been flooded. Be sure the loop flow center provides adequate flow through the unit by checking pressure drop across the heat exchanger. Compare the results to the data in Table 15 and Fig. 35.

## System Flow

### FLOW VERIFICATION

The 50WT WSHP units ordered without a factory-installed water flow switch as standard. It is recommend to provide field-installed water flow switch or order the unit with factory-installed water flow switch to prevent the compressor from operating without loop flow.

**IMPORTANT:** It is recommended to have a flow switch to prevent the unit from running if water flow is lost.

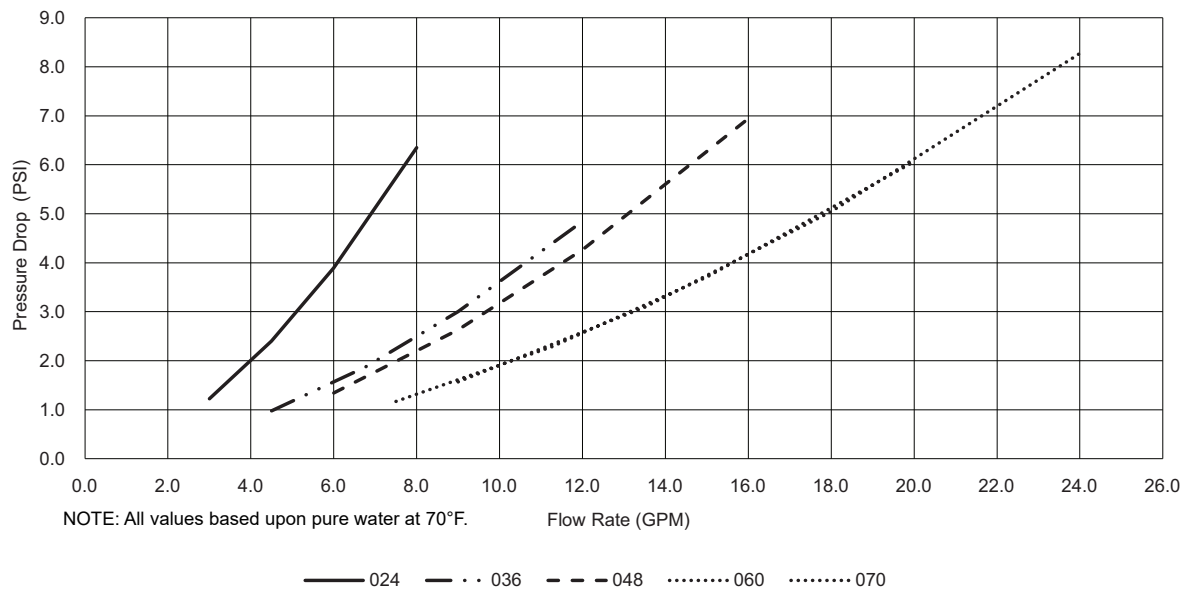
### FLOW REGULATION

Flow regulation can be accomplished by two methods. Most water control valves have a flow adjustment built into the valve. By measuring the pressure drop through the unit heat exchanger, the flow rate can be determined. Adjust the water control valve until the desired flow rate is achieved. Since the pressure constantly varies, two pressure gages may be needed in some applications. See Table 15 and Fig. 35 for waterside pressure drop.

An alternate method of flow regulation is to install an automatic flow control valve. These valves feature a removable cartridge that controls the maximum flow through the valve assembly. Verify that the water flow control cartridge matches the application flow requirement.

**Table 15 — Water Pressure Drop Curve for Units without Factory-Installed 2-Way Valve**

50WT SIZE	WATER FLOW RATE (GPM)	ENTERING WATER TEMPERATURE (°F)								
		30°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F	110°F
24	3.0	1.4	1.3	1.2	1.2	1.1	1.1	1.0	1.0	1.0
	4.5	2.7	2.6	2.4	2.3	2.2	2.2	2.1	2.0	2.0
	6.0	4.4	4.2	4.0	3.8	3.7	3.5	3.4	3.3	3.2
	8.0	7.2	6.9	6.6	6.3	6.1	5.8	5.7	5.5	5.3
36	4.5	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.7
	6.8	1.9	1.8	1.8	1.7	1.6	1.6	1.5	1.5	1.4
	9.0	3.2	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.4
	12.0	5.2	5.0	4.8	4.6	4.4	4.2	4.1	4.0	3.9
48	6.0	1.4	1.3	1.2	1.2	1.2	1.1	1.1	1.0	1.0
	9.0	2.7	2.6	2.5	2.4	2.3	2.3	2.2	2.1	2.1
	12.0	4.5	4.3	4.2	4.0	3.9	3.8	3.6	3.5	3.5
	16.0	7.2	7.1	6.9	6.7	6.5	6.2	6.1	5.9	5.7
60	7.5	1.2	1.2	1.1	1.1	1.0	1.0	1.0	0.9	0.9
	11.3	2.5	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8
	15.0	4.1	3.9	3.7	3.6	3.5	3.3	3.2	3.2	3.1
	20.0	6.6	6.4	6.2	5.9	5.7	5.5	5.4	5.2	5.1
70	9.0	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.3
	13.5	3.4	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5
	18.0	5.5	5.3	5.1	4.9	4.7	4.6	4.5	4.3	4.2
	24.0	9.2	8.8	8.5	8.1	7.9	7.7	7.4	7.2	7.1



**Fig. 35 — Water Pressure Drop Curve for Units with Factory-Installed 2-Way Valve**

## ANTIFREEZE

In areas where leaving water temperatures drop below 40°F or where piping will be routed through areas subject to freezing, antifreeze is needed.

Alcohols and glycols are commonly used as antifreeze agents. Freeze protection should be maintained to 15°F below the lowest expected entering loop temperature. For example, if the lowest expected entering loop temperature is 30°F, the leaving loop temperature would be 22 to 25°F. Therefore, the freeze protection should be at 15°F (30°F – 15°F = 15°F).

NOTE: All alcohols should be pre-mixed and pumped from a reservoir outside of the building or introduced under water level to prevent fuming.

Calculate the total volume of fluid in the piping system (see Table 16). Use the percentage by volume in Table 17 to determine the amount of antifreeze to use. Antifreeze concentration should be checked from a well-mixed sample using a hydrometer to measure specific gravity.

**Table 16 — Approximate Fluid Volume (gal.) per 100 Ft of Pipe<sup>a</sup>**

PIPE	DIAMETER (in.)	VOLUME (gal.)
Copper	1.00	4.1
	1.25	6.4
	1.50	9.2
Rubber Hose	1	3.9
Polyethylene	3/4 IPS SDR11	2.8
	1 IPS SDR11	4.5
	1-1/4 IPS SDR11	8.0
	1/2 IPS SDR11	10.9
	2 IPS SDR11	18.0
	1-1/4 IPS SCH40	8.3
	1-1/2 IPS SCH40	10.9
	2 IPS SCH 40	17.0

NOTE(S):

a. Volume of heat exchanger is approximately 1.0 gallon.

### LEGEND

**IPS** — Internal Pipe Size  
**SCH** — Schedule  
**SDR** — Standard Dimensional Ratio

**Table 17 — Antifreeze Percentages by Volume**

ANTIFREEZE	MINIMUM TEMPERATURE FOR FREEZE PROTECTION (°F)			
	10	15	20	25
Methanol (%)	25	21	16	10
100% USP Food Grade Propylene Glycol (%)	38	30	22	15
Ethanol (%)	29	25	20	14

## FREEZE PROTECTION SELECTION

The 25°F FP1 factory setting (water) should be used to avoid freeze damage to the unit.

Once antifreeze is selected, refer to the Step 9 — “Configure Unit Control Components” on page 21 of this manual for FREEZE Protection settings on the UPM board.

## START-UP

Use the procedure outlined below to initiate proper unit start-up.

## Operating Limits

### ENVIRONMENT

This equipment is designed for indoor installation only. Extreme variations in temperature, humidity and corrosive water or air will adversely affect the unit performance, reliability and service life.

NOTE: Two factors determine the operating limits of a unit: entering-air temperature and water temperature. Whenever any of these factors are at a minimum or maximum level, the other factor must be at a normal level to ensure proper unit operation. See Tables 19-28.

### POWER SUPPLY

A voltage variation of ± 10% of nameplate utilization voltage is acceptable.

### UNIT STARTING CONDITIONS

Depending on the model, units should start and operate with entering water temperature temperatures between 20 and 110°F and entering air temperatures between 45 and 95°F. Water flow rates should be between 1.5 and 3.0 gpm/nominal cooling ton.

NOTE: These operating limits are not normal or continuous operating conditions. Assume that such a start-up is for the purpose of bringing the building space up to occupancy temperature. See Table 18 for operating limits.

**Table 18 — Operating Limits<sup>a</sup>**

FLUID TYPE	LIMIT		COOLING	HEATING
Air	Minimum Ambient (°F)		50	40
	Maximum Ambient (°F)		100	85
	Rated Ambient (°F)		80	68
	Minimum Entering (°F db/wb)		65/57	45
	Maximum Entering (°F db/wb)		95/85	80
	Rated Entering (°F)		80/67	68/57
Liquid	Minimum Entering (°F) <sup>b</sup>		45	20
	Max Entering (°F)		110	80
	Typical Entering Range (F)	Water Loop	—	—
		Ground Loop	50-80	25-50
		Ground Water	50-70	40-60
	Rated Entering (°F)	Water Loop	86	68
		Ground Loop	77	32
		Ground Water	59	50
	Anti-Freeze Requirement (LWT / EWT °F)		<40 / <50	
	Maximum operating water pressure (PSI/kPa)		400 psi/2,758 kPa (Standard unit) 300 psi/2,068 kPa (with water valve option)	
	Minimum operating Flow Rate (GPM/Ton)		1.5	

NOTE(S):

- Maximum and minimum operating limits may not be combined. If one value is at either maximum or minimum, the other value(s) must be within normal operating range.
- Units with waterside economizer options can operate with EWT < 45°F.

### LEGEND

**DB** — Dry Bulb  
**EWT** — Entering Water Temperature  
**LWT** — Leaving Water Temperature  
**WB** — Wet Bulb



## Start-Up Procedure

### WARNING

When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with the energized equipment. Failure to heed this warning could lead to personal injury.

1. Restore power to system.
2. Turn thermostat blower position to ON or use the DDC interface to enable the unit blower. The blower should start.
3. Balance airflow at diffusers/dampers.
4. Adjust all water valves to the full open position.
5. Use the thermostat or DDC control to enable the compressor by placing the unit in cooling mode.
6. Verify compressor operation. If scroll compressor, verify compressor rotation direction.

### SCROLL COMPRESSOR ROTATION

It is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gages to suction and discharge pressure fittings.
2. Energize the compressor by using the thermostat or DDC control to put the unit in cooling mode.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

1. Turn off power to the unit. Install disconnect tag.
2. Reverse any two of the unit power leads.
3. Reapply power to the unit and verify pressures are correct. The suction and discharge pressure levels should now move to their normal start-up levels.

When the compressor is rotating in the wrong direction, the unit makes more noise and does not provide cooling.

After a few minutes of reverse operation, the scroll compressor internal overload protection will open, thus activating the unit lockout. This requires a manual reset. To reset the lockout, turn the thermostat on and then off or power cycle the unit power feed.

NOTE: There is a 5-minute time delay before the compressor will restart.

## COOLING MODE START-UP

1. Using the thermostat or DDC control, operate the unit in the cooling cycle. Refer to Table 18 for operating limits. Allow the unit to run for a minimum of five minutes and record the operating data.
2. Check for water leaks and vibration.
3. Check for cool air delivery at unit grille a few minutes after the unit has begun to operate.
4. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using P/T plugs. Check the elevation and cleanliness of the condensate lines; any dripping could be a sign of a blocked line. Be sure the condensate trap includes a water seal.
5. Check the temperature of both supply and discharge water. Compare to Tables 19-28. If temperature is within range, proceed. If temperature is outside the range, check the cooling refrigerant pressures in Tables 19-28.
6. Check air temperature drop across the coil when compressor is operating. Air temperature drop should be between 15 and 25°F.
7. Disable cooling mode and wait a period of 5 minutes to allow system pressures to equalize.

## HEATING MODE START-UP

1. After waiting for a period of 5 minutes after the cooling cycle, use the thermostat or DDC control to operate the unit in the heating cycle. Refer to Table 18 for operating limits. Allow the unit to run for a minimum of five minutes and record the operating data.
2. Check for water leaks and vibration.
3. Check for warm air delivery at unit grille a few minutes after the unit has begun to operate.
4. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using P/T plugs.
5. Check the temperature of both supply and discharge water. Compare to Tables 19-28. If temperature is within range, proceed. If temperature is outside the range, check the cooling refrigerant pressures in Tables 19-28.
6. Check air temperature rise across the coil when compressor is operating. Air temperature rise should be between 20°F and 30°F.
7. Disable heating mode.

