BRIDGEPORT RESCUE MISSION

(JOEL SMILOW)

O&M HVAC DOCUMENTS
Job 4929

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Installation and Maintenance Manual

IM 1125-10

Group: **Applied Air Systems**
Part Number: **IM 1125**
Date: **August 2019**

Rebel® Commercial Packaged Rooftop Systems

Heating and Cooling
Models DPS003 – 028A
R-410A Refrigerant
MicroTech® III Unit Controller
Energy Recovery Wheel

3–6 tons

7–15 tons
Shown with Energy Recovery

16–28 tons
Shown with Energy Recovery

DAIKIN

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General Information

This manual provides general information about the "A" vintage Daikin Rebel Commercial Packaged Rooftop Unit, model DPS. In addition to an overall description of the unit, it includes mechanical and electrical installation procedures, commissioning procedures, sequence of operation information, and maintenance instructions.

The MicroTech® III rooftop unit controller is equipped on "A" vintage rooftop units. For a detailed description of the MicroTech III components, input/output configurations, field wiring options and requirements, and service procedures, see OM 1141. For operation and information on using and programming the MicroTech III unit controller, refer to the appropriate operation manual (see Table 1).

For a description of operation and information on using the keypad to view data and set parameters, refer to the appropriate program-specific operation manual (see Table 1).

Table 1: Program Specific Unit Operation Literature

Rooftop unit control configuration	Manual bulletin number
Rebel Quick Start Guide	OM 1164
DPS Unit Controller Discharge Air Control (VAV or CAV) Space Comfort Control (SCC)	OM 1141
Rooftop and Self Contained Unit Controller Protocol	ED 15112

Unit Nameplate

The unit nameplate is located on the outside of the main control box door. It includes the unit model number, serial number, electrical characteristics, and refrigerant charge.

Hazard Identification Information

⚠ DANGER

Dangers indicate a hazardous situation which will result in death or serious injury if not avoided.

⚠ WARNING

Warnings indicate potentially hazardous situations, which can result in property damage, severe personal injury, or death if not avoided.

⚠ CAUTION

Cautions indicate potentially hazardous situations, which can result in personal injury or equipment damage if not avoided.

⚠ WARNING

Warning indicates potentially hazardous situations for PVC (Polyvinyl Chloride) and CPVC (Clorinated Polyvinyl Chloride) piping in chilled water systems. In the event the pipe is exposed to POE (Polyolester) oil used in the refrigerant system, the pipe can be chemically damaged and pipe failure can occur.

Nomenclature (DPS 003–028)

DPS – 010 – A H H G 4

Daikin Packaged System

Nominal capacity

003 = 3 tons
004 = 4 tons
005 = 5 tons
006 = 6 tons
007 = 7.5 tons
010 = 10 tons
012 = 12 tons
015 = 15 tons
016 = 16 tons
018 = 18 tons
020 = 20 tons
025 = 25 tons
028 = 28 tons

Design vintage

A = Vintage 1

Cooling efficiency

H = High (exceeds ASHRAE 92)

Unit style

C = Cooling only
H = Heat pump (3–20 ton only)-
M = Cooling-only microchannel

Heat medium

Y = None (cooling only)
G = Natural gas heat
E = Electric heat
W = Hot water heat

Line voltage

2 = 208 volt power supply
3 = 230 volt power supply
4 = 460 volt power supply
5 = 575 volt power supply

Installer Responsibilities

⚠ CAUTION

Sharp edges on sheet metal and fasteners can cause personal injury. This equipment must be installed, operated, and serviced only by an experienced installation company and fully trained personnel.

The installation of this equipment shall be in accordance with the regulations of authorities having jurisdiction and all applicable codes. It is the responsibility of the installer to determine and follow the applicable codes.

Receiving Inspection

When the equipment is received, all items should be carefully checked against the bill of lading to be sure all crates and cartons have been received. **If the unit has become dirty during shipment (winter road chemicals are of particular concern), clean it when received.**

All units should be carefully inspected for damage when received. Report all shipping damage to the carrier and file a claim. In most cases, equipment is shipped F.O.B. factory and claims for freight damage should be filed by the consignee.

Before unloading the unit, check the unit nameplate to make sure the voltage complies with the power supply available.

Service Clearance

⚠ CAUTION

Location. Care should be taken for the installation location to minimize snow drifts on the outdoor coil.

Allow service clearances as approximately indicated in Figure 1. Also, Daikin recommends providing a roof walkway to the rooftop unit as well as along each side of the unit that provides access to most controls and serviceable components.

Refer to NEC and local for minimum clearances around the unit and control panel.

Reasons for clearance:

1. Door swings – all hinged access doors need space to freely swing to accomodate standard service, such as filter replacement
2. Components pulls – on the off chance a component such as an energy recovery wheel fails, space to the side of the unit to allow for full removal will be required
3. Condenser flow – packaged equipment reject heat via proper airflow pulled across the condenser coil. If airflow is is restricted, the unit may not operate properly
4. Air recirculation – whether it is the building exhaust or gas burner flue, there is a reqired clearance to allow those undesired airstreams from aproaching the outdoor intake
5. Pertinant codes – whether it is anelectrical or other code, many manicipalities dictate minimum clearances around powered devices.

Ventilation Clearance

Below are minimum ventilation clearance recommendations. The system designer must consider each application and provide adequate ventilation. If this is not done, the unit may not perform properly.

Unit(s) Surrounded by a Screen or a Fence:

1. The bottom of the screen or fence should be at least 1 ft. (305 mm) above the roof surface.
2. The distance between the unit and a screen or fence should be as described in Figure 1.
3. The distance between any two units within a screen or fence should be at least 120" (3048 mm).

Unit(s) Surrounded by Solid Walls:

1. If there are walls on one or two adjacent sides of the unit, the walls may be any height. If there are walls on more than two adjacent sides of the unit, the walls should not be higher than the unit.
2. The distance between the unit and the wall should be at least 96" (2438 mm) on all sides of the unit.
3. The distance between any two units within the walls should be at least 120" (3048 mm).

Do not locate outside air intakes near sources of contaminated air.

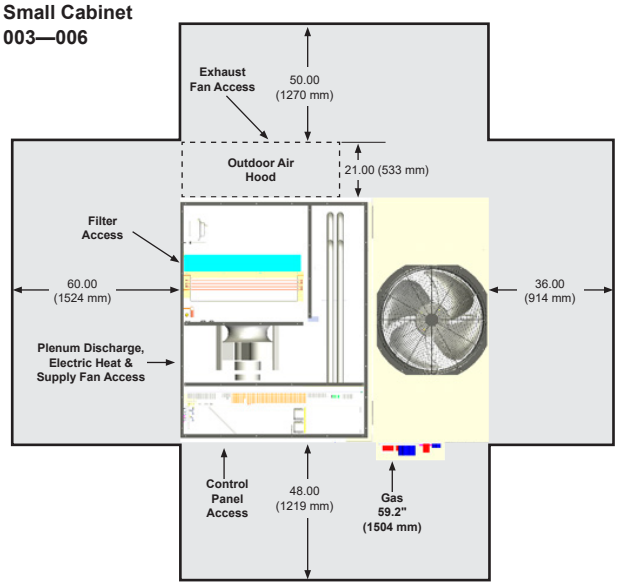
If the unit is installed where windy conditions are common, install wind screens around the unit, maintaining the clearances specified (see Figure 1). This is particularly important to maintain adequate head pressure control when mechanical cooling is required at low outdoor air temperatures.

Overhead Clearance

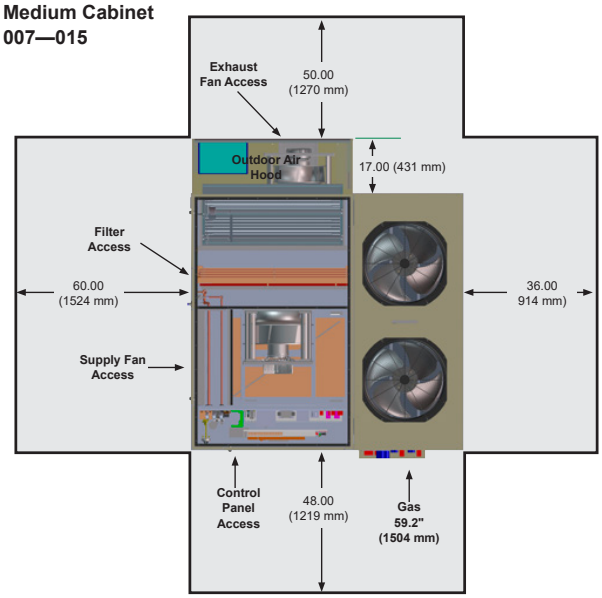
1. Unit(s) surrounded by screens or solid walls must have no overhead obstructions over any part of the unit. For heat pump models overhead obstructions could allow the formation of dangerous icicles.
2. The area above the condenser must be unobstructed in all installations to allow vertical air discharge.
3. The following restrictions must be observed for overhead obstructions above the air handler section:
   a. There must be no overhead obstructions above the furnace flue, or within 9" (229 mm) of the flue box.
   b. Overhead obstructions must be no less than 96" (2438 mm) above the top of the unit.
   c. There must be no overhead obstructions in the areas above the outside air and exhaust dampers that are farther than 24" (610 mm) from the side of the unit.

Figure 1: Service Clearances

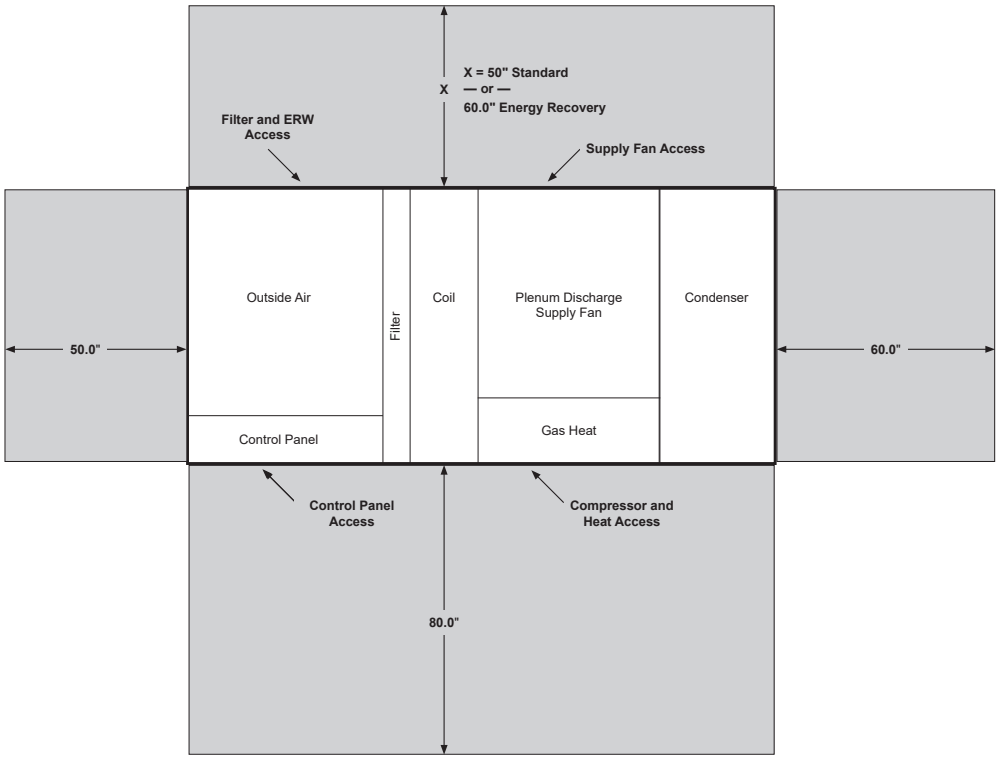
Small Cabinet
003—006



Medium Cabinet
007—015



Large Cabinet
016—028



Steel Rail Installation

Rebel units may be mounted directly on steel support beams. Verify that the structure has the ability to properly support the weight of the unit. Support must be around the entire perimeter of the air handling section with the base of the unit centered and compltely supported.

Local installers have the descresion, if they wish, to support the condenser section or allow it to be cantilever-mounted on Rebels DPS 003 – 015. Rebel units DPS 016 – 028 must be supported for the entire base perimeter including the condenser section.

Daikin does allow welding of the base of the unit directly to the structural steel supports.

Roof Curb Assembly and Installation

⚠ WARNING

Mold can cause personal injury. Some materials such as gypsum wall board can promote mold growth when damp. Such materials must be protected from moisture that can enter units during maintenance or normal operation.

Locate the roof curb and unit on a portion of the roof that can support the weight of the unit. The unit must be supported to prevent bending or twisting of the machine.

If building construction allows sound and vibration into the occupied space, locate the unit over a non-critical area. It is the responsibility of the system designer to make adequate provisions for noise and vibration in the occupied space.

Install the curb and unit level to allow the condensate drain to flow properly and allow service access doors to open and close without binding.

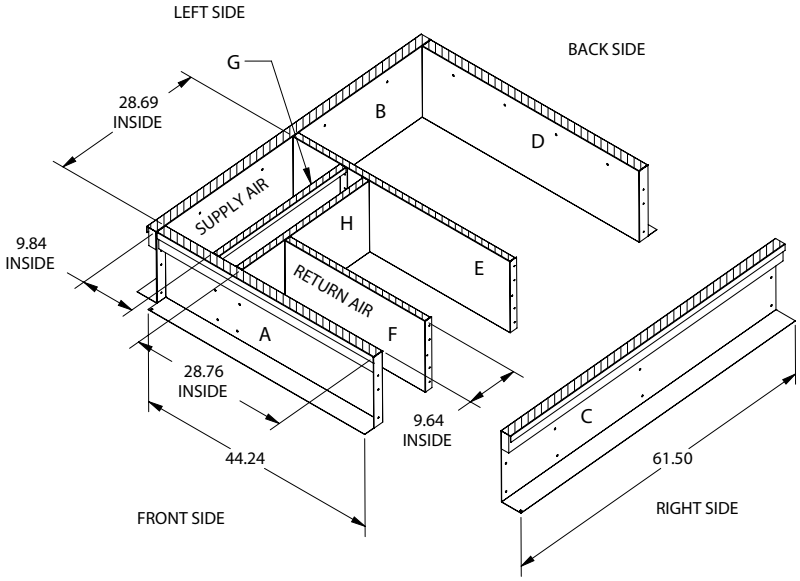
The gasketed top surface of the curb seals against the unit when it is set on the curb. These flanges must not support the total weight of the duct work. See Installing Ductwork on page 15 for details on duct connections. It is critical that the condensate drain side of the unit be no higher than the opposite side.

Assembly Instructions

Assembly of a typical roof curb is shown in Figure 2, Figure 3 on page 8 and Figure 4 on page 9.

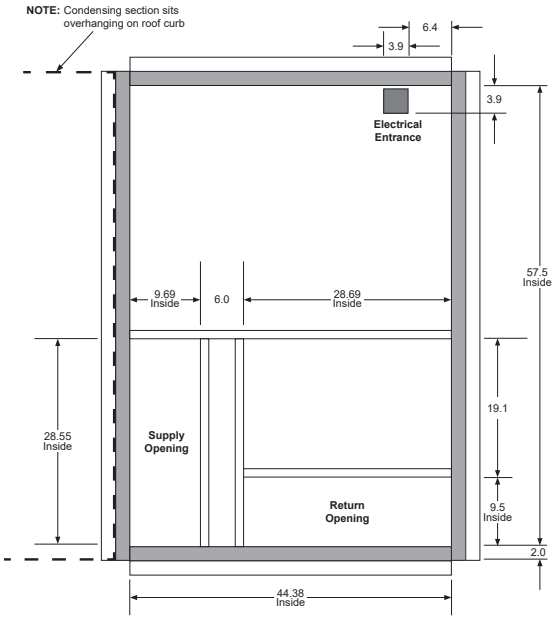
1. Set curbing parts A thru G per dimensions shown over roof opening or on a level surface. Note location of supply air opening. Check alignment of all mating screw holes.
2. Screw curbing parts together using fasteners provided. Leave all screws loose until curb is checked to be square.
3. Square entire curbing assembly and securely tighten all screws.
4. Position curb assembly over roof openings. Curb must be level within 0.25 inches from side to side and 1.50 inches over its length. Check that top surface of curb is flat with no bowing or sagging.
5. Weld curb assembly in place. Caulk all seams watertight. Remove backing from 0.25 × 1.50 wide gasket and apply to surfaces shown by crosshatching.
6. Check that electrical connections are coordinated and installed in accordance with all applicable local and NEC codes.

Figure 2: Roof Curb Assembly (DPS 003—006)[1]



NOTE: 1. Check submittal drawing for gas/water/electrical/supply/return air opening
2. Horizontal above the roof gas connection only
3. All dimensions in inches