**Table 19 — 50WT024 Full Load, Typical Unit Operating Pressures and Temperatures**

ENTER FLUID TEMP (°F)	WATER FLOW (gpm)	COOLING				HEATING			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	3	—	—	—	—	60-70	241-261	8-9	15-19
	6	—	—	—	—	67-77	246-266	4-5	16-20
40	3	114-131	180-198	20-23	18-22	72-82	251-271	10-11	17-21
	6	113-130	153-171	9-12	19-23	80-90	257-277	5-6	19-23
50	3	116-133	209-227	19-22	18-22	85-95	262-282	11-12	20-24
	6	114-131	180-198	9-12	18-22	95-105	270-290	6-7	21-25
60	3	117-134	240-258	19-22	18-22	99-109	274-294	13-14	22-26
	6	116-133	210-228	9-12	18-22	112-122	285-305	7-8	24-28
70	3	119-136	274-292	19-22	18-22	115-125	287-307	15-16	25-29
	6	117-134	244-262	9-12	18-22	131-141	301-321	8-9	28-32
80	3	120-137	312-330	19-22	17-21	133-143	302-322	17-18	28-32
	6	119-136	281-299	9-12	18-22	152-162	319-339	9-10	31-35
90	3	122-139	354-372	18-21	17-21	152-162	318-338	19-20	31-35
	6	121-138	322-340	9-12	17-21	176-186	339-359	11-12	35-39
100	3	124-141	400-418	18-21	17-21	—	—	—	—
	6	122-139	368-386	9-12	17-21	—	—	—	—

**Table 20 — 50WT036 Full Load, Typical Unit Operating Pressures and Temperatures**

ENTER FLUID TEMP (°F)	WATER FLOW (gpm)	COOLING				HEATING			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	4.5	—	—	—	—	58-68	259-279	9-10	18-22
	9.0	—	—	—	—	65-75	266-286	5-6	19-23
40	4.5	109-125	182-206	20-23	20-24	69-79	271-291	11-12	21-25
	9.0	108-124	157-181	10-13	20-24	78-88	279-299	6-7	22-26
50	4.5	111-127	210-234	20-23	19-23	82-92	284-304	12-13	23-27
	9.0	109-125	184-208	10-13	20-24	93-103	295-315	7-8	25-29
60	4.5	112-128	242-266	20-23	19-23	96-106	299-319	14-15	26-30
	9.0	111-127	215-239	9-12	19-23	110-120	313-333	8-9	29-33
70	4.5	114-130	277-301	19-22	19-23	112-122	316-336	16-17	29-33
	9.0	113-129	249-273	9-12	19-23	129-139	334-354	9-10	33-37
80	4.5	115-131	316-340	19-22	18-22	129-139	334-354	18-19	33-37
	9.0	114-130	288-312	9-12	19-23	150-160	356-376	10-11	37-41
90	4.5	117-133	358-382	19-22	18-22	148-158	355-375	21-22	36-40
	9.0	116-132	330-354	9-12	18-22	174-184	382-402	11-12	41-45
100	4.5	119-135	404-428	18-21	18-22	—	—	—	—
	9.0	118-134	377-401	9-12	18-22	—	—	—	—

**Table 21 — 50WT048 Full Load, Typical Unit Operating Pressures and Temperatures**

ENTER FLUID TEMP (°F)	WATER FLOW (gpm)	COOLING				HEATING			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	6	—	—	—	—	50-70	241-261	8-9	17-21
	12	—	—	—	—	57-77	247-267	4-5	18-22
40	6	108-124	175-195	20-23	20-24	61-81	251-271	10-11	19-23
	12	106-122	156-176	10-13	20-24	69-89	259-279	5-6	21-25
50	6	110-126	202-222	20-23	20-24	74-94	263-283	11-12	22-26
	12	108-124	179-199	9-12	20-24	84-104	273-293	6-7	24-28
60	6	111-127	232-252	19-22	19-23	88-108	277-297	13-14	25-29
	12	110-126	209-229	9-12	20-24	100-120	289-309	7-8	27-31
70	6	113-129	266-286	19-22	19-23	103-123	292-312	15-16	28-32
	12	112-128	242-262	9-12	19-23	119-139	306-326	8-9	31-35
80	6	115-131	304-324	19-22	19-23	121-141	308-328	17-18	31-35
	12	114-130	279-299	9-12	19-23	140-160	326-346	9-10	35-39
90	6	116-132	346-366	18-21	18-22	139-159	326-346	19-20	35-39
	12	115-131	321-341	9-12	18-22	163-183	348-368	11-12	39-43
100	6	118-134	391-411	18-21	18-22	—	—	—	—
	12	117-133	366-386	9-12	18-22	—	—	—	—

**Table 22 — 50WT060 Full Load, Typical Unit Operating Pressures and Temperatures**

ENTER FLUID TEMP (°F)	WATER FLOW (gpm)	COOLING				HEATING			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	7.5	—	—	—	—	53-69	225-282	8-10	19-23
	15.0	—	—	—	—	60-76	231-289	5-6	20-25
40	7.5	104-129	170-209	19-25	21-25	64-82	234-296	10-11	22-26
	15.0	103-127	149-185	9-12	21-25	72-91	242-305	5-6	24-29
50	7.5	105-131	195-241	18-24	20-24	75-96	245-311	12-13	25-30
	15.0	104-129	172-215	9-12	20-25	86-108	255-323	6-7	26-32
60	7.5	106-133	223-276	18-24	19-24	89-112	257-328	13-15	27-33
	15.0	105-130	199-249	9-13	20-24	101-126	269-342	7-8	30-36
70	7.5	107-134	253-314	18-24	20-24	103-130	270-346	15-17	31-37
	15.0	106-132	229-286	9-13	20-24	119-147	286-364	9-10	34-41
80	7.5	108-136	288-356	18-24	19-23	119-148	286-366	17-20	34-41
	15.0	108-134	264-327	9-12	19-23	138-169	304-387	9-11	38-45
90	7.5	110-138	326-402	17-23	19-23	137-169	301-387	19-22	37-45
	15.0	109-136	302-372	9-12	19-23	160-194	325-412	11-13	42-50
100	7.5	111-140	368-451	17-22	18-22	—	—	—	—
	15.0	111-138	344-421	9-12	18-22	—	—	—	—

**Table 23 — 50WT070 Full Load, Typical Unit Operating Pressures and Temperatures**

ENTER FLUID TEMP (°F)	WATER FLOW (gpm)	COOLING				HEATING			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	9	—	—	—	—	53-69	230-287	8-10	21-25
	18	—	—	—	—	60-76	237-295	4-5	22-27
40	9	100-126	171-211	18-22	21-26	64-82	241-303	10-11	24-28
	18	99-124	150-188	8-13	21-26	71-90	249-312	5-6	25-30
50	9	101-128	194-242	18-22	20-25	75-96	253-319	11-12	27-32
	18	100-126	173-218	9-12	21-26	85-107	263-331	6-7	29-35
60	9	103-130	221-277	17-22	20-24	89-112	266-337	13-15	30-36
	18	101-128	199-251	8-13	21-25	100-125	279-352	7-8	33-39
70	9	104-132	252-314	17-22	20-25	103-130	281-357	14-16	33-39
	18	103-130	229-288	8-12	20-25	118-146	298-376	8-9	36-43
80	9	105-133	286-356	17-21	20-24	119-148	299-379	16-19	37-44
	18	104-132	263-329	8-11	19-24	138-169	319-402	9-11	41-48
90	9	107-136	324-402	17-21	19-23	137-169	317-403	18-21	41-49
	18	106-134	301-373	8-11	19-23	160-194	343-430	10-12	45-53
100	9	108-138	366-450	16-21	19-23	—	—	—	—
	18	108-137	343-422	8-11	19-23	—	—	—	—

**Table 24 — 50WT024 Part Load**

ENTER FLUID TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (PSIG)	Discharge Pressure (PSIG)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	3	—	—	—	—	88-98	252-272	7-8	17-21
	6	—	—	—	—	88-98	252-272	3-4	17-21
40	3	132-149	181-199	14-17	20-24	96-106	258-278	7-8	18-22
	6	131-148	170-188	7-10	20-24	102-112	263-283	3-4	20-24
50	3	134-151	210-228	14-17	20-24	110-120	268-288	8-9	21-25
	6	132-149	185-203	7-10	20-24	118-128	276-296	4-5	22-26
60	3	136-153	245-263	13-16	19-23	125-135	281-301	9-10	24-28
	6	134-151	215-233	6-9	20-24	135-145	288-308	5-6	25-29
70	3	138-155	278-296	13-16	19-23	142-152	295-315	11-12	27-31
	6	137-154	248-266	6-9	19-23	156-166	341-361	5-6	29-33
80	3	139-156	305-323	13-16	19-23	162-172	308-328	12-13	30-34
	6	139-156	284-302	6-9	19-23	178-188	344-364	6-7	32-36
90	3	141-158	343-361	12-15	18-22	183-193	333-353	13-14	34-38
	6	140-157	325-343	6-9	19-23	203-213	362-382	7-8	36-40
100	3	143-160	386-404	11-14	18-22	—	—	—	—
	6	142-159	369-387	5-8	18-22	—	—	—	—

**Table 25 — 50WT036 Part Load**

ENTER FLUID TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	4.5	—	—	—	—	80-90	261-281	6-7	17-21
	9.0	—	—	—	—	86-96	266-286	3-4	18-22
40	4.5	128-144	177-201	14-17	20-24	95-105	274-294	7-8	20-24
	9.0	128-144	171-195	7-10	20-24	102-112	281-301	4-5	21-25
50	4.5	130-146	204-228	14-17	20-24	111-121	289-309	9-10	23-27
	9.0	129-145	185-209	6-9	20-24	120-130	297-317	5-6	25-29
60	4.5	131-147	233-257	13-16	19-23	129-139	306-326	10-11	27-31
	9.0	130-146	214-238	6-9	20-24	140-150	316-336	5-6	29-33
70	4.5	133-149	266-290	13-16	19-23	148-158	324-344	12-13	30-34
	9.0	132-148	247-271	6-9	19-23	163-173	336-356	6-7	33-37
80	4.5	135-151	303-327	12-15	19-23	170-180	343-363	14-15	34-38
	9.0	134-150	284-308	6-9	19-23	188-198	359-379	7-8	37-41
90	4.5	136-152	342-366	12-15	18-22	194-204	365-385	15-16	38-42
	9.0	136-152	325-349	6-9	18-22	216-226	383-403	8-9	41-45
100	4.5	138-154	385-409	11-14	18-22	—	—	—	—
	9.0	138-154	370-394	5-8	18-22	—	—	—	—

**Table 26 — 50WT048 Part Load**

ENTER FLUID TEMP (°F)	WATER FLOW (GPM/Ton)	COOLING				HEATING			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	6	—	—	—	—	74-94	247-267	6-7	16-20
	12	—	—	—	—	79-99	251-271	3-4	17-21
40	6	130-146	172-192	13-16	19-23	87-107	258-278	7-8	18-22
	12	130-146	168-188	6-9	19-23	94-114	264-284	4-5	20-24
50	6	131-147	199-219	13-16	19-23	102-122	271-291	8-9	21-25
	12	130-146	181-201	6-9	19-23	110-130	278-298	4-5	23-27
60	6	132-148	228-248	13-16	19-23	118-138	285-305	10-11	24-28
	12	131-147	211-231	6-9	19-23	129-149	294-314	5-6	26-30
70	6	133-149	261-281	12-15	18-22	136-156	301-321	11-12	28-32
	12	132-148	243-263	6-9	19-23	149-169	313-333	6-7	30-34
80	6	135-151	296-316	12-15	18-22	156-176	318-338	13-14	31-35
	12	134-150	279-299	6-9	18-22	172-192	333-353	7-8	34-38
90	6	137-153	334-354	11-14	18-22	177-197	338-358	14-15	35-39
	12	136-152	318-338	5-8	18-22	198-218	356-376	8-9	39-43
100	6	139-155	376-396	11-14	17-21	—	—	—	—
	12	138-154	361-381	5-8	17-21	—	—	—	—

**Table 27 — 50WT060 Part Load**

ENTER FLUID TEMP (°F)	WATER FLOW (GPM/Ton)	COOLING				HEATING			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	7.5	—	—	—	—	76-92	227-284	5-7	17-21
	15	—	—	—	—	82-98	231-289	3-4	17-22
40	7.5	126-151	164-203	13-19	20-24	88-106	235-297	7-8	19-23
	15	125-149	147-183	6-9	20-24	95-114	240-303	4-5	20-25
50	7.5	126-152	186-232	12-18	20-24	101-122	245-311	8-9	22-27
	15	126-151	169-212	6-9	19-24	109-131	251-319	4-5	23-29
60	7.5	127-154	212-265	12-18	19-24	116-139	256-327	9-11	24-30
	15	127-152	194-244	6-10	19-23	126-151	265-338	5-6	26-32
70	7.5	129-156	240-301	12-18	19-23	136-163	272-348	11-13	28-34
	15	128-154	223-280	5-10	19-23	145-173	280-358	6-7	30-37
80	7.5	130-158	271-339	11-17	18-22	151-180	285-365	12-15	31-38
	15	130-156	255-318	6-9	19-23	167-198	299-382	6-8	34-41
90	7.5	133-161	327-403	10-16	18-22	176-208	307-393	14-17	36-44
	15	132-159	290-360	5-8	18-22	190-224	321-408	7-9	39-47
100	7.5	134-163	345-428	10-15	17-21	—	—	—	—
	15	134-161	329-406	5-8	18-22	—	—	—	—

**Table 28 — 50WT070 Part Load**

Enter Fluid Temp (°F)	Water Flow (GPM/Ton)	Cooling				Heating			
		Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Rise (°F)	Air Temp Drop (°F)	Suction Pressure (psig)	Discharge Pressure (psig)	Water Temp Drop (°F)	Air Temp Rise (°F)
30	9	—	—	—	—	74-90	233-290	5-7	18-22
	18	—	—	—	—	80-96	237-295	3-4	19-24
40	9	121-147	169-209	13-17	20-25	87-105	242-304	7-8	21-25
	18	120-145	152-190	6-10	20-25	94-113	248-311	4-5	22-27
50	9	122-149	190-238	13-17	19-24	101-122	254-320	8-9	24-29
	18	121-147	173-218	6-9	19-24	109-131	261-329	4-5	25-31
60	9	123-150	215-271	12-17	19-23	116-139	266-337	9-11	26-32
	18	122-149	199-251	5-10	20-24	126-151	275-348	5-6	29-35
70	9	124-152	244-306	12-16	19-24	133-160	280-356	11-13	30-36
	18	124-151	228-287	5-10	19-24	146-174	291-369	6-7	32-39
80	9	126-154	276-346	11-16	19-23	152-181	296-376	12-15	33-40
	18	125-153	260-326	6-9	18-23	168-199	310-393	6-8	36-43
90	9	127-156	310-388	11-15	18-22	173-205	313-399	13-16	37-45
	18	127-155	297-369	5-8	18-22	192-226	330-417	7-9	40-48
100	9	129-159	350-434	10-15	18-22	—	—	—	—
	18	129-158	337-416	5-8	18-22	—	—	—	—



## OPERATION

### Power Up Mode

The unit will not operate until all the inputs, terminals and safety controls are checked for normal operation.

NOTE: The compressor will have a 5-minute anti-short cycle upon power up.

### Unit Protection Module (UPM)

All Carrier WSHP units feature an advanced UPM which implements all the critical equipment safeties and allows for continuous safe and reliable operation. Fig. 36 shows the UPM sequence of operations for units safeties. Refer to Step 9 — “Configure Unit Control Components” on page 21 for detailed information about Safeties and Alarms.

### Option Card

An optional expansion card is provided on units that are intended to be controlled by a thermostat. The card supplements the primary thermostat control by controlling auxiliary devices that a thermostat is not typically capable of controlling. Refer to Step 9 — “Configure Unit Control Components” on page 21 for information.

### Sequence of Operation of Units Without DDC Controller

#### STANDBY

Y and W terminals are not active in Standby mode; however, the O and G terminals may be active, depending on the application. The compressor will be off.

#### COOLING

Y and O terminals are active in Cooling mode. After power up, the first call to the compressor will initiate a 270 to 300 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

NOTE: On all subsequent compressor calls the random start delay is omitted.

#### HEATING STAGE 1

Terminal Y is active in heating stage 1. After power up, the first call to the compressor will initiate a 270 to 300 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

NOTE: On all subsequent compressor calls the random start delay is omitted.

#### HOT GAS REHEAT WITH OPTION CARD (OPTIONAL)

Terminal H is active in dehumidification mode with hot gas reheat. After a call for H, the reversing valve (O), compressor (Y), and fan (G) are also enabled.

NOTE: Any call for cooling (Y), heating (Y or W), or reversing valve (O) will override dehumidification mode (H).