Standard Roof Curb – Small Cabinet



Roof Curb for ERW – Small Cabinet

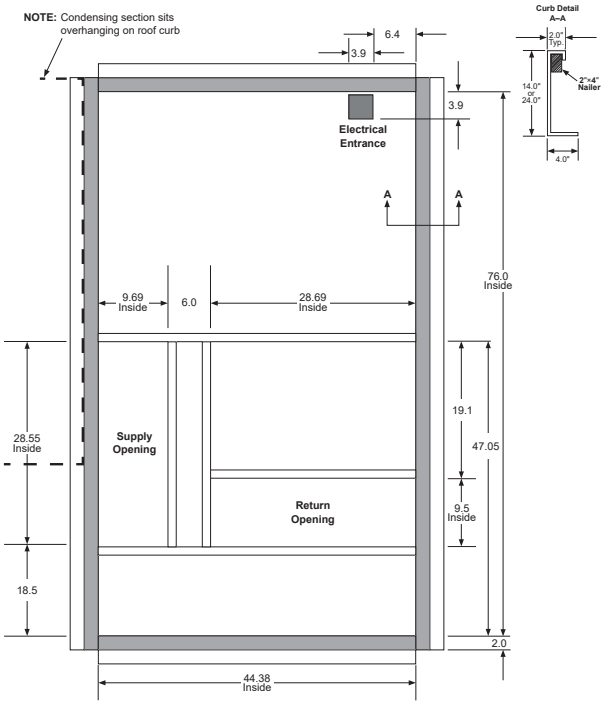
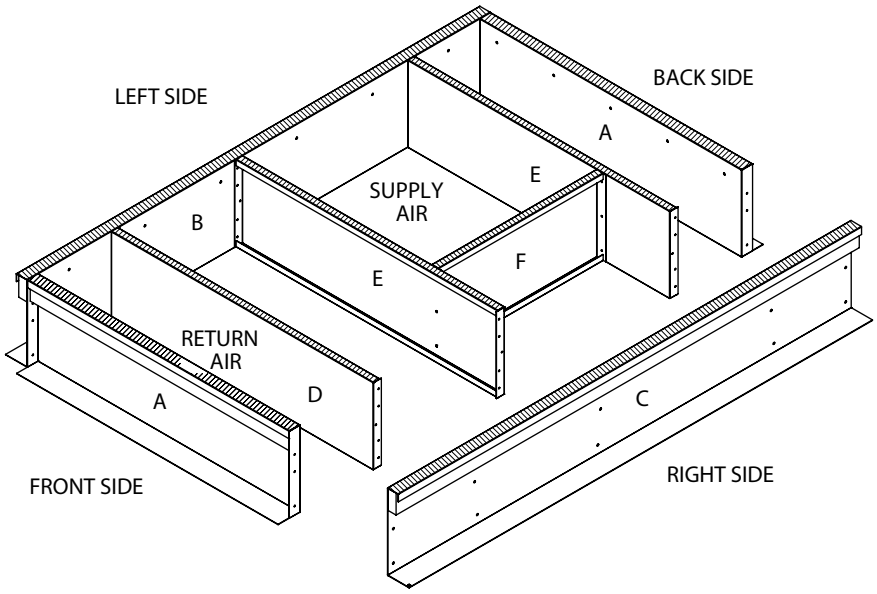
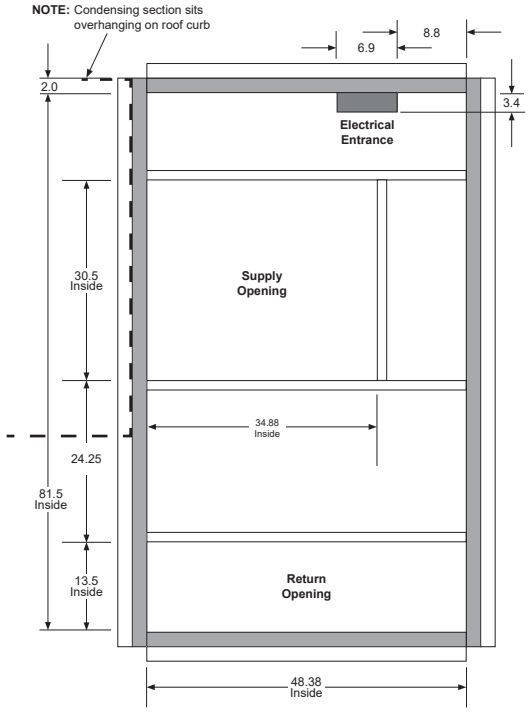


Figure 3: Roof Curb Assembly (DPS 007–015)[1]



NOTE: 1. Check submittal drawing for gas/water/electrical/supply/return air opening
2. Horizontal above the roof gas connection only
3. All dimensions in inches

Standard Roof Curb – Medium Cabinet



Roof Curb for ERW – Medium Cabinet

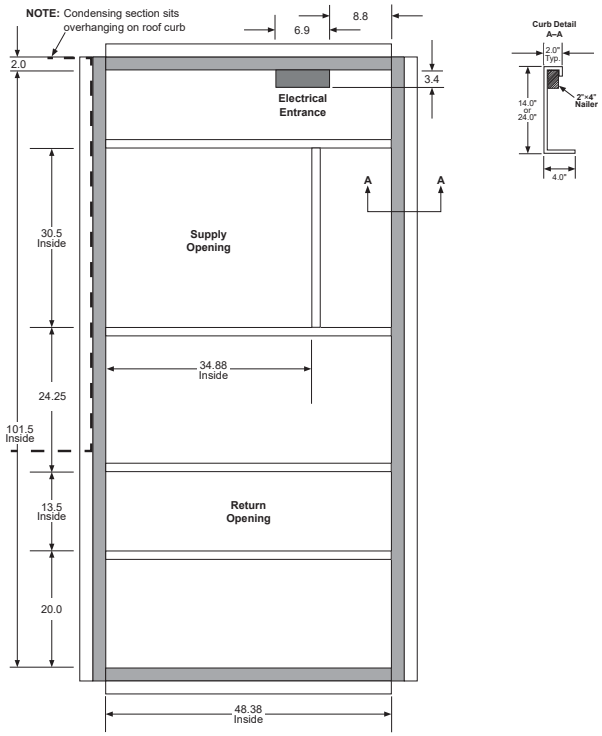
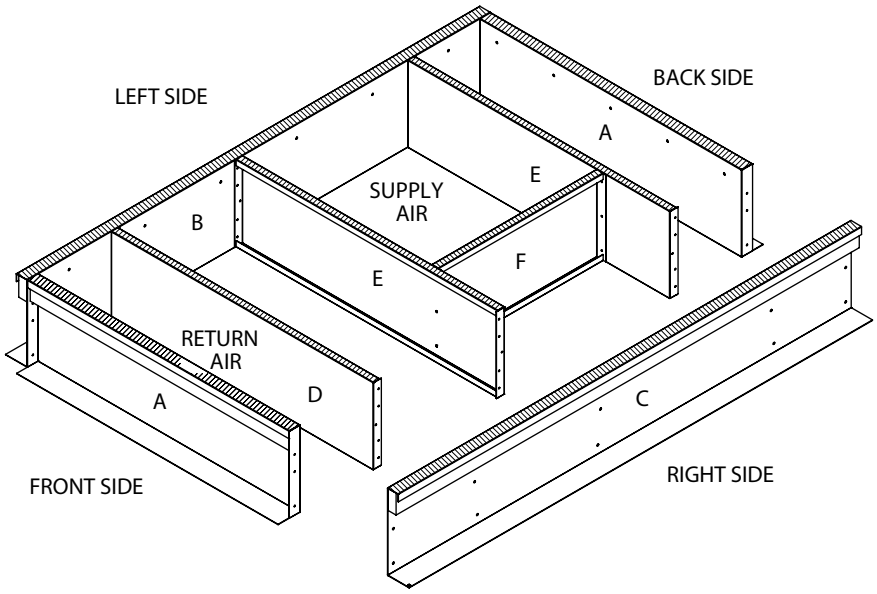
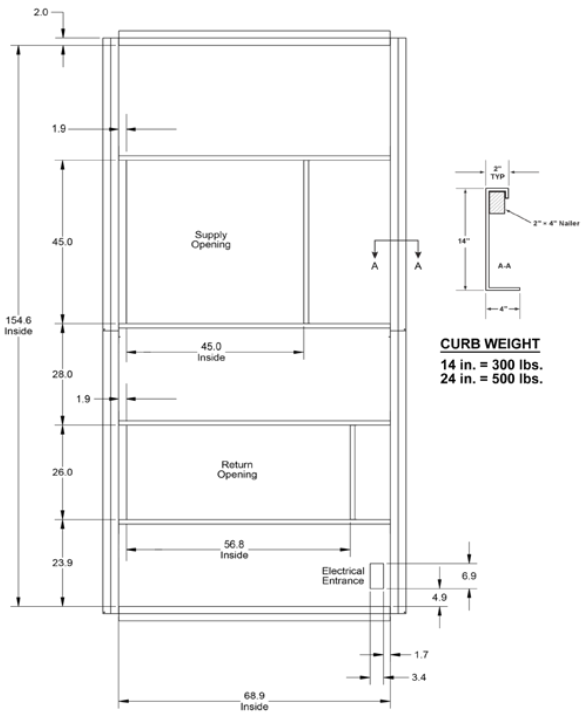


Figure 4: Roof Curb Assembly (DPS 016–028)[1]



NOTE: 1. Check submittal drawing for gas/water/electrical/supply/return air opening
2. Horizontal above the roof gas connection only
3. All dimensions in inches

Standard Roof Curb – Large Cabinet



Roof Curb for ERW – Large Cabinet

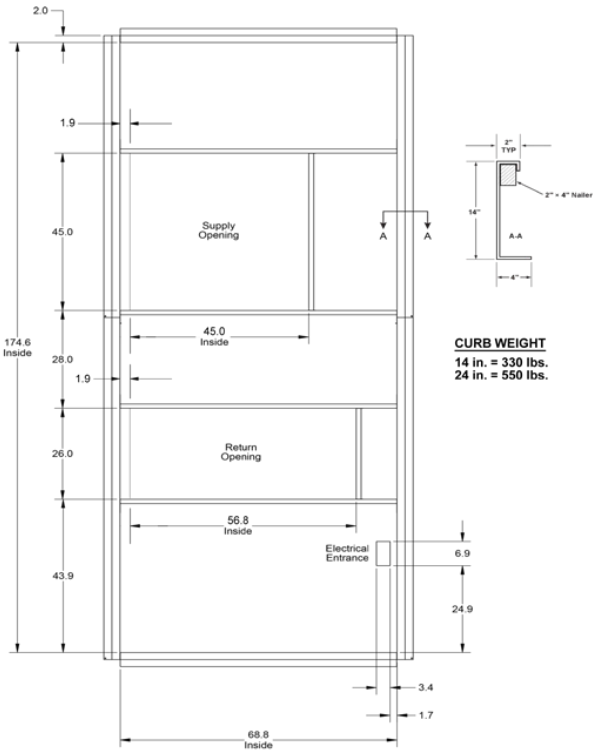
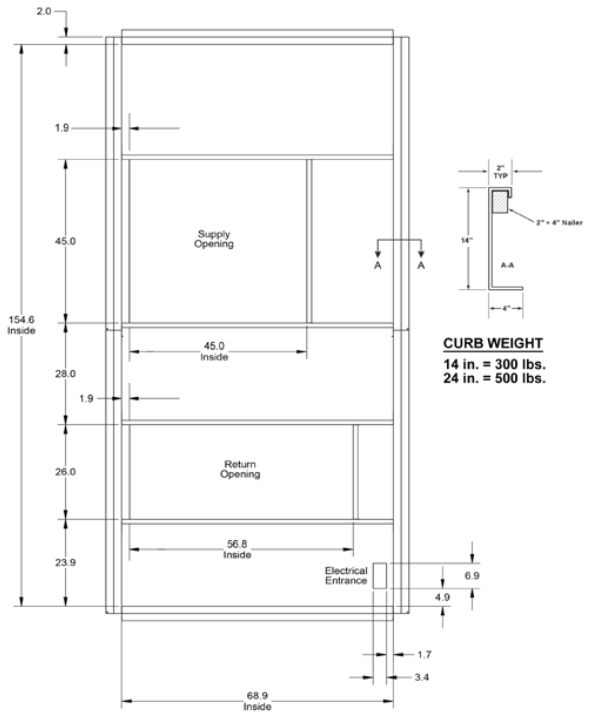
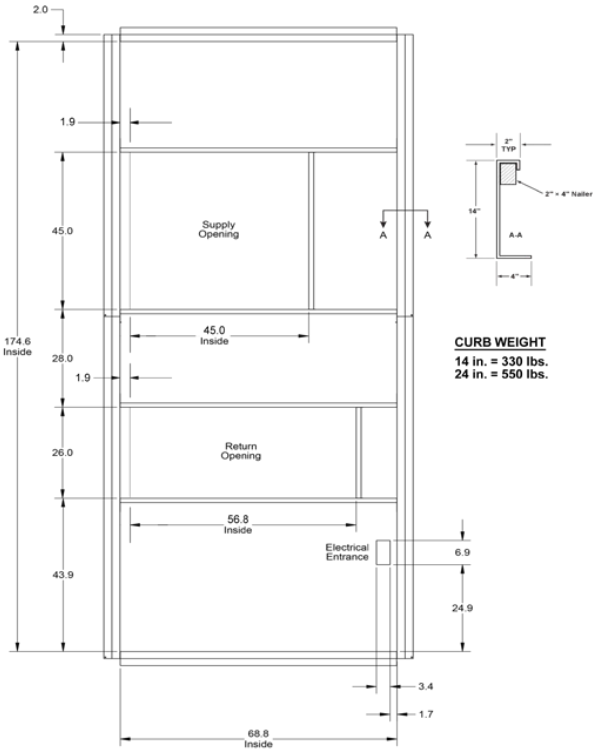


Figure 5: Roof Curb Assembly (DPS 007, 011, 015—021) with CORE ERV

CORE Roof Curb – Medium Cabinet (DPS 007 – 015)



CORE Roof Curb – Large Cabinet (DPS 016 – 028)



Rigging and Handling

⚠ WARNING

Only trained and qualified personnel should be allowed to rig loads or operate load rated cranes and/or hoist assemblies. Do not use a forklift to lift or maneuver the unit. Failure to use a load rated crane or hoist assembly to lift or maneuver the unit can cause severe personal injury and property damage.

⚠ WARNING

Use all lifting points. Improper lifting can cause property damage, severe personal injury, or death.

⚠ CAUTION

Lifting points may not be symmetrical to the center of gravity of the unit. Ballast or unequal cable lengths may be required.

⚠ CAUTION

Unit is equipped with fork slot reenforcement pieces. These need to be removed before unit is set on the curb.

Rigging holes for shackles are integral on the unit base. **Use four independent lines, securing one end of a line to a unit base lifting point and the other end of the line to an associated spreader bar lifting point**. Figure 6 and Figure 7 are examples of instruction labels shipped with each unit.

Use spreader bars to prevent damage to the unit cabinet. Avoid twisting or uneven lifting of the unit. The cable length from the bracket to the hook should always be longer than the distance between the outer lifting points.

If the unit is stored at the construction site for an intermediate period, take these additional precautions:

1. Support the unit well along the length of the base rail.
2. Level the unit (no twists or uneven ground surface).
3. Provide proper drainage around the unit to prevent flooding of the equipment.
4. Provide adequate protection from vandalism, mechanical contact, etc.
5. Securely close the doors.
6. Cover the supply and return air openings.

NOTE: Only DPS 003–015 without CORE have the ability to be forklift moved. All other units must be overhead rigged and transported via previous descriptions.

Figure 6: Rigging Label 003–015

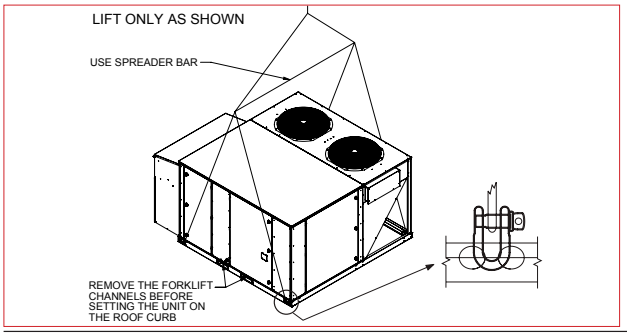


Figure 7: Rigging Label 016–028

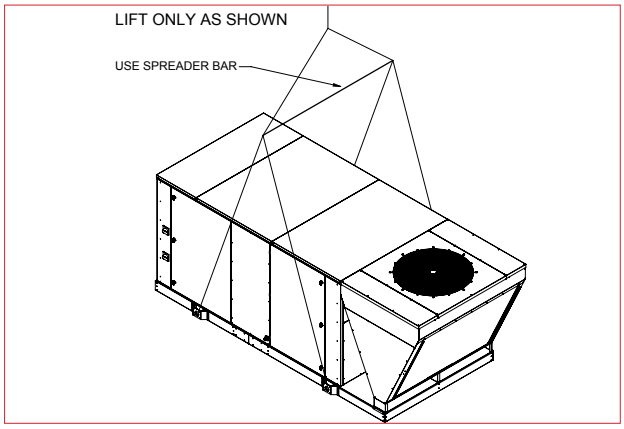


Figure 8: Rebel with CORE 007–015

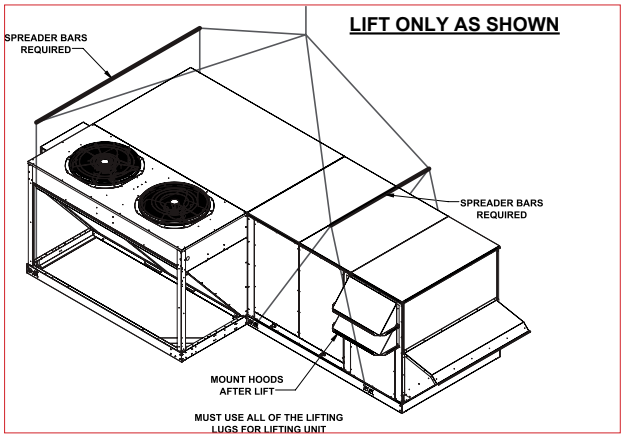


Figure 9: Rebel with CORE 016–028

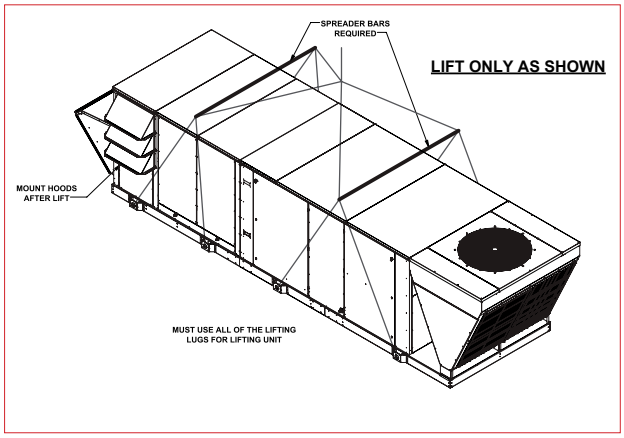
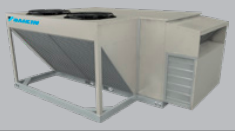
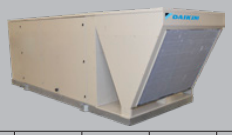