#### WATERSIDE ECONOMIZER WITH OPTION CARD (OPTIONAL)

Y and O terminals are active in Cooling mode. When the entering water temperature drops below the configured entering water temperature set point specified on the Option Card, the compressor and reversing valve are disabled and the waterside economizer is enabled. The waterside economizer three way control valve will divert water to the economizer coil for free cooling. If a cooling call remains for a period of > 10 min the compressor will be enabled to assist the WSE in meeting the cooling demand. When the entering water temperature rises above the configured on the Op-

tion card board set point, the waterside economizer is disabled and the compressor and reversing valve are enabled.

#### AUXILIARY ELECTRIC HEAT (OPTIONAL)

The output provided on the controller shall be able to control single stage of electric heat. The sequence of operation of the electrical heat is an alternative/emergency heat. When the terminal W is energized, it will enable Electric heater and disable compressor (Y).

#### TWO-POSITION MOTORIZED ISOLATION VALVE (2-WAY SOLENOID VALVE) (OPTIONAL)

The two way water flow control valve is enabled anytime there is a call for cooling (Y), heating (Y), or dehumidification (H) and allows water to flow through the unit. When there is no call for cooling, heating, or dehumidification, the water flow control valve is disabled, stopping flow through the unit.

#### BOILERLESS HEAT WITH OPTION CARD (OPTIONAL)

When the entering water temperature is below the configured set point on the Option Card (refer to Step 9 — “Configure Unit Control Components” on page 21) and there is a call for heating (Y), the compressor is disabled and the auxiliary heat output is enabled (W). When the entering water temperature is above the configured EWT set point, the auxiliary heat output is disabled and the compressor is enabled.

#### DIFFERENTIAL PRESSURE SWITCH / FLOW SWITCH (OPTIONAL)

The flow switch monitors the pressure difference between two points on the waterside. The unit will be shut down if flow is not met.

#### REFRIGERANT LEAK DETECTION SYSTEM (OPTIONAL)

The A2L sensor continually samples the air and if the concentration of refrigerant detected is higher than the preset threshold (15% LFL), it sends a signal to the UPM which then switches off the compressor and turns on the blower. The compressor will remain off until saturation level is within acceptable range (12% LFL). The A2L sensor is connected to the UPM, it must always remain connected. If communication is lost, the UPM will enter refrigerant leak hard lockout fault and energize the alarm contact. To test that the communication between the sensor and board is active, the sensor can be disconnected from the UPM, which should simulate a fault. The A2L sensor for the refrigerant leak detection system shall only be replaced with the part specified on the spare parts list.

**IMPORTANT:** When refrigerant leak detection system installed, unit must be powered except for service.

**IMPORTANT:** Continuous air circulation required for proper functioning.

#### COMPRESSOR RELAY (OPTIONAL)

Optional relay providing compressor status via a normally open set of dry contacts.

#### PUMP/VALVE RELAY (OPTIONAL)

The pump/valve relay is enabled anytime there is a call for cooling (Y), heating (Y), or dehumidification (H) and can be used to enable/disable field installed 2 way solenoid valve or circulator pumps. When there is no call for cooling, heating, or dehumidification, pump/valve relay is disabled.

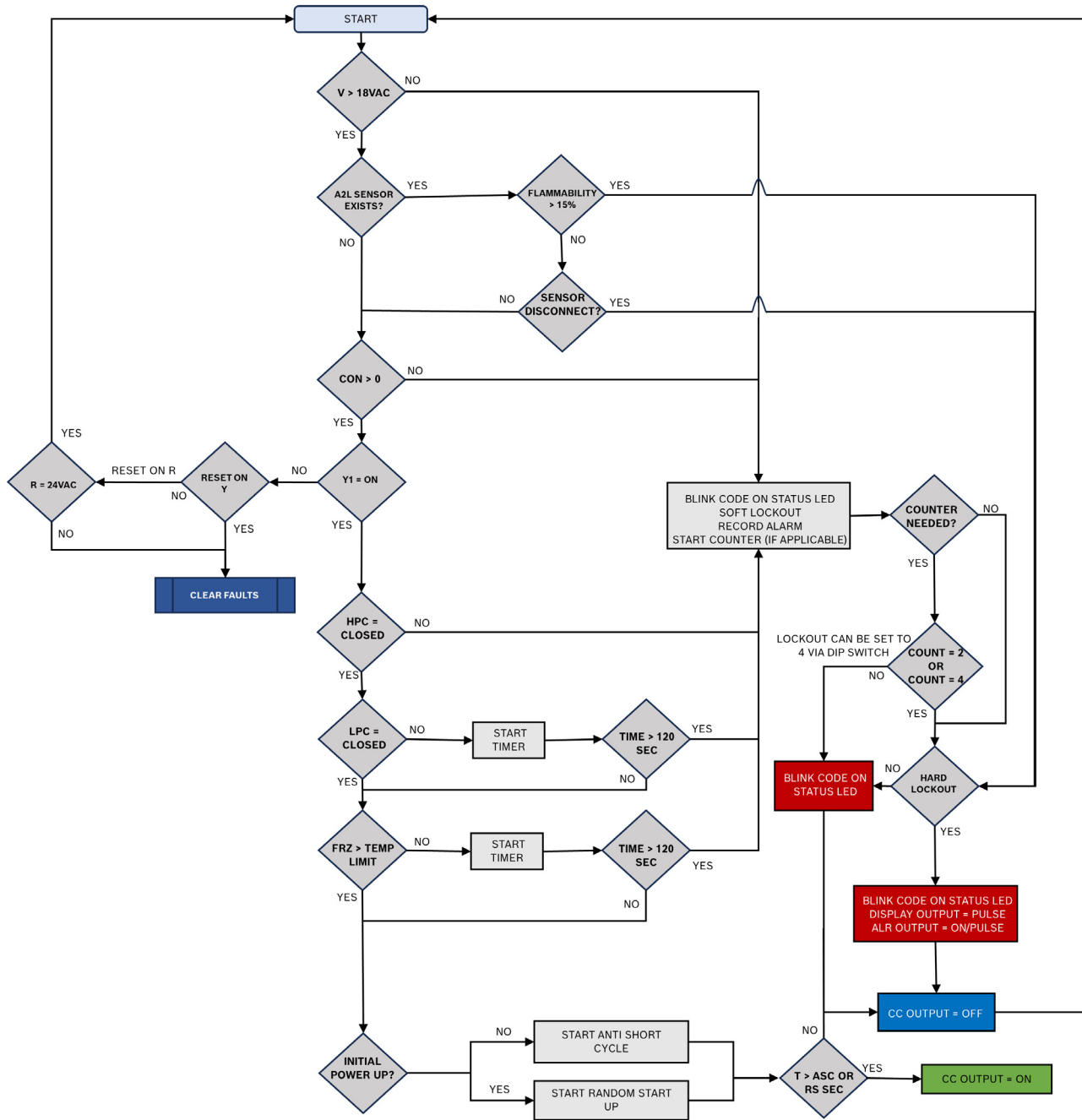


Fig. 36 — UPM Sequence of Operations

## Sequence of Operation for Units with TruVu DDC Controller

Units with TruVu™ DDC controller still feature a UPM board for unit operation, so the operation will be similar to the sequence for units without DDC controller. TruVu™ does feature advanced functionality, such as automatic fan speed control

and intelligent alarming, which will differ from the units with UPM board only. Below is an overview of the different features for the TruVu™ controls. See Fig. 37 for TruVu™ Control Board overview.

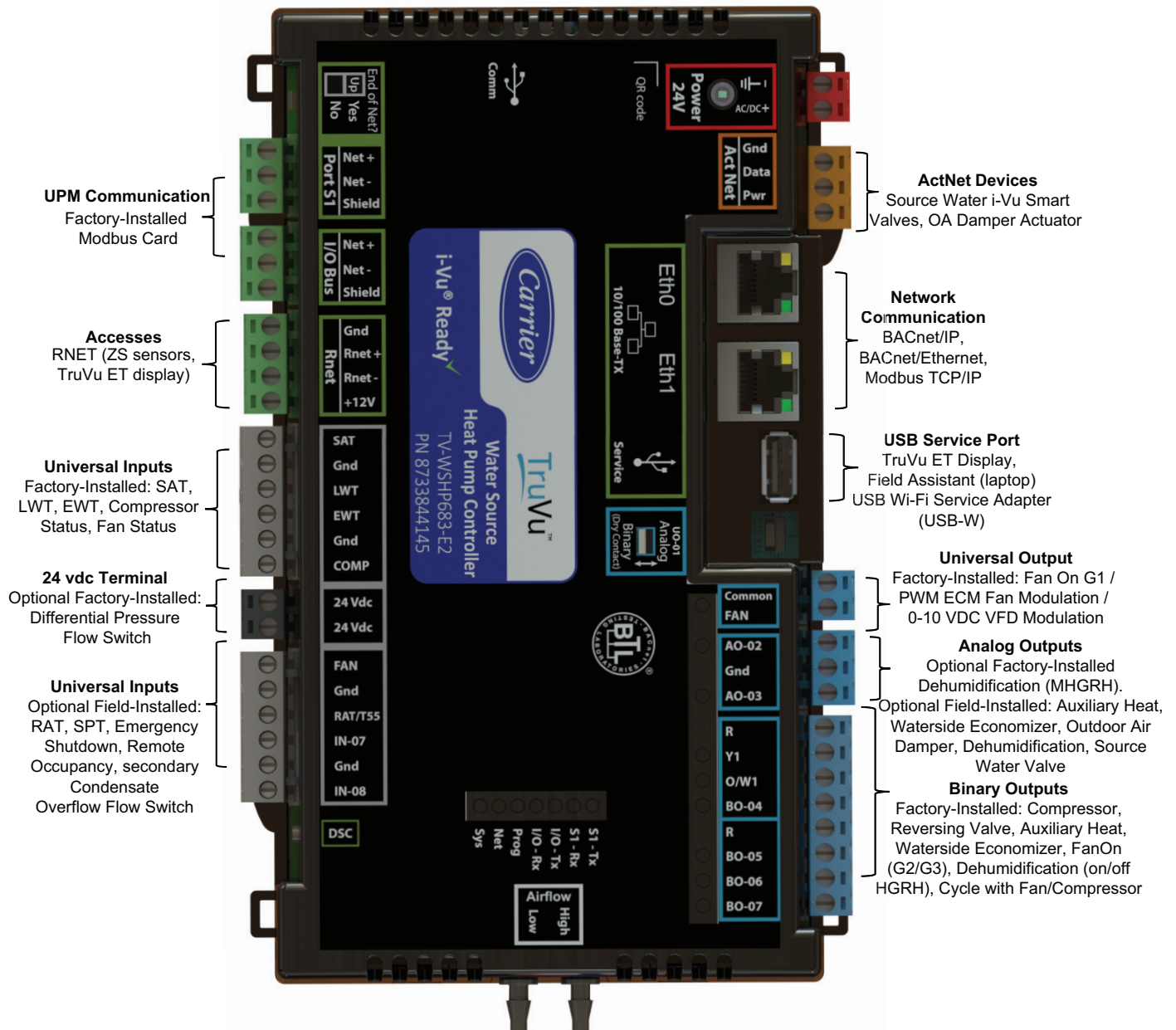


Fig. 37 — TruVu Control Board

## SCHEDULING

Time periods can be configured to schedule the transitions from occupied to unoccupied operation. The time periods control the space temperature to occupied heating and cooling setpoints. The unit operates continuously in the Occupied mode until a time schedule is configured by using either the TruVu Equipment Touch, Field Assistant, the i-Vu® application, or a third-party control system enables/disables the BAS On/Off point. The local time and date for these functions must be set to operate properly.

The occupancy source can be changed to one of the following:

### **Occupancy Schedules**

The controller is occupied 24/7 until you configure a time schedule using either the TruVu Equipment Touch, Field Assistant, the i-Vu® application, or a third party Enables/Disables the BAS On/Off point. You can disable this by going to Configuration > Unit Configuration > Occupancy Schedules, changing the point from Enable to Disable and clicking OK.

NOTE: You must Enable this point in order for the TruVu™ ET Touch, Field Assistant, or the i-Vu® application to assign a time schedule to the controller.

### **Schedule Schedule**

The unit operates according to the schedule configured and stored in the unit. The schedule is accessible via the TruVu ET, the i-Vu® application, or Field Assistant. The daily schedule consists of a start and stop time (standard or 24-hour mode) and 7 days of the week, starting with Monday and ending on Sunday.

### CAUTION

Scheduling can only be controlled from one source.

### **Occupancy Input Contact (Option)**

If configured for remote occupancy control (default), the TruVu can use an external dry contact closure to determine the occupancy status of the unit. You must disable the Occupancy Schedules in order to use the occupancy contact input. The unit enters an occupied mode when it senses the abnormal input. After the input returns to its normal state, the unit stays in the occupied mode for the configured OCC Override Delay period (15 minutes default).

### **BAS (Building Automation System) On/Off**

For use with a Building Automation System that supports network scheduling, you must disable the Occupancy Schedules so the BAS system can control the unit through a network communication and the BAS scheduling function.

### **Global Occupancy Scheduling**

The TruVu can read the occupancy status from another unit so that a group of WSHP's can be controlled from a single occupancy schedule. The local Occupancy Schedules must be disabled in order to use the global occupancy input.

### **BACnet Network Occupancy Input**

The TruVu can accept an external BACnet Binary Network Input for occupancy control. This function is only compatible with units used in BACnet systems. You need to configure the System Occupancy BACnet network input point to locate the device and point name where the external occupancy point information resides. You must also disable Occupancy Schedules in order to use this input.

## INDOOR FAN

### **Fan Modes**

You can configure the indoor fan to operate in any one of 3 fan modes:

- Auto - intermittent operation during both occupied and unoccupied periods

- Continuous (default) - intermittent operation during unoccupied periods and continuous during occupied periods
- Always on - operates the fan continuously during both occupied and unoccupied periods

In the continuous default mode, the fan is turned on when any one of the following is true:

- It is in occupied mode, which is determined by the occupancy status.
- There is a demand for cooling or heating in unoccupied mode.
- There is a call for dehumidification (optional).

### **Auto Fan Speed Control**

The TruVu can control up to 3 fan speeds using the ECM (Electronically Commutated Motor). The motor operates at the lowest speed possible to provide quiet and efficient fan operation with the best latent capability. The motor increases speed if additional cooling or heating is required to reach the desired space temperature setpoint. The control increases the motor's speed as the space temperature rises above the cooling or below the heating setpoint. The amount of space temperature increase above or below the setpoint required to increase the fan speed is configurable in the setpoint. Also, the control increases the fan speed as the Supply Air Temperature approaches the configured minimum or maximum limits.