Table 2: Physical Data—Standard Units DPS 003 through 028

Model	Small cabinet				Medium cabinet				Large cabinet				
													
	003	004	005	006	007	010	012	015	016	018	020	025	028
Cooling only performance													
Gross cooling capacity (tons)	3	4	5	6	7.5	10	12	15	15.5	17.5	20.1	25	27.5
Nominal airflow (cfm)	1125	1500	1875	2100	2450	3500	4200	5250	5900	6600	7600	9500	10400
EER[1, 7]	13.5	12.4	13.0	11.6	12.5	12.4	11.6	11.0	12.2	11.9	11.3	11.3	10.5
IEER[1, 7] or SEER	16.9	17.0	18.5	19.8	20.6	19.3	18.0	18.0	21.0	20.8	20.4	18.3	17.9
Heat pump performance[4]													
High temperature capacity @ 47°F (MBh)	32	43	54	64	78	105	134	164	158	172	218	—	—
COP @ 47°F or HSPF[5]	9.2	8.9	8.5	3.69	3.66	3.42	3.33	3.64	3.67	3.6	3.40	—	—
Low temperature capacity @ 17°F (MBh)	20	24	33	39	47	61.5	77	91	93	104	132	—	—
COP @ 17°F[5]	N/A	N/A	N/A	2.54	2.42	2.38	2.32	2.25	2.34	233	2.20	—	—
Electric heat performance													
Control options	2/4 stage/SCR				4 stage/SCR				4 stage/SCR				
kW (low/medium/high heat)	6/12/18/24/30				18/36/54/72				10, 20, 30, 45, 60, 72 90, 120, 150				
Gas heating performance													
Input capacity (MBh)	80/120/160				200/300/400				300, 450, 600				
Number of stages (staged option)	2				2				4				
Turndown (modulating options)	5:1				5:1, 10:1				12:1				
Gas connection size (mpt)	1/2"				3/4"				3/4"				
Steady state efficiency	80%				80%				80%				
Heating coil													
Type	Hot water				Hot water				Hot water				
Rows/FPI (high heat/low heat)	(2/10) / (1/8)				(2/10) / (1/8)				1/12, 2/12, 3/13				
Face area (sq. ft.)	2.5				5.4				12.3				
Compressors													
Quantity/type	(1) Inverter scroll				(1) Inverter scroll, (1) Fixed speed scroll				(1) Inverter scroll on 16–20, (1) Inverter scroll + (1) Fixed speed scroll				
Number of stages	Modulating				Modulating				Modulating				
Refrigerant	R-410A				R-410A				R - 410A				
Indoor coil													
Rows/FPI	3/16	4/16	4/14	4/14	3/15	4/15	4/15	6/12	4/15	4/15	4/15	4/15	4/15
Face area (sq. ft.)	4.8	4.8	6.0	6.0	14.0	15.4	15.4	15.4	18.9	18.9	21.4	21.4	21.4
Capacity control	Electronic Expansion Valve (EEV)				Electronic Expansion Valve (EEV)				Electronic Expansion Valve (EEV)				
Outdoor coil													
Type: non-heat pump/heat pump[6]	Aluminum microchannel/copper tube-aluminum fin												
Rows/FPI — heat pump	2/16		3/16		3/16	4/16	4/16	4/16	3/16	3/16	4/16	—	—
Rows/FPI — non-heat pump	1/21		3/16		1/21	1/21	4/16	1/21	1/23				
Outdoor fan and motor													
HP/Quantity	0.5/1		1.0/1		1.0/2				3.5/1				
Fan Diameter (in)/quantity	27/1		27/1		27/2				39/1				
Indoor fan													
Type	Centrifugal airfoil (SWSI)				Centrifugal airfoil (SWSI)				Centrifugal airfoil (SWSI)				
Quantity/diameter[2]	(1) 12", (1) 14", (1) 16"				(1) 14" (1) 16" (1) 22"	(1) 22"			1/20 or 1/24			1/24	
Quantity/diameter[3]	(1) 12", (1) 14", (1) 16"				(1) 14", (1) 16", (1) 22"				1/16 or 1/20				
Drive type	Direct drive				Direct drive				Direct drive				
Motor HP range	1.3 / 2.3 / 4.0				4.0 / 8.0				2.0 / 3.0 / 5.0 / 7.5 / 10.0 / 15.0 / 20.0				
Hot gas reheat coil													
Coil type	Microchannel				Microchannel				Microchannel				
Control type	Modulating				Modulating				Modulating				
Temperature rise	20°				20°				20°				
Filters													
Type	2", 4"				2", 4"				2" (MERV8), 4" (MERV14)				
Area (sq. ft.)	7.1				18				27.0				
Qty. - size	4 – 16 × 16				6 – 18 × 24				9 – 18 x 24				

NOTE:
1. EER and IEER/SEER for cooling only VAV, 460 volt unit, largest SAF
2. Mixed outside air and return air units
3. 100% outside air unit only
4. Heat pump performance for units with back up electric heat
5. HSPF for 3-5 ton units only
6. Size 5 and 6 non-heat pump models use copper tube aluminum fin
7. Down discharge

Table 3: Physical Data—Unit Weights DPS 003 through 028

Model	Small cabinet 				Medium cabinet 			
	003	004	005	006	007	010	012	015
Electrical	208/230V or 460V				208/230V, 460V, or 575V			
Dimensions (inches)								
Standard (with OA)	87" x 85" x 41"				87" x 85" x 41"			97" x 107" x 56"
With ERW and OA	87" x 103" x 41"				97" x 133" x 56"			97" x 150" x 56"
Weight (lbs.)								
Base weight[1]	1000	1000	1025	1058	1600	1600	1600	1763
Heat pump	1030	1030	1058	1058	1660	1660	1660	1823
Electric heat	45	45	45	45	100	100	100	100
Hot water 1 row	11	11	11	11	32	32	32	32
Hot water 2 row	16	16	16	16	41	41	41	41
Gas heat	93	93	93	93	186	186	186	186
Hot gas reheat	8	8	12	12	28	31	31	31
Economizer	163	163	163	163	308	308	308	308
Energy wheel weight add (lbs.)								
100% OA	160	160	160	160	300	300	300	300
Mixed air	175	175	175	175	250	250	250	250
CORE® Recovery	—				1,460			

1. Includes standard cooling coil

Model		Large cabinet 			
		016	018	020	025
Electrical		208/230V, 460V, or 575V			
Dimensions (inches)					
Standard (with OA)		77" x 186" x 71"			
With ERW and OA		77" x 205" x 71"			
Weight (lbs.)					
Base weight (in lbs.)		2,465		2,575	2,700
Heat pump		2,750		2,830+	—
Electric heat		228			
Hot water heat	1-row	60			
	2-row	100			
	3-row	140			
Gas heat	300	175			
	450	225			
	600	275			
Hot gas reheat		30			
Economizer		500			
ERW – small		350			
ERW – large		400			
Indoor fan	16"	100			
	20"	150			
	24"	260			
Indoor fan motors	2	40			
	3	69			
	5	84			
	7.5	115			
	10	128			
	15	211			
	20	225			
Exhaust fan		Up to 230			
CORE® Recovery		2,260			

Size 3–15 Fan Weights (lbs.)	
12 Inch (310 mm)	87
14 Inch (360 mm)	91
16 Inch (400 mm)	115
22 Inch (560 mm)	115

Curb Weights (lbs.)	14"	24"
003—006	156	230
007—015	200	295
016—028	566	657

Table 4: Refrigerant Charge

Unit size	Refrig. charge - cooling model		Refrig. charge - heat pump model	
	Standard unit	Standard unit w/MHGRH	Standard unit	Standard unit w/MHGRH
3	8.6	11.3	12.0	14.4
4	8.5	11.3	12.6	15.0
5	15.3	18.2	16.8	19.7
6	15.3	18.2	16.8	19.7
7.5	11.1	17.8	26.0	31.2
10	20.0	25.8	40.0	45.8
12	20.0	25.8	40.0	45.8
15	24.4	30.2	46.0	51.8
16	30.3	30.7	53.0	53.4
18	30.3	30.7	53.0	53.4
20	32.5	32.9	56.0	56.4
25	35.5	35.9	Not Available	
28	35.5	35.9		

Unit Piping - Condensate Drain Connection

⚠ WARNING

Warning indicates potentially hazardous situations for PVC (Polyvinyl Chloride) and CPVC (Clorinated Polyvinyl Chloride) piping in chilled water systems. In the event the pipe is exposed to POE (Polyolester) oil used in the refrigerant system, the pipe can be chemically damaged and pipe failure can occur.

⚠ WARNING

Drain pans must be cleaned periodically. Material in uncleaned drain pans can cause disease. Cleaning should be performed by qualified personnel.

The unit is provided with a condensate drain connection, a 3/4" male NPT for 003–015 units and a 1" male NPT for 016–028 units. For proper drainage, level the unit and drain pan side to side and install a P-trap.

Figure 10 shows the layout of the condensate drain connection. The distance from the drain pan outlet to the horizontal run of the P-trap should be a distance of twice the static pressure in the drain pan.

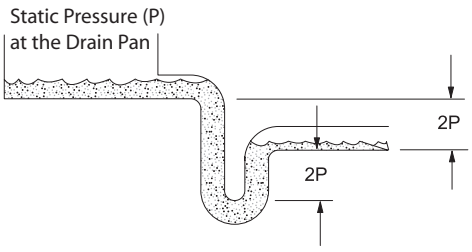
Example: If the static pressure as measured in the drain pan is 1.5", then the distance between the drain outlet and the horizontal run should be 3".

Draining condensate directly onto the roof may be acceptable; refer to local codes. Provide a small drip pad of stone, mortar, wood, or metal to protect the roof against possible damage.

If condensate is piped into the building drainage system, pitch the drain line away from the unit a minimum of 1/8" per foot. The drain line must penetrate the roof external to the unit. Refer to local codes for additional requirements. Sealed drain lines require venting to provide proper condensate flow.

Periodically clean to prevent microbial growth/algae buildup from plugging the drain and causing the drain pan to overflow. Clean drain pans to prevent the spread of disease. Cleaning should be performed by qualified personnel.

Figure 10: Condensate Drain Connection



Damper Assemblies

The optional damper assemblies described in this section are ordered with factory-installed actuators and linkages. The following sections describe the operation and linkage adjustment of the factory option.

Figure 11: Damper Assembly

Economizer Dampers

As the single actuator modulates, the outside air dampers open, the return air dampers close, and the exhaust air exits the unit through the gravity relief dampers.

The economizer comes with manually adjustable linkage (Figure 11). The damper is set so that the crank-arm moves through a 90-degree angle to bring the economizer dampers from full open to full close. Mechanical stops are placed in the crank-arm mounting bracket. Do not remove stops. Driving the crank-arm past the stops results in damage to the linkage or damper.

Outdoor Air Dampers (0% to 30%)

These dampers are intended to remain at a fixed position during unit operation, providing fresh air quantities from 0 to 30% of the total system airflow, depending on the damper setting.

The damper position may be set at the unit controller keypad (refer to OM 1141 for further detail). During unit operation, the damper is driven to the position set at the unit controller. During the OFF cycle, the damper is automatically closed.

Cabinet Weather Protection

⚠ CAUTION

Transportation, rigging, or maintenance can damage the unit's weather seal. Periodically inspect the unit for leakage. Standing moisture can promote microbial growth, disease, or damage to the equipment and building.

This unit ships from the factory with fully gasketed access doors and cabinet caulking to provide weather resistant operation. After the unit is set in place, inspect all door gaskets for shipping damage and replace if necessary.

Protect the unit from overhead runoff from overhangs or other such structures.

Installing Ductwork

⚠ WARNING

Mold can cause personal injury. Materials such as gypsum wall board can promote mold growth when damp. Such materials must be protected from moisture that can enter units during maintenance or normal operation.

On vertical-supply/vertical-return units, if a Daikin roof curb is not used, the installing contractor should make an airtight connection by attaching field fabricated duct collars to the bottom surface of the unit's duct opening. Do not support the total weight of the duct work from the unit.

Use flexible connections between the unit and ductwork to avoid transmission of vibration from the unit to the structure.

To minimize losses and sound transmission, design duct work per ASHRAE and SMACNA recommendations.

Where return air ducts are not required, connect a sound absorbing T or L section to the unit return to reduce noise transmission to the occupied space.

Ductwork exposed to outdoor conditions must be built in accordance with ASHRAE and SMACNA recommendations and local building codes.

Table 5: AHRI CFM Ratings

Unit Size	AHRI Rated CFM	Unit Size	AHRI Rated CFM
3	1140	15	4690
4	1550	16	5300
5	1810	18	5920
6	2310	20	7315
7.5	2885	25	8180
10	3850	28	8200
12	4620		

Large Rebel units, DPS 016A–DPS 028A, with horizontal gas heat cannot be directly connected to combustile materials.

Installing Duct Static Pressure Sensor Taps

For all VAV units, duct static pressure taps must be field installed and connected to the static pressure sensor 1 (SPS1) in the unit. Sensor SPS1 is standard on VAV units and is located in the main control panel.

Carefully locate and install the duct static pressure sensing tap. Improperly locating or installing the sensing tap causes unsatisfactory operation of the entire variable air volume system. Below are pressure tap location and installation recommendations. The installation must comply with local code requirements.

1. Install a tee fitting with a leak-tight removable cap in each tube near the sensor fitting. This facilitates connecting a manometer or pressure gauge if testing is required.
2. Use different colored tubing for the duct pressure (HI) and reference pressure (LO) taps, or tag the tubes. Daikin recommends 3/16" ID tubing.
3. Locate the duct pressure (HI) tap approximately 2/3 down the longest run with adequate separation from turns or transitions to assure terminal box take-offs have adequate static pressure.
4. Locate the duct tap in a nonturbulent flow area of the duct. Keep it several duct diameters away from take-off points, bends, neckdowns, attenuators, vanes, or other irregularities.
5. Use a static pressure tip (Dwyer A302 or equivalent) or the bare end of the plastic tubing for the duct tap. (If the duct is lined inside, use a static pressure tip device.)
6. Install the duct tap so that it senses only static pressure (not velocity pressure). If a bare tube end is used, it must be smooth, square (not cut at an angle) and perpendicular to the airstream (see Figure 13).
7. Locate the reference pressure (LO) tap near the duct pressure tap within the building. If the tap is not connected to the sensor, unsatisfactory operation will result.
8. Route the tubes through the curb and feed them into the unit through the knockout in the bottom of the control panel (see Figure 12). Connect the tubes to appropriate barbed fittings (on SPS1) in the control panel. (Fittings are sized to accept 3/16" ID tubing).

Figure 12: Typical Wiring Chase, Size 007–015 shown

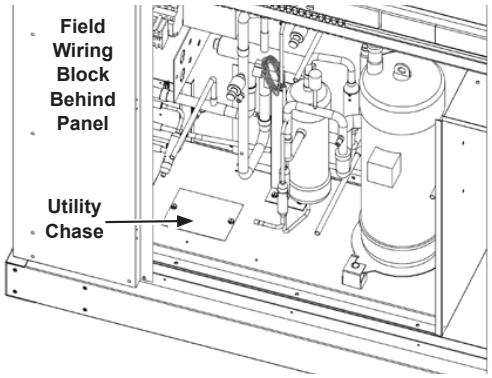
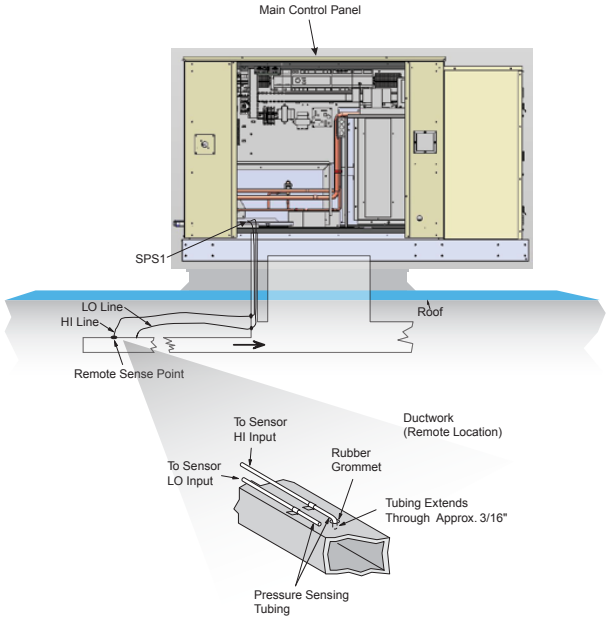


Figure 13: Duct Static Pressure Sensing Tubing Installation



Installing Building Static Pressure Sensor Taps

⚠ CAUTION

Fragile sensor fittings. If you must remove tubing from a pressure sensor fitting, use care. Do not use excessive force or wrench the tubing back and forth to remove or the fitting can break off and damage sensor.

If a unit has building static pressure control capability, you must field install and connect static pressure taps to the static pressure sensor SPS2 in the unit. This sensor is located at the bottom of the main control panel next to SPS1.

Carefully locate and install the two static pressure sensing taps. Improper location or installation of the sensor taps causes unsatisfactory operation. Below are pressure tap location and installation recommendations for both building envelope and lab, or “space within a space” pressure control applications. The installation must comply with local code requirements.

Building Pressurization Applications

1. Install a tee fitting with a leak-tight removable cap in each tube near the sensor fitting. This facilitates connecting a manometer or pressure gauge if testing is required.
2. Locate the building pressure (high) tap in the area that requires the closest control. Typically, this is a ground level floor that has doors to the outside.
3. Locate the building tap so it is not influenced by any source of moving air (velocity pressure). These sources may include air diffusers or outside doors.
4. Route the building tap tube through the curb and feed it into the unit through the knockout in the bottom of the control panel (refer to Figure 12). Connect the 3/16" ID tube to the (high) fitting for sensor SPS2.
5. Locate the reference pressure (low) tap on the roof. Keep it away from the condenser fans, walls, or anything else that may cause air turbulence. Mount it high enough above the roof so it is not affected by snow. Not connecting the reference tap to the sensor results in unsatisfactory operation.
6. Use an outdoor static pressure tip (Dwyer A306 or equivalent) to minimize the adverse effects of wind. Place some type of screen over the sensor to keep out insects. Loosely packed cotton works well.
7. Route the outdoor tap tube out of the main control panel through a small field-cut opening in the upright. Seal the penetration to prevent water from entering. Connect the 3/16" ID tube to the (low) fitting for sensor SPS2.

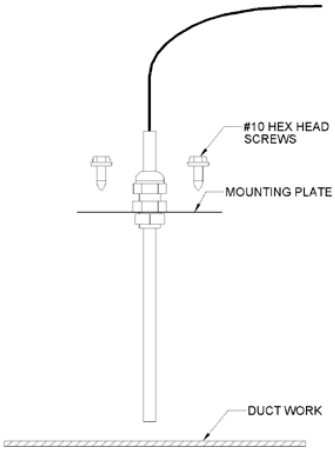
Discharge Air Temperature Sensor

The discharge air temperature sensor must be installed in the discharge air duct, downstream of the rooftop unit. Locate the sensor in a location that closely approximates the average duct temperature. To avoid the effects of radiation, the sensor should not be in the line-of-sight of a gas furnace or electric heater. Generally, locate sensor in the center of a duct wall, 5′ – 10′ from unit opening to allow for air mixing. Do not mount down stream of VAV boxes or other dampers.