- Heating Max SAT Control - When heat is required and active, the control continuously monitors the supply air temperature to verify it does not rise above the configured Maximum Heating SAT Limit (110° default). As the SAT approaches this value, the control increases the fan speed as required to ensure the SAT remains within the limit. This provides the most quiet and efficient operation by running the fan at the lowest speed possible.
- Cooling Min SAT Control - When mechanical cooling is required and active, the control continuously monitors the supply air temperature to verify it does not fall below the configured Minimum Cooling SAT Limit (50° default). As the SAT approaches this value, the control increases the fan speed as required to ensure the SAT will remain within the limit. Fan operates at the lowest speed during dehumidification to maximize latent capacity during cooling.

### **Fan Delay**

When power is reapplied after a power outage, there is a configurable delay of 5 - 600 seconds (default 60) before starting the fan. You must configure the fan delay:

- The Fan On Delay defines the delay time (0 - 30 seconds, default 10) before the fan begins to operate after heating or cooling is started.
- The Fan Off Delay defines the delay time (0 - 180 seconds, default 45) the fan continues to operate after heating or cooling is stopped.

NOTE: The fan continues to run as long as the compressors, heating stages, or the dehumidification relays are on. If the SPT failure alarm, ZS Sensor failure alarm, or condensate overflow alarm is active, the fan is shutdown immediately, regardless of occupancy state or demand.

### **Fan Status**

You can configure an optional input as either an occupancy input contact or a fan status input. If configured as fan status, the controller compares the status of the fan to the desired commanded state. When the fan is commanded to run (ON), the fan status is checked and verified to match the commanded state. If the fan status is not on, then a fan status alarm is generated after 1 minute and the equipment's compressor(s) and auxiliary heat is disabled and the optional OA damper closes.

## COOLING OPERATION

### *Space Temperature Control*

The TruVu operates 1 or 2 stages of compression to maintain the desired cooling setpoint. The compressor outputs are controlled by the PI (Proportional-integral) cooling loop and cooling stages capacity algorithm. The algorithm calculates the desired number of stages needed to satisfy the space by comparing the control temperature (return air or space) to the appropriate cooling setpoint.

NOTE: The waterside economizer, if applicable, is used for first stage cooling, in addition to the compressor(s). The following conditions must be true for the cooling algorithm to run:

- Cooling is set to Enable.
- The Fire/Smoke Input and Shutdown modes are inactive.
- Heat mode is not active and the compressor time guard(s) have expired.
- Condensate overflow alarm status is Normal.
- Fan Status is True (if option is enabled).
- If occupied, the control temperature is greater than the occupied cooling setpoint.
- Control temperature reading is valid.
- If unoccupied, the control temperature is greater than the unoccupied cooling setpoint.
- If economizer cooling is available and active, and the economizer alone is insufficient to provide enough cooling.
- OAT > Cooling Lockout Temperature if OAT is available.
- Source water pump is on (if source water linkage is active).
- Water Flow Switch Status is True (if option is enabled).

If all of the above conditions are met, the compressors' relays are energized as required. Otherwise, they will be de-energized. If cooling is active and if the SAT approaches the minimum SAT limit, the fan will be indexed to the next higher speed. If this is insufficient, and if the SAT falls further (equal to the minimum SAT limit), the fan will be indexed to the maximum speed. If the SAT still continues to fall 5°F below the minimum SAT limit, all cooling stages will be disabled.

During Cooling, the reversing valve output is held in the cooling position (either B or O type, as configured), even after the compressor is stopped. The valve does not switch position until the heating mode is required.

The configuration screens contain the Min SAT parameter as well as Cooling Lockout based on outdoor air temperature (OAT). Both can be adjusted to meet various specifications.

### *Passive Dehumidification*

When the unit is configured for auto fan speed control the TruVu will use the lowest fan speed setting possible to meet the setpoint and stay within the maximum SAT limits. Using the lowest fan speed possible in cooling operation will provide a method of passive dehumidification allowing for enhanced latent capacity.

### *Hot Gas Reheat Dehumidification*

The TruVu provides occupied and unoccupied dehumidification only on units that are equipped with the reheat option. This function requires an accessory hardwired space relative humidity sensor. When using a relative humidity sensor to control dehumidification during occupied or unoccupied times, the dehumidification setpoints are used accordingly. Also, you may use a ZS Humidity Sensor or a network input point System Space RH in place of the hardwired RH sensor.

When the indoor relative humidity becomes greater than the dehumidification setpoint, a dehumidification demand is acknowledged. Once acknowledged, the dehumidification output is energized, bringing on the supply fan (medium speed), mechanical cooling, and the integral reheat coil. The controls engage cooling mode and the waste heat from the compressor cooling cycle is returned to the reheat coil simultaneously, meaning that the reversing valve causes the compressor to operate in the cooling mode.

NOTE: During cooling mode, the unit cools and dehumidifies, and disables the reheat coil. However, once the call for cooling has been satisfied and there is still a call for dehumidification, the unit continues to operate in the reheat mode.

## HEATING OPERATION

### *Space Temperature Control (Reverse Cycle Heating)*

The TruVu operates 1 or 2 stages of compression to maintain the desired heating setpoint. The compressor outputs are controlled by the heating PI (Proportional-integral) loop and heating stages capacity algorithm. The algorithm calculates the desired number of stages needed to satisfy the space by comparing the control temperature (return air or space) to the appropriate heating setpoint.

The following conditions must be true for the heating algorithm to run:

- Heating is set to Enable.
- The Fire/Smoke Input and Shutdown modes are inactive.
- Cool mode is not active and the compressor time guard has expired.
- Condensate overflow alarm status is Normal.
- Fan Status is True (if option is enabled).
- If occupied, the control temperature is less than the occupied heating setpoint.
- Control temperature reading is valid.
- If unoccupied, the control temperature is less than the unoccupied heating setpoint.
- OAT > Heating Lockout Temperature if OAT is available.
- Source Water Pump is on (if Source Water Linkage active).
- Water Flow Switch Status is True (if option is enabled).

If all the above conditions are met, the heating outputs are energized as required, otherwise they are de-energized. If heating is active and the SAT approaches the maximum SAT limit, the fan is indexed to the next higher speed. If this is insufficient, and if the SAT rises further and reaches the Maximum Heating SAT limit, the fan is indexed to the maximum speed. If the SAT still continues to rise 5°F above the maximum limit, all heating stages are disabled.

### *Space Temperature Control (Reverse Cycle Heating and Auxiliary Heat)*

The TruVu can control a 2-position or modulating water or steam valve, connected to a coil on the discharge side of the unit and supplied by a boiler, or a single stage ducted electric heater, in order to maintain the desired heating setpoint. If the compressor capacity is insufficient, or a compressor failure occurs, the auxiliary heat is used. Unless the compressor fails, the auxiliary heat only operates to supplement the heat provided by the compressor, if the space temperature falls more than 1°F below the desired heating setpoint. (This amount is configurable.) The heat is controlled so the SAT does not exceed the Maximum Heating SAT limit.

The same conditions required for Reverse Cycle Heating must be true in order for the Auxiliary Heat algorithm to run.

### Auxiliary Modulating Hot Water / Steam Heating

The control can modulate a hot water or steam valve connected to a coil on the discharge side of the unit, and supplied by a boiler in order to maintain the desired heating setpoint, if the compressor capacity is insufficient, or a compressor failure occurs. Unless a compressor fault condition exists, the valve only operates to supplement the heat provided by the compressor if the space temperature falls more than 1°F below the desired heating setpoint. The valve is controlled so the SAT does not exceed the Maximum Heating SAT limit.

### 2-Position Hot Water / Steam Heating

The control can operate a 2-position, NO or NC, hot water or steam valve, connected to a coil on the discharge side of the unit and supplied by a boiler, in order to maintain the desired heating setpoint, if the compressor capacity is insufficient or a compressor

failure occurs. Unless a compressor fault condition exists, the valve only opens to supplement the heat provided by the compressor, if the space temperature falls more than 1°F below the desired heating setpoint. The valve is controlled so the SAT does not exceed the Maximum Heating SAT limit and is subject to a 2-minute minimum OFF-time to prevent excessive valve cycling.

#### Electric Auxiliary Heat

The control can operate a factory or field-installed single or two stage of electric heat that is installed on the discharge side of the unit, in order to maintain the desired heating setpoint, if the compressor capacity is insufficient or a compressor failure occurs. Unless a compressor fault condition exists, the heat stage only operates to supplement the heat provided by the compressor if the space temperature falls more than 1°F below the desired heating setpoint. The heat stage is controlled so the SAT does not exceed the Maximum Heating SAT limit and is subject to a 2-minute minimum OFF-time to prevent excessive cycling.

#### ***“Boilerless” Control (Auxiliary Heat)***

The TruVu can be configured to control the auxiliary heat source for “boilerless” types of systems or system with no means for heat injection into the source water loop. Compressor will be disabled, and the auxiliary heat source will be enabled when the entering water temperature drops below the configurable boilers electric heat setpoint.

### **WATERSIDE ECONOMIZER**

The TruVu can provide modulating, or 2-position waterside economizer operation (for a factory or field-installed economizer coil mounted to the return air side of the unit and connected to the source water loop), in order to provide free cooling or preheating, when water conditions are optimal. Waterside economizer settings can be accessed on Properties > Equipment > Status.

The following conditions must be true for economizer operation:

- SAT reading is available.
- EWT reading is available.
- If occupied, the control temperature is greater than the occupied cooling setpoint or less than the occupied heating setpoint and the source water is suitable.
- Space temperature reading is valid.
- If unoccupied, the SPT or ZS is greater than the unoccupied cooling setpoint, or less than the unoccupied heating setpoint, and the source water is suitable.

#### ***Modulating Waterside Economizer Control***

Modulates a water valve to control source water flowing through a coil on the entering air side of the unit.

#### Cooling

Provides an economizer cooling function by using the source water loop when the entering water loop temperature is at least 5°F below space temperature. If the water loop conditions are suitable, the valve modulates open to maintain a Supply Air Temperature that meets the load conditions. If the economizer coil capacity alone is insufficient for a period greater than 5 minutes, or if a high humidity condition occurs, then the compressor starts, in order to satisfy the load. If the SAT approaches the Minimum Cooling SAT limit (HOME > CONFIG > UNIT), the economizer valve modulates closed during compressor operation.

#### Heating

In addition, the control modulates the water valve if the entering source water loop temperature is suitable for heating (at least 5°F above space temperature) and heat is required. The valve is controlled in a similar manner, except to satisfy the heating requirement. If the coil capacity alone is insufficient to satisfy the space load conditions for more than 5 minutes, then the compressor starts in order to satisfy the load. If the SAT approaches the Maximum Heating SAT limit, the economizer valve modulates closed during compressor operation.

#### ***2-position Waterside Economizer Control***

2-Position Waterside Economizer Control has the capability to control a NO or NC, 2-position water valve to control source water flow through a coil on the entering air side of the unit.

#### Cooling

The purpose is to provide a cooling economizer function directly from the source water loop when the entering water loop temperature is at least 5°F below space temperature. If the optional coil is provided and the water loop conditions are suitable, then the valve opens to provide cooling to the space, when required. If the capacity is insufficient for a period greater than 5 minutes, or if a high humidity condition occurs, the compressor is started in order to satisfy the load. If the SAT reaches the Minimum Cooling SAT limit, the economizer valve closes during compressor operation.

#### Heating

In addition, the economizer control opens the water valve, if the entering water loop temperature is suitable for heating (at least 5°F above space temperature) and heat is required. The valve is controlled in a similar manner, except to satisfy the heating requirement. If the coil capacity is insufficient to satisfy the space load for more than 5 minutes, then the compressor is started to satisfy the load. If the SAT reaches the Maximum Heating SAT limit, the economizer valve closes during compressor operation.

### **Indoor Air Quality and Demand Control Ventilation**

If the optional hardwired indoor air quality sensor is installed, ZS CO<sub>2</sub> (IAQ), or the System Space AQ network input point is used, the TruVu maintains indoor air quality with a modulating OA damper, which provides demand controlled ventilation. The control operates the modulating OA damper during occupied periods, monitors the CO<sub>2</sub> level, compares it to the configured setpoints, and adjusts the ventilation rate, as required. The control provides proportional ventilation to meet the requirements of ASHRAE specifications by providing a base ventilation rate and then increasing the rate as the CO<sub>2</sub> level increases. The control proportionally increases ventilation when the CO<sub>2</sub> level rises above the start ventilation setpoint and reaches the full ventilation rate when the CO<sub>2</sub> level is at or above the maximum setpoint.

Configure the minimum damper position to ensure that proper base ventilation is delivered when occupants are not present. Access the IAQ configurations through the configuration screen.

The following conditions must be true in order for this algorithm to run:

- Damper Control is configured for DCV.
- The Fire/Smoke Input and Shutdown modes are inactive.
- Fan status is True (if option is enabled).
- The unit is in an occupied mode.
- IAQ sensor reading is greater than the DCV start CTRL setpoint.

The control has the following 4 adjustable setpoints:

- DCV Start Ctrl Setpoint.
- DCV Max Ctrl Setpoint.
- Minimum Damper POS.
- DCV Max Vent Damper POS.

NOTE: For the damper to maintain proper base ventilation, you must configure the fan as Continuous or Always On.

#### ***2-Position OA Damper***

Alternatively, the controller can be configured to operate as a ventilation damper in a 2-position ventilation mode to provide the minimum ventilation requirements during occupied periods.

#### ***Differential pressure switch / water flow switch***

The flow switch monitors the pressure difference between two points on the waterside. An optional input can be configured as condenser water flow status input. If configured, the flow status must be ON for 3 seconds to enable the compressors.

## COMPRESSOR STATUS

The TruVu provides a status input to monitor the compressor operation. The status is monitored to determine if the compressor status matches the commanded state. This input is used to determine if a refrigerant safety switch or other safety device has tripped and caused the compressor to stop operating normally. If this occurs, an alarm is generated to indicate the faulted compressor condition.

## DEMAND LIMITING

The TruVu can accept 3 levels of demand limit from the BACnet network. In response to a demand limit, the unit decreases its heating setpoint and increases its cooling setpoint to widen the range, in order to immediately lower the electrical demand. You can configure the temperature adjustment for both heating and cooling and for each demand level. You can also set the response to a particular demand level to 0.

## REMOTE DISABLE

### ***Fire/Smoke Detector Input***

The TruVu can read the status of a normally closed FSD contact input to determine if a fire or smoke detector alarm is present. If the controller determines an alarm condition is present, all heating, cooling, and the fan are disabled. The switch is factory-set to Normally Closed and cannot be changed.

### ***Shutdown Input***

The TruVu controller has a shutdown input (software point) which, when set to its Active mode causes the WSHP to safely shutdown in a controlled fashion. Heating and cooling is disabled after any minimum runtime conditions expire and the fan is disabled after the fan-off timer expires. All alarms are reset but any active alarm remains active. After the shutdown input transitions from Active mode to Inactive, the TruVu restarts after the configured power fail restart delay expires.

## ALARMS

### ***High Discharge Pressure (UPM Alarm)***

The TruVu WSHP monitors the status of a high discharge pressure fault condition via the serial port (S1). The fault condition is determined by the Unit Protection Module (UPM) included on all WSHPs. The UPM monitors a high-pressure switch input and establishes a high-pressure fault when the discharge pressure exceeds 600 PSIG. Upon fault a 5-minute break is initiated (soft lockout) and the compressor is disabled. The unit will automatically restart after this time period. If the fault occurs 2 times (configurable on UPM) within 60 minutes the UPM will put the unit into hard lockout requiring manual reset. Manual reset can be accomplished remotely when the UPM is configured for the reset method “Y” by remotely disabling the unit via the TruVu WSHP.

### ***Low Suction Pressure (UPM Alarm)***

The TruVu WSHP monitors the status of a low suction pressure fault condition via the serial port (S1). The fault condition is determined by the Unit Protection Module (UPM) included on all WSHPs. The UPM monitors a low-pressure switch input and establishes a high-pressure fault when the discharge pressure drops below 40 PSIG. Upon fault a 5-minute break is initiated (soft lockout) and the compressor is disabled. The unit will automatically restart after this time period. If the fault occurs 2 times (configurable on UPM) within 60 minutes the UPM will put the unit into hard lockout requiring manual reset. Manual reset can be accomplished remotely when the UPM is configured for the reset method “Y” by remotely disabling the unit via the TruVu WSHP.

### ***Air Coil Freeze Alarm (UPM Alarm)***

The TruVu WSHP monitors the status of an air coil freeze fault condition via the serial port (S1). The fault condition is determined by the Unit Protection Module (UPM) included on all WSHPs. The UPM monitors the heating liquid line refrigerant temperature and establishes a high-pressure fault if the temperature drops below 26°F (configurable on UPM) for 30 seconds. Upon fault a

5-minute break is initiated (soft lockout) and the compressor is disabled. The unit will automatically restart after this time period. If the fault occurs 2 times (configurable on UPM) within 60 minutes the UPM will put the unit into hard lockout requiring manual reset. Manual reset can be accomplished remotely when the UPM is configured for the reset method “Y” by remotely disabling the unit via the TruVu WSHP.

### ***Water Coil Freeze Alarm (UPM Alarm)***

The TruVu WSHP monitors the status of a water coil freeze fault condition via the serial port (S1). The fault condition is determined by the Unit Protection Module (UPM) included on all WSHPs. The UPM monitors the cooling liquid line refrigerant temperature and establishes a high-pressure fault if the temperature drops below 26°F (configurable on UPM) for 30 seconds. Upon fault a 5-minute break is initiated (soft lockout) and the compressor is disabled. The unit will automatically restart after this time period. If the fault occurs 2 times (configurable on UPM) within 60 minutes the UPM will put the unit into hard lockout requiring manual reset. Manual reset can be accomplished remotely when the UPM is configured for the reset method “Y” by remotely disabling the unit via the TruVu WSHP.

### ***Condensate Overflow Alarm (UPM Alarm)***

The TruVu WSHP monitors the status of a condensate overflow fault condition via the serial port (S1). The fault condition is determined by the Unit Protection Module (UPM) included on all WSHPs. The UPM monitors a condensate overflow switch and upon fault puts the unit in a hard lockout condition, disabling the compressor. The hard lockout condition requires manual reset. Manual reset can be accomplished remotely when the UPM is configured for the reset method “Y” by remotely disabling the unit via the TruVu WSHP.

### ***Brownout Alarm (UPM Alarm)***

The TruVu WSHP monitors the status of a brownout fault condition via the serial port (S1).

### ***Fire/Smoke Detector Alarm***

The control monitors the voltage input to J1-9 to detect if a smoke detector or fire detector NC contact has opened, indicating an alarm condition. The control verifies the presence of 24 vac on this input. If the input opens at any time, an alarm is generated after 3 seconds and the equipment (fan, compressor, aux heat, and damper) immediately shuts down.

### ***Space Temperature Alarms***

The control provides the ability to generate an alarm when the space temperature exceeds the alarm setpoint. A separate occupied hysteresis and fixed unoccupied high and low alarm setpoints are provided. The control provides a 5-minute alarm delay during unoccupied periods. During occupied periods, the control uses the occupied temperature setpoint and applies the hysteresis value to determine the alarm setpoints. When occupancy transitions from unoccupied to occupied or the occupied temperature setpoints are changed, causing an alarm condition to occur, the control automatically calculates an alarm delay (equivalent to the configured delay time in minutes/° F, multiplied by the temperature error, + 15 minutes). This prevents nuisance alarms when an occupancy change occurs and allows time for the unit to correct an alarming temperature condition.

### ***Source Water Temperature Alarm***

The control has 4 configurable alarm limits for source water temperature. The control verifies that the water temperature is within operating range (between high and low limits) for the specific operating mode (heating or cooling) before energizing the compressor. Once the compressor is started, the source water temperature is further monitored to verify that it is within limits to insure sufficient water is flowing through the coil. If the leaving water temperature rises above or falls below the appropriate limits, and lasts for more than 15 seconds, an alarm is generated and the compressor shuts down.



### ***Supply Air Temperature Alarm***

The control has 2 configurable alarm limits for supply air temperature. The control verifies that the supply air temperature is within operating range (between high and low limits) when the compressor or auxiliary heat is operating. If the air temperature rises above or falls below the appropriate limits, and this lasts for more than 5 minutes, an alarm is generated.

### ***Fan Status Alarm***

The control generates a fan status alarm if the fan status input detects the fan is OFF after any fan speed output has been enabled. A 30-second alarm delay is used to allow the fan to start operation before an alarm condition is detected. The control monitors the fan output and if the fan is operating at any speed, the fan status must detect the fan is operating.

### ***Compressor Status Alarm***

The control generates a compressor failure alarm if the compressor status input detects the compressor is OFF after the compressor output has been energized. A 6-minute alarm delay is used to allow the compressor to start (prevents alarms due to timeguard operation) before an alarm condition is detected. The control monitors the compressor output and if the compressor output is energized, the compressor status input must detect the compressor operation.

### ***Filter Status Alarm***

The control provides the ability to generate a dirty filter alarm after the number of fan run hours exceeds a configurable filter alarm timer limit. The control monitors the fan output and if the fan is operating at any speed, it accumulates run time. If the fan run time hours exceed the configurable limit, an alarm is generated. To reset the alarm timer after the alarm has been generated, a Reset Filter Alarm input is provided. You can disable the filter alarm by setting the Filter Alarm Timer Delay to 0 (factory default).

### ***Indoor Air Quality Alarm***

The control provides the ability to generate a high CO<sub>2</sub> level alarm during occupied periods when the CO<sub>2</sub> sensor value exceeds the adjustable limit. When a transition from unoccupied to occupied occurs, or the occupied alarm limit is changed to a value that causes an alarm condition to occur, the control will automatically calculate an alarm delay (equivalent to the configured delay time in minutes/ppm, times the error that occurred, + 15 minutes). This prevents nuisance alarms from occurring when occupancy changes or the setpoint is changed. You can disable the IAQ alarm by setting Occupied High IAQ Alarm Limit to 0.

### ***Relative Humidity Alarm***

The control provides the ability to generate an alarm when the space relative humidity exceeds the alarm setpoint. Separate occupied and unoccupied high humidity alarm setpoints are provided. The control provides a 5-minute alarm delay during unoccupied periods. During occupied periods, the controller uses the occupied high RH alarm limit. When an occupancy transition from unoccupied to occupied occurs, or the occupied high alarm limit is lowered, causing an alarm condition to occur, the control automatically calculates an alarm delay (equivalent to the configured delay time in minutes/% RH, times the humidity error condition that occurred, + 15 minutes). This prevents nuisance alarms when an occupancy change occurs and allows time for the unit to correct an alarming humidity condition.

### ***Source Water Linkage Failure Alarm (if Source Water Linkage was active)***

The control generates a Source Water Linkage failure alarm if Linkage fails after once being active. The Linkage status is monitored and if it fails to be updated from the Loop controller, then a Source Water Linkage alarm is generated. There is a 6-minute alarm delay to prevent false alarms.

NOTE: You can reset this alarm only by re-establishing Linkage and correcting the condition that caused the Linkage failure, or by momentarily setting the Shutdown point to Active.

### ***Airside Linkage Failure Alarm (if Airside Linkage was active)***

The control generates an Airside Linkage failure alarm if Linkage fails after once being active. The Linkage status is monitored and if it fails to be updated from the master zone controller, then an Airside Linkage alarm is generated. There is a 6-minute alarm delay to prevent false alarms.

NOTE: You can reset this alarm only by re-establishing Linkage and correcting the condition that caused the Linkage failure, or by momentarily setting the Shutdown point to Active.

### ***OAT Sensor Alarm (if Network OA Temperature was active)***

The control generates an OAT Sensor failure alarm if the value of OAT fails to be updated through the network after once being active. The update status is monitored and if it fails to be updated, then an OAT sensor alarm is generated. There is an alarm delay (approximately 1 hour) to prevent false alarms, while minimizing the required update rate for OAT.

NOTE: You can reset this alarm by momentarily setting the Shutdown point to Active.

### ***SPT Sensor Alarm (if SPT sensor was active)***

The control generates an SPT sensor failure alarm if the SPT sensor fails to communicate with the control for 5 minutes or greater. The update status is monitored and if it fails to be updated, then an SPT sensor alarm is generated.

### ***ZS Sensor Alarm (if ZS sensor was active)***

The control generates a ZS sensor failure alarm if the ZS sensor fails to communicate with the control for 5 minutes or greater. The update status is monitored and if it fails to be updated, then a ZS sensor alarm is generated.

### ***UPM Alarm - Hard lockout status***

The control generates Alarm when Hard lockout Alarm is active on UPM board. Configurable 2 or 4 soft lockout alarms on UPM board before unit enters to hard lock out. Soft lockout alarm history is available via controller.

### ***Low Water Flow Alarm***

The control monitors differential pressure switch (water flow switch), and generates alarm if water flow is not met.

### ***Air Side Delta T Alarm***

The control has 4 configurable alarm limits for Air Side Delta T.

The control verifies that the calculates delta T based on Return and Supply Air temperatures reading and verifies if it operates within configured ranged (between high and low limits) for the specific operating mode (heating or cooling) before energizing the compressor.

### ***Source Water Valve Alarm***

The control generates alarm if communication with Act Net device is lost.

### ***Water Side Delta T Alarm***

The control has 4 configurable alarm limits for Source water Delta T.

The control verifies that the calculates delta T based on Entering and Leaving water temperatures reading and verifies if it operates within configured ranged (between high and low limits) for the specific operating mode (heating or cooling) before energizing the compressor.

### ***Entering Water Temperature Alarm***

The control has 4 configurable alarm limits for Entering Water temperature.

The control verifies that the entering water temperature is within operating range (between high and low limits) for the specific operating mode (heating or cooling) before energizing the compressor. Once the compressor is started, the entering water temperature is further monitored to verify that it is within limits to insure sufficient water is flowing through the coil. If the entering water

temperature rises above or falls below the appropriate limits, and lasts for more than 15 seconds, an alarm is generated and the compressor shuts down.

***Return Air Temperature Alarm (if RAT sensor is field provided)***

The control has 2 configurable alarm limits for return air temperature. The control verifies that the return air temperature is within operating range (between high and low limits) when unit is operating. If the air temperature rises above or falls below the appropriate limits, and this lasts for more than 5 minutes, an alarm is generated.

## SERVICE

Perform the procedures outlined below periodically, as indicated. An annual “checkup” is recommended by a licensed refrigeration mechanic. Recording the performance measurements of volts, amps, and water temperature differences (both heating and cooling) is recommended. This data should be compared to the information on the unit’s data plate and the data taken at the original start-up of the equipment.

Periodic lockouts almost always are caused by air or water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur call a qualified technician immediately and have them check for water flow problems, water temperature problems, airflow problems or air temperature problems. Use of the pressure and temperature charts for the unit may be required to properly determine the cause.

## Jobsite Check

### CHECKS TO THE AREA

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the refrigerating system the following precautions shall be completed prior to conducting work on the system.

### WORK PROCEDURE

Work shall be undertaken under a controlled procedure to minimize the risk of a flammable gas or vapor being present while the work is being performed.

### GENERAL WORK AREA

All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.

### CHECKING FOR PRESENCE OF REFRIGERANT

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with R-454B refrigerant, i.e., non-sparking, adequately sealed or intrinsically safe.

### PRESENCE OF FIRE EXTINGUISHER

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO<sub>2</sub> fire extinguisher adjacent to the charging area.

### NO IGNITION SOURCES

No person carrying out work in relation to a refrigerating system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the possible ignition sources. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no

flammable hazards or ignition risks. “No Smoking” signs shall be displayed.

### VENTILATED AREA

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

#### **WARNING**

To avoid injury and the discharge of refrigerant into the environment, all refrigerant discharged from this unit must be recovered without exception. Technicians must follow industry accepted guidelines and all local, state and federal statutes for the recovery and disposal of refrigerants.

#### **WARNING**

To avoid injury and the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must only be serviced by technicians who meet local, state and federal proficiency requirements.

#### **WARNING**

To prevent injury or death due to electrical shock or contact with moving parts, lockout/tagout disconnect switch before servicing unit.

## Electrical Devices

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily repaired. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner so all parties are advised.

Initial safety checks shall include:

- that capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking;
- that no live electrical components and wiring are exposed while charging, recovering or purging the system;
- that there is continuity of earth bonding

## Repairs to Sealed Components

Sealed electrical components shall be replaced.

## Repair to Intrinsically Safe Components

Intrinsically safe components must be replaced.

## Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or other adverse environmental effects. During the check take into account the effects of aging or continual vibration from sources such as compressors or fans.

## Filters

Filter changes or cleanings are required at regular intervals. The time period between filter changes will depend upon type of environment the equipment is used in. In a single family home, that is not under construction, changing or cleaning the filter every 60 days may be sufficient. In other applications such as motels, where daily vacuuming produces a large amount of lint, filter changes may be needed to be as frequent as biweekly. See Fig. 2 and 3 for replacement filter sizes. Note that horizontal units

containing two filters are taped together at the factory to facilitate removal. This should be done by end user as new filters are installed.

**IMPORTANT:** Units should never be operated without a filter.

**⚠ CAUTION**

Equipment should never be used during construction or renovation due to possibility of contaminants entering the air coil of the equipment which permanently affects the performance and may shorten the life of the equipment.

## Condensate Drain Pans

The condensate drain should be checked quarterly by cleaning and flushing to ensure proper drainage.

## Refrigerant System

Verify air and water flow rates are at proper levels before servicing. To maintain sealed circuitry integrity, do not install service gages unless unit operation appears abnormal. Check to see that unit is within the superheat and subcooling temperature ranges shown in Tables 19-28. If the unit is not within these ranges, recover and reweigh in refrigerant charge.