Installation: Drill 7/8" diameter hole in duct, insert sensor probe and secure plate to duct with 2 – #10 screws. Be sure to apply gasket or silicone sealant to back of mounting plate prior to screwing plate to the duct to create an air-tight seal.

NOTE: If there is a stratification concern up to 4 sensors can be utilized with an averaging signal. Sensors must be wired in parallel.

Figure 14: Discharge Air Temperature Sensor Installation



Pre-Construction

The Rebel unit comes equipped with a Microtech III controller and can be used for sites that are still under construction. The following conditions must be met.

1. Ductwork has to be installed. The fan proving switch and furnace might not run correctly without the specified external static pressure
2. Filters must be installed.
3. Follow furnace commissioning instructions found in the furnace section.
4. After substantial completion of the construction process the unit is to be thoroughly cleaned. Special attention should be paid to the indoor DX coil and the furnace. Filters should be changed
5. Furnace operation, rate, and temperature rise should be re-verified. See instructions found in the furnace section.

Lab Pressurization Applications

1. Install a “T” fitting with a leak-tight removable cap in each tube near the sensor fitting. This facilitates connecting a manometer or pressure gauge if testing is required.
2. Use different colored tubing for the controlled space pressure (high) and reference pressure (low) taps, or tag the tubes.
3. Regardless whether the controlled space is positive or negative with respect to its reference, locate the high pressure tap in the controlled space (the setpoint can be set between -0.2" and 0.2" wc).
4. Locate the reference pressure (low) tap in the area surrounding the controlled space. Not locating the reference tap to the sensor results in unsatisfactory operation.
5. Locate both taps so they are not influenced by any source of moving air (velocity pressure). These sources may include air diffusers or doors between the high and low pressure areas.
6. Route the building tap tube between the curb and the supply duct and feed it into the unit through the knockout in the bottom of the control panel.
7. Connect the tube to the (high) fitting for sensor SPS2.

⚠ DANGER

Hazardous voltage. Can cause severe injury or death.

Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

⚠ WARNING

Provide proper line voltage and phase balance.

Improper line voltage or excessive phase imbalance constitutes product abuse. It can cause severe damage to the unit's electrical components.

⚠ WARNING

Electrical shock hazard. Can cause severe injury or death.

Connect only low voltage NEC Class II circuits to terminal block TB2.

⚠ DANGER

Overheating or failure of the gas supply to shut off can cause equipment damage, severe personal injury or death. Turn off the manual gas valve to the appliance before shutting off the electrical supply.

Electrostatic Discharge (ESD)

Disconnect Power to the Rebel Rooftop Unit prior to inspecting and/or repairing.

When inspecting/repairing Rebel Rooftop units the technician or building owner must take precautions to ground themselves to the unit. This will prevent them from damaging the circuit boards mounted inside the inverter box, VFD, and main control panel.

Electrostatic Discharge (ESD) can damage components in a manner that is not always readably detectable. A static potential can easily be generated on a person that reaches 25 kVolts. If this potential is discharged into one of the unit's circuit boards it can degrade part of the current carrying conductors inside.

In order to prevent ESD damage the technician and the unit must both be at the same electrical potential. The technician must ground themselves to the unit; this can be achieved by touching any galvanized (not painted) section of the unit. The unit's base rail and refrigerant piping are both reliable options as well as the control panel backpane. The next step is to attach a grounded wrist or ankle strap to the copper tubing or backpane. This grounding strap must have direct contact with the technician's skin. Once this has been done the technician is free to work on electrical components inside the unit.

All Units

Wiring must comply with all applicable codes and ordinances. The warranty is voided if wiring is not in accordance with these specifications.

According to the National Electrical Code, a disconnecting means shall be located within sight of and readily accessible from the air conditioning equipment. The unit can be ordered with an optional factory mounted disconnect switch. This switch is not fused unless ordered with a fuse. Power leads must be over-current protected at the point of distribution. The maximum rated overcurrent protection device (MROPD) value appears on the unit nameplate.

All units are provided with internal power wiring for single point power connection. The power block or an optional disconnect switch is located within the main control panel. Field power leads are brought into the unit through knockouts in the bottom of the main control panel (see Figure 12 and also Table 6). Refer to the unit nameplate to determine the number of power connections.

NOTE: Two wire entry points, refer to certified drawings for dimensions.

Table 6: DPS 003–015, Recommended Field Power Wiring

Ampacity (MCA)	Number of Power Wires Per Phase	Wire Gauge	Insulation Temperature Rating (°C)
20	1	14	75
25	1	12	75
35	1	10	75
50	1	8	75
65	1	6	75
85	1	4	75
100	1	3	75
115	1	2	75
130	1	1	75
150	1	Jan-00	75
175	1	Feb-00	75
200	1	Mar-00	75
230	1	Apr-00	75
255	1	250	75
285	1	300	75
310	1	350	75
335	1	400	75
380	1	500	75
420	1	600	75

Table 7: DPS 016–028, Recommeded Field Power Wiring

MROPD	Wire Qty per Pole	Wire Range of Standard Lug	Anticipated Wire Size
20	1	#18-8	(1) 10
25	1	#18-8	(1) 8
30	1	#18-8	(1) 8
35	1	#14-4	(1) 6
40	1	#14-4	(1) 6
45	1	#14-4	(1) 6
50	1	#14-4	(1) 6
60	1	#14-4	(1) 4
70	1	#14-2/0	(1) 3
80	1	#14-2/0	(1) 3
90	1	#14-2/0	(1) 2
100	1	#14-2/0	(1) 2
110	1	#4-300 mcm	(1) 1
125	1	#4-300 mcm	(1) 1/0
150	1	#4-300 mcm	(1) 2/0
150	1	#4-350 mcm	(1) 2/0
100	1	#14-1/0	(1) 2
175	1	#4-300 mcm	(1) 3/0
200	1	#4-300 mcm	(1) 4/0
175	1	#14-2/0	(1) 3/0
225	1	#2-600 mcm	(1) 250 mcm
225	2	#4-300 mcm	(2) 1
225	1	#4-350 mcm	(1) 250 mcm
250	1	#2-600 mcm	(1) 300 mcm
250	2	#4-300 mcm	(2) 1/0
250	1	#6-350 mcm	(1) 300 mcm
300	1	#2-600 mcm	(1) 400 mcm
300	1	#6-350 mcm	(1) 400 mcm
300	1	#6-350 mcm	(1) 400 mcm
300	1	#6-400 mcm	(1) 400 mcm
300	2	#4-300 mcm	(2) 2/0
350	1	#2-600 mcm	(1) 600 mcm
350	1	#4-500 mcm	(1) 600 mcm
350	2	#4-300 mcm	(2) 3/0
350	2	#6-2/0	(2) 3/0
400	1	#2-600 mcm	(1) 700 mcm
400	1	#2-600 mcm	(1) 700 mcm
400	2	#4-300 mcm	(2) 4/0
300	1	#250-500 mcm	(1) 400 mcm
400	2	#3/0-250 mcm	(2) 4/0
500	2	#1/0-250 mcm	(2) 250 mcm
600	2	#4-350 mcm	(2) 400 mcm
600	2	#3/0-500 mcm	(2) 400 mcm

⚠ WARNING

Provide proper line voltage and phase balance.

Improper line voltage or excessive phase imbalance constitutes product abuse. Severe electrical component damage will occur.

⚠ WARNING

Electrical shock hazard. Can cause severe injury or death.

Connect only low voltage NEC Class II circuits to terminal block TB2.

⚠ DANGER

Overheating or failure of the gas supply to shut off can cause equipment damage, severe personal injury or death. Turn off the manual gas valve to the appliance before shutting off the electrical supply.

The preferred entrance for power cables is through the bottom knockouts provided on the unit. If a side entrance is the only option, a hole may be drilled in the stationary upright.

The minimum circuit ampacity (MCA) is shown on the unit nameplate. Refer to Table 6 for the recommended number of power wires.

Copper wire is required for all conductors. Size wires in accordance with the ampacity tables in Article 310 of the National Electrical Code or other applicable code. If long wires are required, it may be necessary to increase the wire size to prevent excessive voltage drop. Wires should be sized for a maximum of 3% voltage drop. Supply voltage must not vary by more than 10% of nameplate. Phase voltage imbalance must not exceed 2%. (This can be calculated by finding the average voltage of the three legs. The leg with voltage deviating the farthest from the average value must not be more than 2% away.) Daikin suggests contacting the local power company for correction of improper voltage or phase imbalance.

The power source to the unit must be a balanced 3-phase power supply, meaning that the voltage and impedance to the line is matched. Unbalanced voltage and/or current (such as provided with an "Open Delta" configuration), is likely to result in nuisance alarms, premature failure of components and it will void equipment warranty. **Daikin does not recommend the use of Rebel units in facilities with corner grounded delta power.**

A grounded conductor lug is provided in the control panel. Size the grounding conductor in accordance with Table 250-95 of the National Electrical Code or other applicable code.

In compliance with the National Electrical Code, a 120 V factory mounted service receptacle outlet is provided. This outlet must be powered by a field connected 15 A, 120 V power supply, unless unit power outlet was utilized. Leads are brought into the unit through the bottom of the main control panel.

Field Control Wiring

The Rebel rooftop units are available with the following field control connections:

- Space sensor.
- Space sensor with setpoint adjustment.
- Fan operation output.
- VAV box output.
- Remote alarm output.
- External discharge air temperature reset.
- Outdoor air damper minimum position adjustment.