### REFRIGERATING EQUIPMENT.

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines shall be followed.

The following checks shall be applied to installations using flammable refrigerants:

- the actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed;
- the ventilation machinery and outlets are operating adequately and are not obstructed;
- if an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant;
- signs on the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected;
- refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

### DETECTION OF FLAMMABLE REFRIGERANTS

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

The following leak detection methods are deemed acceptable for all refrigerant systems:

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL gas (25% maximum) and it is confirmed.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

NOTE: Examples of leak detection fluids are the bubble method and fluorescent dye method. If a leak is suspected, all naked

flames shall be removed/extinguished. If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.

## Compressor

**IMPORTANT:** When a compressor is removed from this unit, system refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, the refrigerant lines of the compressor must be sealed after it is removed.

Conduct annual amperage checks to ensure that amp draw is no more than 10% greater than indicated on the serial plate data.

## Fan Motors

All units have lubricated fan motors. Fan motors should never be lubricated unless obvious, dry operation is suspected. Periodic maintenance oiling is NOT recommended as it will result in dirt accumulating in the excess oil and cause eventual motor failure. Conduct annual dry operation check and amperage check to ensure amp draw is no more than 10% greater than indicated on serial plate data and remove any build up on the blower assembly.

## Condensate Drain Cleaning

Clean the drain line and unit drain pan at the start of each cooling season. Check flow by pouring water into drain. Be sure trap is filled to maintain an air seal.

## Air Coil Cleaning

Remove dirt and debris from evaporator coil as required by condition of the coil. A 10% solution of dishwasher detergent and water is recommended for cleaning both sides of the coil, followed by a thorough water rinse. Clean coil with a stiff brush, vacuum cleaner, or compressed air. Use a fin comb of the correct tooth spacing when straightening mashed or bent coil fins.

## Condenser Cleaning

Water-cooled condensers may require cleaning of scale (water deposits) due to improperly maintained closed-loop water systems. Sludge build-up may need to be cleaned in an open water tower system due to induced contaminants.

Local water conditions may cause excessive fouling or pitting of tubes. Condenser tubes should therefore be cleaned at least once a year, or more often if the water is contaminated.

Proper water treatment can minimize tube fouling and pitting. If such conditions are anticipated, water treatment analysis is recommended. Refer to the Carrier System Design Manual, Part 5, for general water conditioning information.

**⚠ CAUTION**

Follow all safety codes. Wear safety glasses and rubber gloves when using inhibited hydrochloric acid solution. Observe and follow acid manufacturer's instructions.

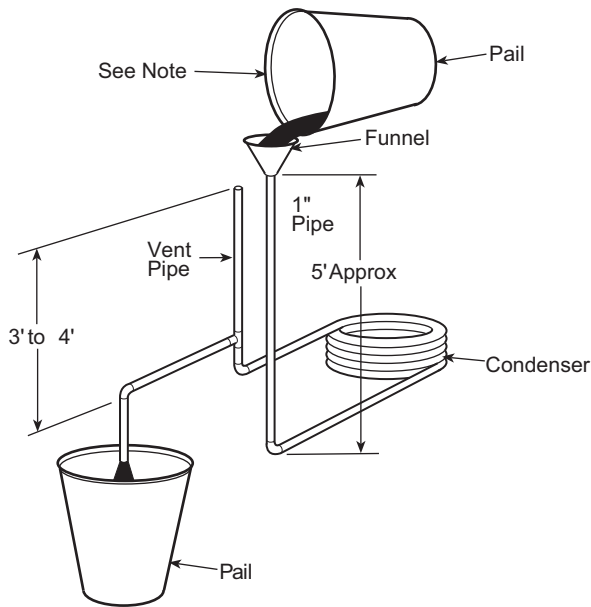
Clean condensers with an inhibited hydrochloric acid solution. The acid can stain hands and clothing, damage concrete, and, without inhibitor, damage steel. Cover surroundings to guard against splashing. Vapors from vent pipe are not harmful, but take care to prevent liquid from being carried over by the gases.

Warm solution acts faster, but cold solution is just as effective if applied for a longer period.

### GRAVITY FLOW METHOD

Do not add solution faster than vent can exhaust the generated gases.

When condenser is full, allow solution to remain overnight, then drain condenser and flush with clean water. Follow acid manufacturer's instructions (see Fig. 38).



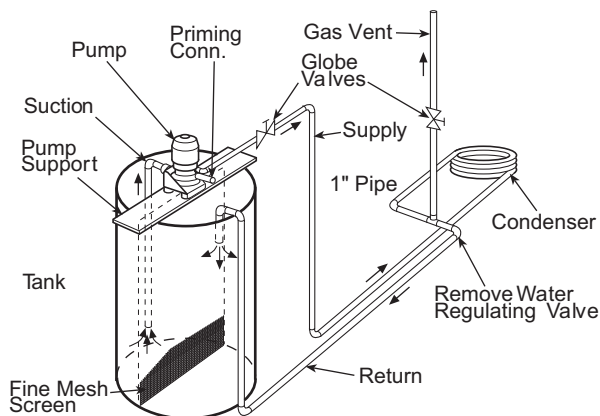
NOTE: Fill condenser with cleaning solution. Do not add solution more rapidly than vent can exhaust gases caused by chemical action.

**Fig. 38 — Gravity Flow Method**

#### FORCED CIRCULATION METHOD

Fully open vent pipe when filling condenser. The vent may be closed when condenser is full and pump is operating. See Fig. 39. Regulate flow to condenser with a supply line valve. If pump is a non-overloading type, the valve may be fully closed while pump is running.

For average scale deposit, allow solution to remain in condenser overnight. For heavy scale deposit, allow 24 hours. Drain condenser and flush with clean water. Follow acid manufacturer's instructions.



**Fig. 39 — Forced Circulation Method**

#### Removal and Evacuation

When breaking into the refrigerant circuit to make repairs, or for any other purpose, conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

- safely remove refrigerant following local and national regulations
- evacuate

- purge the circuit with inert gas (optional for A2L)
- evacuate (optional for A2L)
- continuously flush or purge with inert gas when using flame to open circuit; and
- open the circuit.

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process shall be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

#### Refrigerant Charging

##### **⚠ WARNING**

To prevent personal injury, wear safety glasses and gloves when handling refrigerant. Do not overcharge system — this can cause compressor flooding.

NOTE: Do not vent or depressurize unit refrigerant to atmosphere. Remove and recover refrigerant following accepted practices.

#### CHARGING PROCEDURES

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigerating system.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

#### RECOVERY

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (i.e., special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.

The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

### Blower Assembly Service and Removal

#### CAUTION

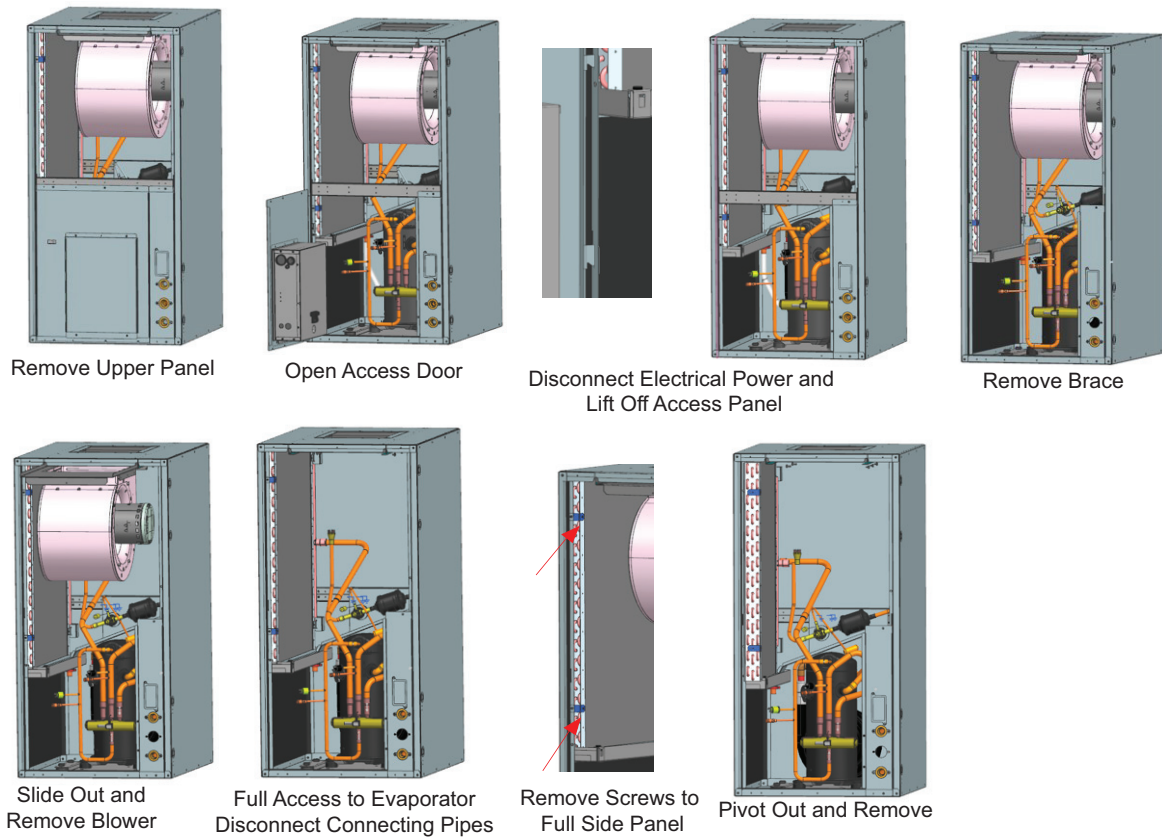
Before attempting to remove fan motors or motor mounts, place a piece of plywood over evaporator coils to prevent coil damage.

### Vertical Configuration Units

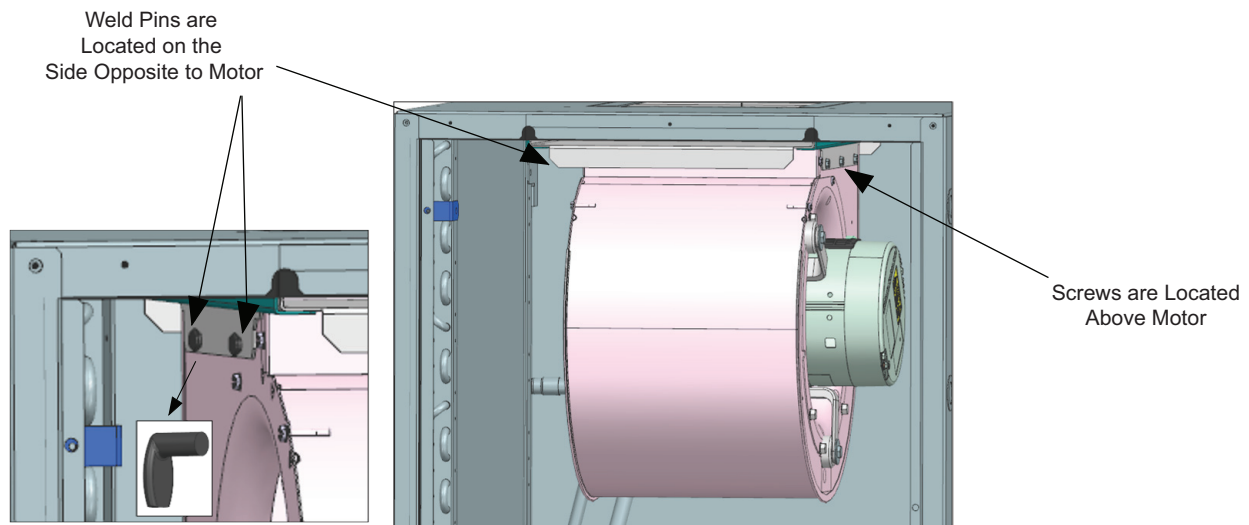
For the vertical configuration, the blower assembly is designed to slide out to facilitate access and servicing of the blower/motor assembly. If removal of the blower assembly is required, such as when installation constraints prevent the use of the slide-out feature, follow these steps:

1. Disconnect the motor power wires from the motor terminals before removing the motor from the unit.
2. Shut off the main power supply to the unit and apply lock-out/tag-out procedures.
3. Remove the three screws positioned above the motor. See Fig. 40 and.
4. Drop down and slide off the welded pins situated on the opposite side from the motor. See Fig. 41.

Ensure all steps are followed for safe and efficient removal of the blower assembly.



**Fig. 40 — Evaporator Coil Service on Vertical Units**



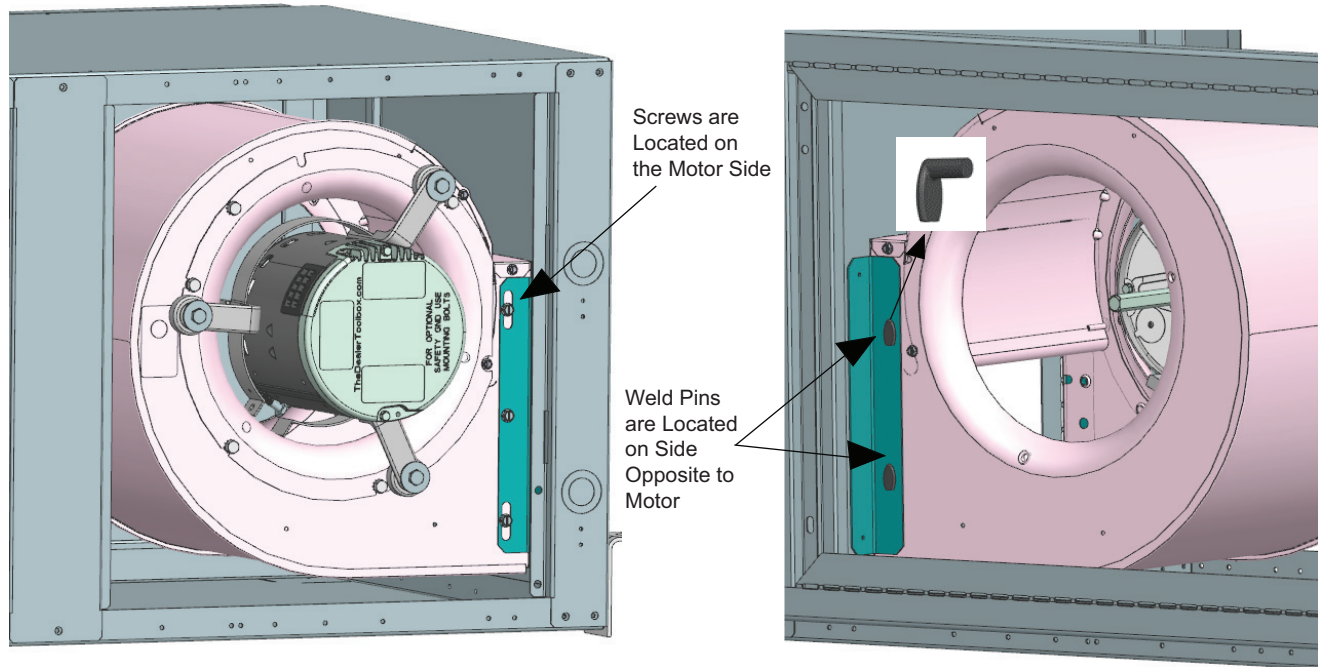
**Fig. 41 — Vertical Units Blower Assembly**

## Horizontal Configuration Units

For horizontal configurations, if removal of the blower assembly becomes necessary, follow these steps:

1. Disconnect the motor power wires from the motor terminals before removing the motor from the unit.
2. Shut off the main power supply to the unit and apply lock-out/tag-out procedures.
3. Remove the three screws located on the motor side of the blower assembly. See Fig. 42.
4. Twist and pull blower back from welded pins located on opposite side to the motor, near the evaporator. See Fig. 42.

Ensure all steps are followed for safe and efficient removal of the blower assembly.



**Fig. 42 — Horizontal Units Blower Assembly**



## Troubleshooting

When troubleshooting problems with a WSHP, consider the following:

### UNIT PROTECTION MODULE (UPM)

All Carrier WSHPs are equipped with a 24-v low voltage control circuit. Units are selectable to be provided with no controls for control via a field installed thermostat or third party DDC or to be provided with a factory installed Carrier i-Vu DDC for advanced equipment control and monitoring. Regardless of the selection all units will be equipped with a unit protection module. The UPM board should be one of the first areas to start with troubleshooting an equipment issue. See Fig. 21. Refer to Step 9 — “Configure Unit Control Components” on page 21, UPM Configuration and Alarms.

### Thermostatic Expansion Valves

Thermostatic expansion valves (TXV) are used as a means of metering the refrigerant through the evaporator to achieve a preset superheat at the TXV sensing bulb. Correct superheat of the refrigerant is important for the most efficient operation of the unit and for the life of the compressor. Refer to Fig. 43 for refrigerant diagram.

Packaged heat pumps typically use one bi-flow TXV to meter refrigerant in both modes of operation. When diagnosing possible TXV problems it may be helpful to reverse the refrigerant flow to assist with the diagnosis.

Geothermal and water source heat pumps are designed to operate through a wide range of entering-water temperatures that will have a direct effect on the unit refrigerant operating pressures. Therefore, diagnosing TXV problems can be difficult.

### TXV FAILURE

The most common failure mode of a TXV is when the valve fails while closed. Typically, a TXV uses spring pressure to close the valve and an opposing pressure, usually from a diaphragm, to open the valve. The amount of pressure exerted by the diaphragm will vary, depending on the pressure inside of the sensing bulb. As the temperature of and pressure within the bulb decreases, the valve will modulate closed and restrict the refrigerant flow through the valve. The result is less refrigerant in the evaporator and an increase in the superheat. As the temperature at the bulb increases the diaphragm pressure will increase, which opens the valve and allows more refrigerant flow and a reduction in the superheat.

If the sensing bulb, connecting capillary, or diaphragm assembly are damaged, pressure is lost and the spring will force the valve to a closed position. Often, the TXV will not close completely so some refrigerant flow will remain, even if there is inadequate flow for the heat pump to operate.

The TXV sensing bulb must be properly located, secured, and insulated as it will attempt to control the temperature of the line to which it is connected. The sensing bulb must be located on a dedicated suction line close to the compressor. On a packaged heat pump, the bulb may be located almost any place on the tube running from the compressor suction inlet to the reversing valve. If the bulb is located on a horizontal section, it should be placed in the 10:00 or 2:00 position for optimal performance.

### CAUTION

Use caution when tightening the strap. The strap must be tight enough to hold the bulb securely but caution must be taken not to over-tighten the strap, which could dent, bend, collapse or otherwise damage the bulb.

The bulb must be secured to the pipe using a copper strap. The use of heat transfer paste between the bulb and the pipe will also help ensure optimum performance.

The bulb must also be properly insulated to eliminate any influence on valve operation by the surrounding conditions. Cork tape is the recommended insulation as it can be molded tight to the bulb to prevent air infiltration.

### Causes of TXV Failure

The most common causes of TXV failure are:

1. A cracked, broken, or damaged sensing bulb or capillary can be caused by excessive vibration of the capillary during shipping or unit operation.  
If the sensing bulb is damaged or if the capillary is cracked or broken, the valve is considered failed and must be replaced. Replacement of the TXV “power head” or sensing bulb, capillary, diaphragm assembly is possible on some TXVs. The power head assembly screws onto most valves, but not all are intended to be replaceable. If the assembly is not replaceable, replace the entire valve.
2. Particulate debris within the system can be caused by several sources including contaminated components, tubing, and service tools, or improper techniques used during brazing operations and component replacement.  
Problems associated with particulate debris can be compounded by refrigerant systems that use POE (polyester oil). POE oil has solvent-like properties that will clean the interior surfaces of tubing and components. Particulates can be released from interior surfaces and may migrate to the TXV strainer, which can lead to plugging of the strainer.
3. Corrosive debris within the system may happen after a failure, such as a compressor burn out, if system was not properly cleaned.
4. Non-condensables may be present in the system. Non-condensables includes any substance other than the refrigerant or oil such as air, nitrogen, or water. Contamination can be the result of improper service techniques, use of contaminated components, and/or improper evacuation of the system.

### Symptoms

The symptoms of a failed TXV can be varied and will include one or more of the following:

- Low refrigerant suction pressure.
- High refrigerant superheat.
- High refrigerant subcooling.
- TXV and/or low pressure tubing frosting.
- Equalizer line condensing and at a lower temperature than the suction line or the equalizer line frosting.
- FP1 faults in the heating mode in combination with any of the symptoms listed above.
- FP2 faults in the cooling mode in combination with any of the symptoms listed above. Some symptoms can mimic a failed TXV but may actually be caused by another problem.

Before conducting an analysis for a failed TXV the following must be verified:

- Confirm that there is proper water flow and water temperature in the heating mode.
- Confirm that there is proper airflow and temperature in the cooling mode.
- Ensure coaxial water coil is clean on the inside; this applies to the heating mode and may require a scale check.
- Refrigerant may be undercharged. To verify, subcooling and superheat calculations may be required.

## Diagnostics

Several tests may be required to determine if a TXV has failed. The following tools may be required for testing:

1. Refrigerant gage manifold compatible with the refrigerant in the system.
2. Digital thermometer, preferably insulated, with wire leads that can be connected directly to the tubing.
3. Refrigerant pressure-temperature chart for the refrigerant used.

To determine that a TXV has failed, verify the following:

- The suction pressure is low and the valve is non-responsive.
- The TXV sensing bulb can be removed from the suction line and warmed by holding the bulb in your hand. This action should result in an increase in the suction pressure while the compressor is operating. The sensing bulb can also be chilled by immersion in ice water, which should result in a decrease in the suction pressure while the compressor is operating. No change in the suction pressure would indicate a nonresponsive valve.
- Simultaneous LOW suction pressure, HIGH refrigerant subcooling and HIGH superheat.
- LOW suction pressure, LOW subcooling and HIGH superheat may indicate an undercharge of refrigerant. HIGH subcooling and LOW superheat may indicate an overcharge of refrigerant. The suction pressure will usually be normal or high if there is an overcharge of refrigerant.
- LOW suction pressure and frosting of the valve and/or equalizer line may indicate a failed valve. However, these symptoms may also indicate an undercharge of refrigerant.

Calculate the subcooling and superheat to verify a failed valve or refrigerant charge issue.

## Repair

### ⚠ WARNING

Most TXVs are designed for a fixed superheat setting and are therefore considered non-adjustable. Removal of the bottom cap will not provide access for adjustment and can lead to damage to the valve or equipment, unintended venting of refrigerant, personal injury, or possibly death.

### ⚠ CAUTION

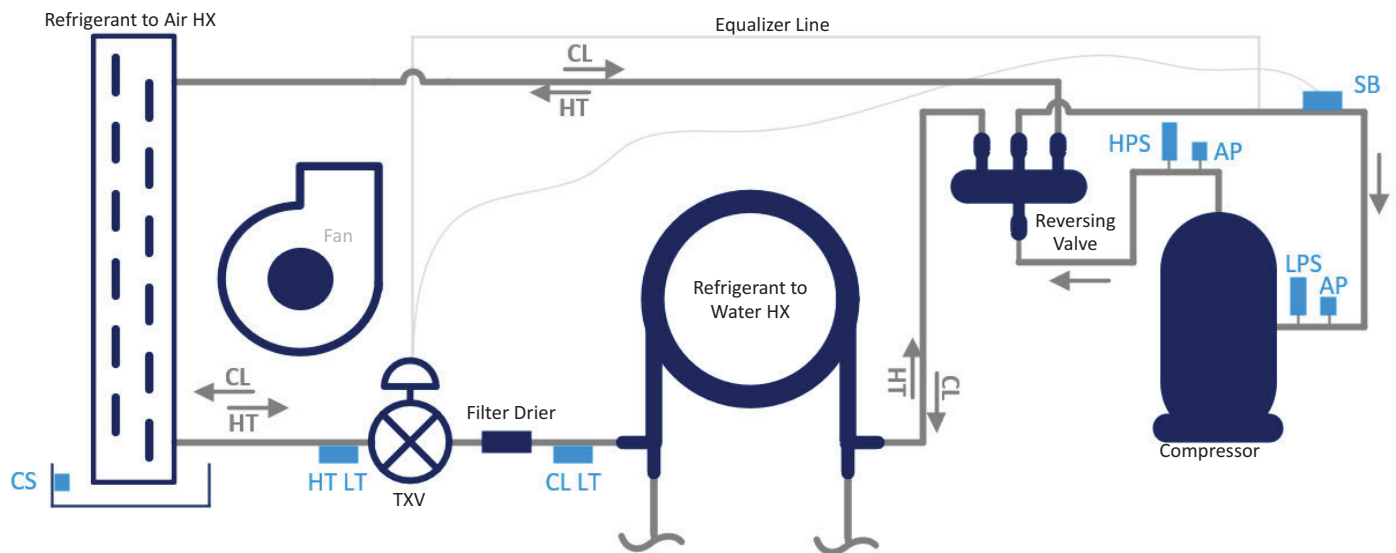
Always recover the refrigerant from the system with suitable approved tools, recovery equipment, and practices prior to attempting to remove or repair any TXV.

**IMPORTANT:** Repair of any sealed refrigerant system requires training in the use of refrigeration tools and procedures. Repair should only be attempted by a qualified service technician. A universal refrigerant handling certificate will be required. Local and/or state license or certificate may also be required.

### ⚠ CAUTION

Disconnect power from unit before removing or replacing connectors, or servicing motor. Wait 5 minutes after disconnecting power before opening motor.

Figure 43 illustrates the typical refrigerant diagram for 50WT units.



## LEGEND

- AP** — Access Port
- CL LT** — Cooling Liquid Line Temperature / Water Side Freeze 1
- CS** — Condensate Overflow Switch
- HT LT** — Heating Liquid Line Temperature / Air Coil Freeze 2
- HPS** — High Pressure Switch
- LPS** — Low Pressure Switch
- SB** — TXV Sensing Bulb

## NOTE(S):

1. Filter Drier only present on units equipped with scroll compressor 2 tons and up.
2. All Pilot and Equalizer Lines 1/4" OD.

**Fig. 43 — Typical Refrigerant Diagram - 50WT Units**

See Table 29 for compressor characteristics and Table 30 for additional troubleshooting information.

**Table 29 — Compressor Characteristics**

50WT MODEL	VOLTAGE CODE	COLD WINDING RESISTANCE VALUES (+/- 7%)					RUN CAPACITOR (μF/V)
		Single Phase		Three Phase			
		R-C	S-C	T1-T2	T2-T3	T3-T1	
24	208-230/1/60	1.07	1.65	—	—	—	30μF/370-v
	265/1/60	1.49	1.57	—	—	—	30μF/370-v
	208-230/3/60	—	—	1.412			—
	460/3/60	—	—	7.638	7.638	6.041	—
36	208-230/1/60	0.728	1.471	—	—	—	45μF/370-v
	265/1/60	0.96	1.39	—	—	—	45μF/370-v
	208-230/3/60	—	—	1.150			—
	460/3/60	—	—	4.484			—
48	208-230/1/60	0.436	1.660	—	—	—	40μF/440-v
	208-230/3/60	—	—	0.979			—
	460/3/60	—	—	3.907			—
60	208-230/1/60	0.349	1.394	—	—	—	40μF/440-v
	208-230/3/60	—	—	0.525	0.678	0.678	—
	460/3/60	—	—	0.864	3.165	3.165	—
70	208-230/1/60	0.329	1.398	—	—	—	55μF/440-v
	208-230/3/60	—	—	0.561			—
	460/3/60	—	—	2.549	3.11	2.549	—

**Table 30 — Troubleshooting**

FAULT	COOLING	HEATING	CHECK	POSSIBLE CAUSE	SOLUTION
No Compressor Operation but Fan Runs	X		Is Fault LED Blinking 1 time?	High Pressure Fault - No or Low Water Flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.
				High Pressure Fault - High Water Temperature	Check water temperature - is it in range?
				High Pressure Fault - Fouled or Scaled Water Coil	Check for proper flow rate and water temperature, but low waterside temp rise in cooling.
		X		High Pressure Fault - No or Low Airflow	Check fan motor for proper operation.
					Check air filter.
					Inspect air coil for dirt/debris.
	X		Is Fault LED Blinking 2 Times?	Low Pressure Fault - No or Low Airflow	Check ductwork - are dampers closed or blocked?
					Check fan motor for proper operation.
					Check air filter.
		X		Low Pressure Fault - Low Refrigerant	Inspect air coil for dirt/debris.
					Check ductwork - are dampers closed or blocked?
					Check refrigerant pressure with gage set.
		X	Is Fault LED Blinking 3 times?	Low Pressure Fault - No or Low Water Flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.
				Low Pressure Fault - Low Refrigerant	Check for proper flow rate and water temperature, but low waterside temp drop in heating.
				Freeze Fault, Water Coil - No or Low Water Flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.
		X	Is Fault LED Blinking 4 Times?	Freeze Fault - Low Water Temperature	Check water temperature - is it below 40°F entering? If heat pump is connected to a closed loop with antifreeze check that the "FREEZE 1" resistor on the UPM board has been cut to set the unit to antifreeze mode.
				Freeze Fault - Low Refrigerant	Check refrigerant pressure with gage set.
				Condensate Fault - Poor Drainage	Check condensate pan for high water level. Check drain line for blockages, double trapping or inadequate trapping.
	X	X	Is Fault LED Blinking 5 Times?	Condensate Fault - Blocked Return Air	Check condensate pan for high water level. Check air filter and return air ductwork for blockage. Check that there is adequate space between the return air opening and walls or other obstructions on free return applications.
				Brown Out Fault - Low Supply Voltage	Check primary voltage - ensure it is within the limits listed on the unit data plate.
				Brown Out Fault - Overloaded Control Circuit	Check control voltage - if it is below 18 V check accessories connected to the unit and ensure that they do not exceed the VA draw shown on page 21.
			Is Fault LED Blinking 6 Times?	Brown Out Fault - Bad Thermostat Connection	Check that thermostat wiring is proper gage and length, that it is not damaged and that all connections at the thermostat and heat pump are secure.
				Freeze Fault, Air Coil - No or Low Airflow	Check fan motor for proper operation.
					Check air filter.
	X		No fault LED - Contactor not Energized		Inspect air coil for dirt/debris.
				Check ductwork - are dampers closed or blocked?	
				Check that there is adequate space between the return air opening and walls or other obstructions on free return applications.	
			No fault LED - Contactor Energized	Freeze Fault, Air Coil - Low Refrigerant	Check refrigerant pressure with gage set.
Thermostat Not Calling for Compressor Operation				Ensure that the thermostat is on and calling for "Y".	
Bad Thermostat Connection				Check "Y" connection from thermostat. Ensure that there is 24 vac between "Y" and "C".	
X	X		Loose Wire To Contactor Coil	Check wiring - ensure that there is 24 vac across the contactor coil.	
			Burned Out Contactor Coil	Test contactor with 24 vac (between "R" and "C"). Ohm contactor coil - an open circuit indicates a burned coil.	
			Open Compressor Overload	Check for supply voltage at the load side of the contactor. For 3 phase models check phase rotation and voltage at all 3 phases.	
			Poor Wiring Connections	Look for signs of heat on the wiring insulation. Check that all wiring connections are secure and properly torqued.	
			Burned Out Compressor	Does compressor hum when power is applied? If not check the resistance of the compressor windings using the values shown in the compressor characteristics chart. Note that the compressor must be cool (70°F) when checking the windings.	
No Compressor or Fan Operation	X	X	Power LED On	Bad Thermostat Connection / Faulty Thermostat	Check thermostat and wiring. Check unit terminal block for 24 vac between "Y" and "C" and "G" and "C".
			Power LED Off	Low or No Supply Power	Ensure that the supply voltage to the unit is with in the range shown on the unit data plate.
				Faulty Control Transformer	Check for 24 vac between "R" and "C" on the unit terminal block. For 75 and 100 VA transformers, check that the transformer circuit breaker has not tripped. Check low voltage circuit for overload conditions or short circuits before replacing the transformer.

**Table 30 — Troubleshooting (cont)**

FAULT	COOLING	HEATING	CHECK	POSSIBLE CAUSE	SOLUTION
<b>No Fan Operation (constant airflow motor)</b>	X	X		No Fan Operation Signal	Check for 24 vac between "G" and "C". Check all wiring connections. Make sure that the thermostat connection plug is securely connected.
				Loose Wiring	Check all wiring connections at motor and control box. Check that power and control harnesses are securely connected.
				Interface Board Problems	Make sure that the interface board is not damaged and that all DIP switches are in the proper configuration (refer to the blower performance tables).
				Faulty Motor	Check supply voltage to the motor. Check that all motor wires are secure. Move the "TEST" DIP switch to "ON" and the other switches to "OFF" on the "ADJUST" switch block on the interface board - the motor should run at 70% torque when "G" is called. With power off spin the motor shaft - noise, resistance or uneven motion can be signs of motor failure.
<b>Unit Not Shifting into Cooling</b>	X		Reversing Valve Solenoid Energized	Faulty Solenoid	Check that the reversing valve solenoid is receiving 24 vac. If so, check the resistance of the solenoid - an open circuit may indicate a burned out solenoid.
			Reversing Valve Solenoid Not Energized	Miswired / Faulty Thermostat	Check that the reversing valve thermostat wire is connected to the "O" terminal of the thermostat. Check for a contact closure between "O" and "R".
				Loose Wire on "O" Terminal	Check that the wires from the thermostat to the unit are securely connected and that the wires from the electrical box to the reversing valve are connected.
<b>Excessively Cold Supply Air Temperature in Cooling or Excessively Hot Supply Air Temperature in Heating</b>	X	X	Reduced Airflow	Dirty Filter	Replace filter.
				Fan Speed Too Low	Consult blower performance table and increase fan speed if possible.
				Excessive Duct Pressure Drop	Consult blower performance table and increase fan speed if possible.
<b>Excessively Warm Supply Air Temperature in Cooling and/or Excessively Cool Air In Heating</b>	X	X	Airflow Too High	Fan Speed Setting Too High	Consult blower performance table and reduce fan speed if possible.
			High or Low Water Temperature	Inlet Water Temperature Out of Range	Check unit capacity vs. water temperature.
			Air Leakage	Leaky Ductwork	Inspect ductwork.
			Loss of Refrigeration Capacity	Low Refrigerant	Check refrigerant pressures with gage set.
<b>High Humidity</b>	X		Airflow Too High	Fan Speed Setting Too High	Consult blower performance table and reduce fan speed if possible.
			Loss of Refrigeration Capacity	Low Refrigerant	Check refrigerant pressures with gage set.
			Short Cycling	Unit Oversized	Check unit performance against building load calculations.
				Poor Thermostat Location	Make sure that thermostat is not located by a supply air duct.
<b>Objectionable Noise Levels</b>	X	X	Air Noise	Poor Ductwork/grille Design	Ensure ductwork and grilles are properly sized for unit airflow.
				Fan Speed Setting Too High	Consult blower performance table and reduce fan speed if possible.
			Structure Borne Noise	Unit Not Mounted on Full Vibration Pad	Mount unit on a vibration pad.
				Unit Not Connected with Flexible Conduit, Water Lines and/or Ductwork	Install unit in accordance with instructions.
	X		Compressor Noise	Unit Cabinet Touching Wall or Other Building Component	Adjust unit location to avoid unit touching structure.
				High Water Temperature or Low Water Flow Rate Elevating Head Pressure	Increase water flow rate and/or reduce water temperature if possible.
				Scaled or Fouled Water Coil Elevating Heat Pressure	Clean/descale water coil.
		X		Low Airflow Elevating Head Pressure	Check filter. Increase fan speed.
	X	X	Water Hammer	Fast Closing Valves Installed	Change valves to slow-close type.

## 50WT START-UP CHECKLIST

(Remove and use for job file.)

**NOTE: To avoid injury to personnel and damage to equipment or property when completing the procedures listed in this start-up checklist, use good judgment, follow safe practices, and adhere to the safety considerations/information as outlined in preceding sections of this Installation, Start-Up, and Service Instructions document.**

CUSTOMER: \_\_\_\_\_ JOB NAME: \_\_\_\_\_

MODEL NO.: \_\_\_\_\_ SERIAL NO.: \_\_\_\_\_ DATE: \_\_\_\_\_

### I. PRE-START-UP

Does the unit voltage correspond with the supply voltage available? (Y/N) \_\_\_\_\_

Have the power and control wiring connections been made and terminals tight? (Y/N) \_\_\_\_\_

Have water connections been made and is fluid available at heat exchanger? (Y/N) \_\_\_\_\_

Has pump been turned on and are isolation valves open? (Y/N) \_\_\_\_\_

Has condensate connection been made and is a trap installed? (Y/N) \_\_\_\_\_

Is an air filter installed? (Y/N) \_\_\_\_\_

### II. START-UP

Is fan operating when compressor operates? (Y/N) \_\_\_\_\_

If 3-phase scroll compressor is present, verify proper rotation per instructions. (Y/N) \_\_\_\_\_

#### UNIT VOLTAGE — COOLING OPERATION

Phase AB Volts \_\_\_\_\_ Phase BC Volts \_\_\_\_\_ (if 3 phase) Phase CA Volts \_\_\_\_\_ (if 3 phase)

Phase AB Amps \_\_\_\_\_ Phase BC Amps \_\_\_\_\_ (if 3 phase) Phase CA Amps \_\_\_\_\_ (if 3 phase)

#### CONTROL VOLTAGE

Is control voltage above 21.6 volts? (Y/N) \_\_\_\_\_.

If not, check for proper transformer connection.

#### TEMPERATURES

Fill in the analysis chart attached.

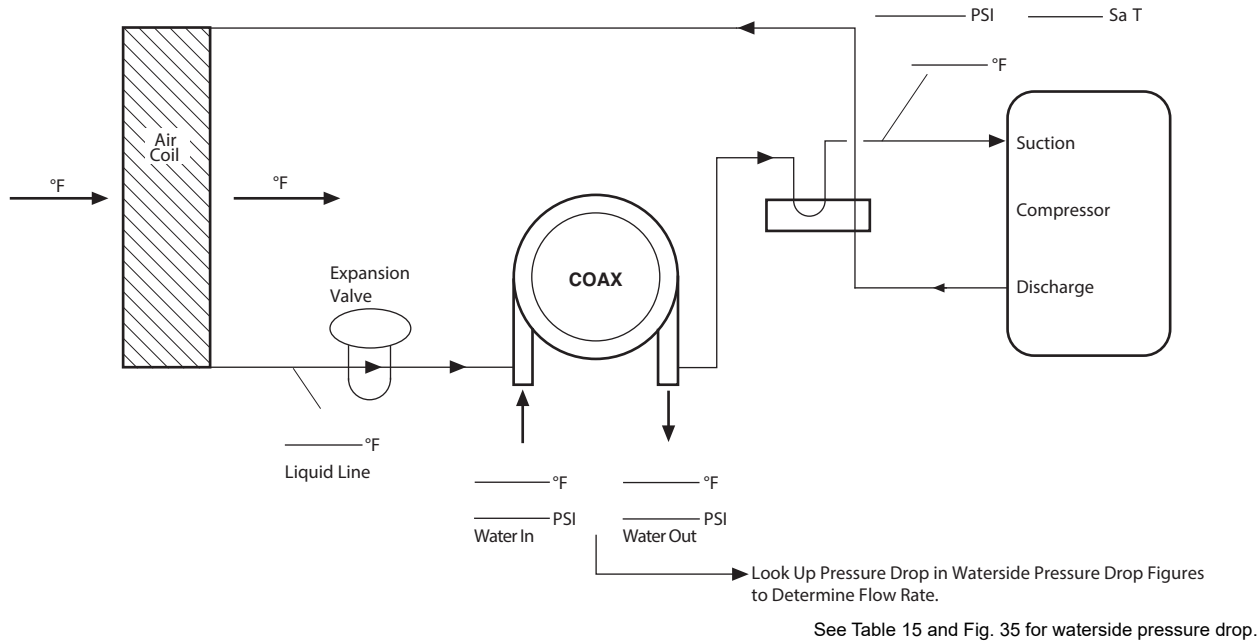
COAXIAL HEAT EXCHANGER COOLING CYCLE:  
FLUID IN \_\_\_\_\_ F FLUID OUT \_\_\_\_\_ F \_\_\_\_\_ PSI \_\_\_\_\_ FLOW

HEATING CYCLE:  
FLUID IN \_\_\_\_\_ F FLUID OUT \_\_\_\_\_ F \_\_\_\_\_ PSI \_\_\_\_\_ FLOW

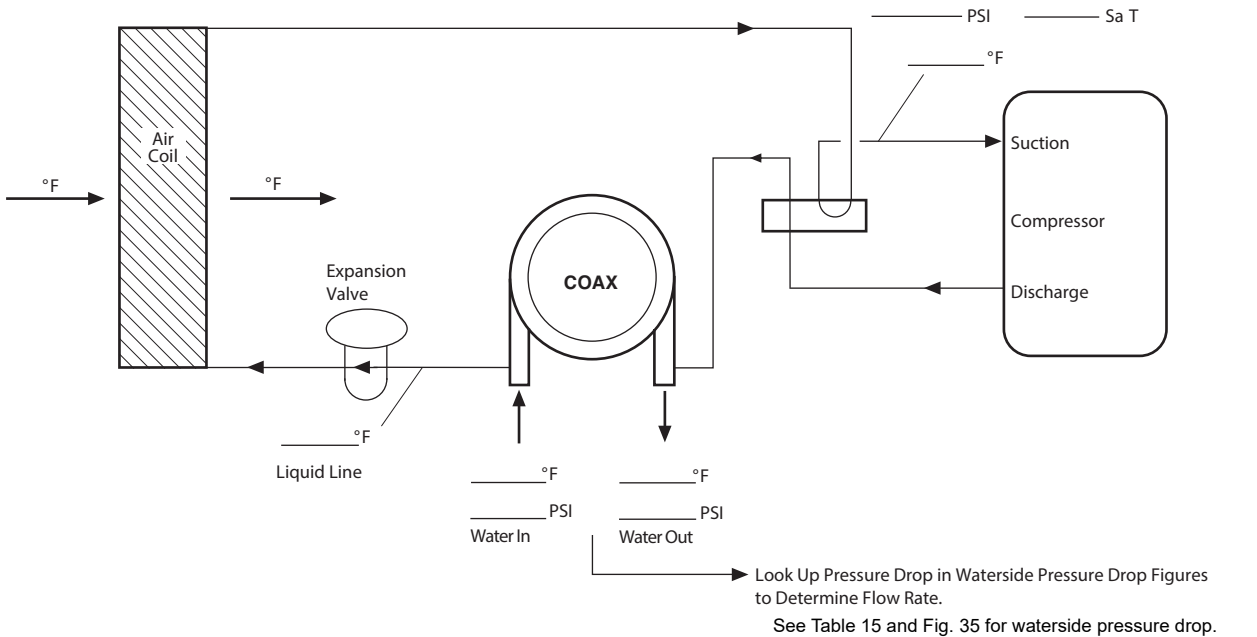
AIR COIL COOLING CYCLE:  
AIR IN \_\_\_\_\_ F AIR OUT \_\_\_\_\_ F

HEATING CYCLE:  
AIR IN \_\_\_\_\_ F AIR OUT \_\_\_\_\_ F

HEATING CYCLE ANALYSIS



COOLING CYCLE ANALYSIS



HEAT OF EXTRACTION (ABSORPTION) OR HEAT OF REJECTION =

\_\_\_\_\_ FLOW RATE (GPM) x \_\_\_\_\_ TEMP. DIFF. (°F) x \_\_\_\_\_ FLUID FACTOR\* = \_\_\_\_\_ (Btu/hr)

SUPERHEAT = SUCTION TEMPERATURE – SUCTION SATURATION TEMPERATURE  
= \_\_\_\_\_ (°F)

SUBCOOLING = DISCHARGE SATURATION TEMPERATURE – LIQUID LINE TEMPERATURE  
= \_\_\_\_\_ (°F)

\*Use 500 for water, 485 for antifreeze.