Descriptions of these field connections are included in the MicroTech III Unit Controller Manual (OM 1141).

Start-up and service of this equipment must be performed by trained and experienced technicians. It is highly recommended that the initial start-up and future service be performed by Daikin trained technicians who are familiar with working on live equipment. A representative of the owner or the operator of the equipment should be present during start-up to receive instructions in the operation, care and adjustment of the unit. Daikin recommends proper use of personal protection equipment whenever starting and/or servicing a unit.

Before Start-Up

1. Notify inspectors or representatives who may be required to be present during start-up of gas fuel equipment. These could include the gas utility company, city gas inspectors, heating inspectors, etc.
2. Review the equipment and service literature and become familiar with the location and purpose of the furnace controls. Determine where the gas and power can be turned off at the unit and before the unit.
3. Determine that power is connected to the unit and available.
4. Determine that the gas piping, meter, and service regulator have been installed, tested, and meet the equipment requirements.
5. Determine that proper instruments will be available for the start-up. A proper start-up requires the following: voltmeter, manometer or gauges with ranges for both manifold pressure and inlet gas pressure.

Table 8: DPS 003–015 Electric Heat Data[1]

KW	Voltage	Amps
6	208	16.7
	240	14.4
	480	7.2
	—	—
12	208	33.3
	240	28.9
	480	14.4
	—	—
18	208	50.0
	240	43.3
	480	21.7
	600	17.3
30	208	83.3
	240	72.2
	480	36.1
	600	28.9
36	208	99.9
	240	86.6
	480	43.3
	600	34.6
54	208	149.9
	240	129.9
	480	65.0
	600	52.0
72	208	199.9
	240	173.2
	480	86.6
	600	69.3

NOTE: 1. Maximum temperature rise equals 60°F

Table 9: DPS 016–028 Electric Heat Data[1]

KW	Voltage	Amps
10	208	27.8
	240	24.1
	480	12.0
	600	9.6
20	208	55.5
	240	48.1
	480	24.1
	600	19.2
30	208	83.3
	240	72.2
	480	36.1
	600	28.9
45	208	124.9
	240	108.3
	480	54.1
	600	43.3
60	208	166.5
	240	144.3
	480	72.2
	600	57.7
72	208	199.9
	240	173.2
	480	86.6
	600	69.3
90	208	249.8
	240	216.5
	480	108.3
	600	86.6
120	—	—
	—	—
	480	144.3
	600	115.5
150	—	—
	—	—
	480	180.4
	600	144.3

NOTE: 1. Maximum temperature rise equals 60°F

Table 10: Amp Draw Data

Unit Size (Tons)	Compressor RLA									Compressor LRA								Condenser Fan FLA Each			
	Compressor 1 - Variable					Compressor 2 - Fixed				Compressor 1				Compressor 2							
	Voltage					Voltage				Voltage				Voltage				Qty	208	230	460
	208	230	460	575	[%]	208	230	460	575	208	230	460	575	208	230	460	575				
3	7.7	7.0	3.5	—	45%	0.0	0.0	0.0	—	See Note				0.0	0.0	0.0	—	1	0.9	0.8	0.4
4	10.0	9.0	4.5	—	55%	0.0	0.0	0.0	—					0.0	0.0	0.0	—	1	0.9	0.8	0.4
5	11.9	10.8	5.4	—	68%	0.0	0.0	0.0	—					0.0	0.0	0.0	—	1	2.0	1.8	0.9
6	15.0	13.6	6.8	—	89%	0.0	0.0	0.0	—					0.0	0.0	0.0	—	1	2.0	1.8	0.9
7.5	11.9	10.8	5.4	—	68%	8.6	7.8	3.9	—					67.5	73.7	37.1	—	2	2.0	1.8	0.9
10	10.0	9.0	4.5	—	59%	17.5	15.8	7.9	—					93.1	84.2	42.1	—	2	2.0	1.8	0.9
12	15.0	13.6	6.8	—	89%	17.5	15.8	7.9	—					93.1	84.2	42.1	—	2	2.0	1.8	0.9
15	28.3	25.6	12.8	—	100%	17.5	15.8	7.9	—					93.1	84.2	42.1	—	2	2.0	1.8	0.9
16	47.0	42.5	22.9	20.5	—	0	0	0	0					See Note				1	8.0	8.0	4.0
18	47.0	42.5	22.9	20.5	—	0	0	0	0									1	8.0	8.0	4.0
20	47.0	42.5	22.9	20.5	—	0	0	0	0									1	8.0	8.0	4.0
25	47.0	42.5	22.9	20.5	—	39.1	35.4	18.6	15.4									1	8.0	8.0	4.0
28	47.0	42.5	22.9	20.5	—	39.1	35.4	18.6	15.4									1	8.0	8.0	4.0

NOTE: The inverter compresor is controlled to have a soft start and an LRA <1.0

Horse Power	Supply Fan FLA				Exhaust Fan FLA			
	Voltage				Voltage			
	208	230	460	kW	208	230	460	kW
1.3	3.1	2.8	1.4	1.0	3.1	2.8	1.4	1.0
2.3	5	4.6	2.3	1.7	5	4.6	2.3	1.7
4	8.8	7.4	4.0	3.0	8.8	7.4	4.0	3.0
8	13.5	12.2	6.1	6.0	—	—	—	—

NOTE: 575V Amp Draws: Compressors and motors will be run off a 575 to 460V transformer. Motors will be nameplated at 460V. 575 voltage is for large cabinet only.

Piping System

The Rebel piping system varies significantly between the multiple possible configurations; heat pump, cooling only, and modulating hot gas reheat. In spite of this multiplicity there are some consistent characteristics. All units have a single circuit with a single or tandem compressor. All units use an electronic expansion valve (EVI) and a start-up by pass solenoid valve (SVB).

Figure 15: Typical Refrigeration Circuit for Cooling Only Unit with Modulating Hot Gas Reheat (DPS 007–015 shown)

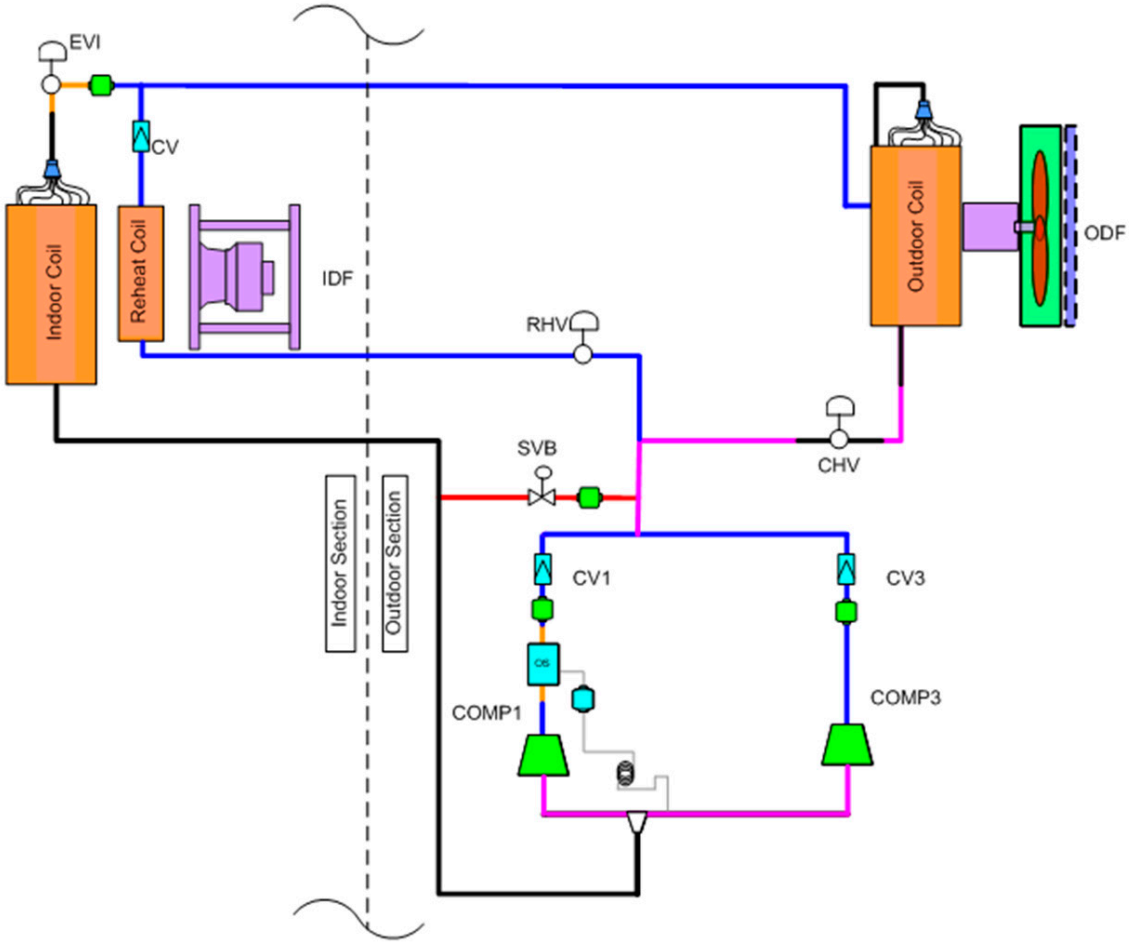
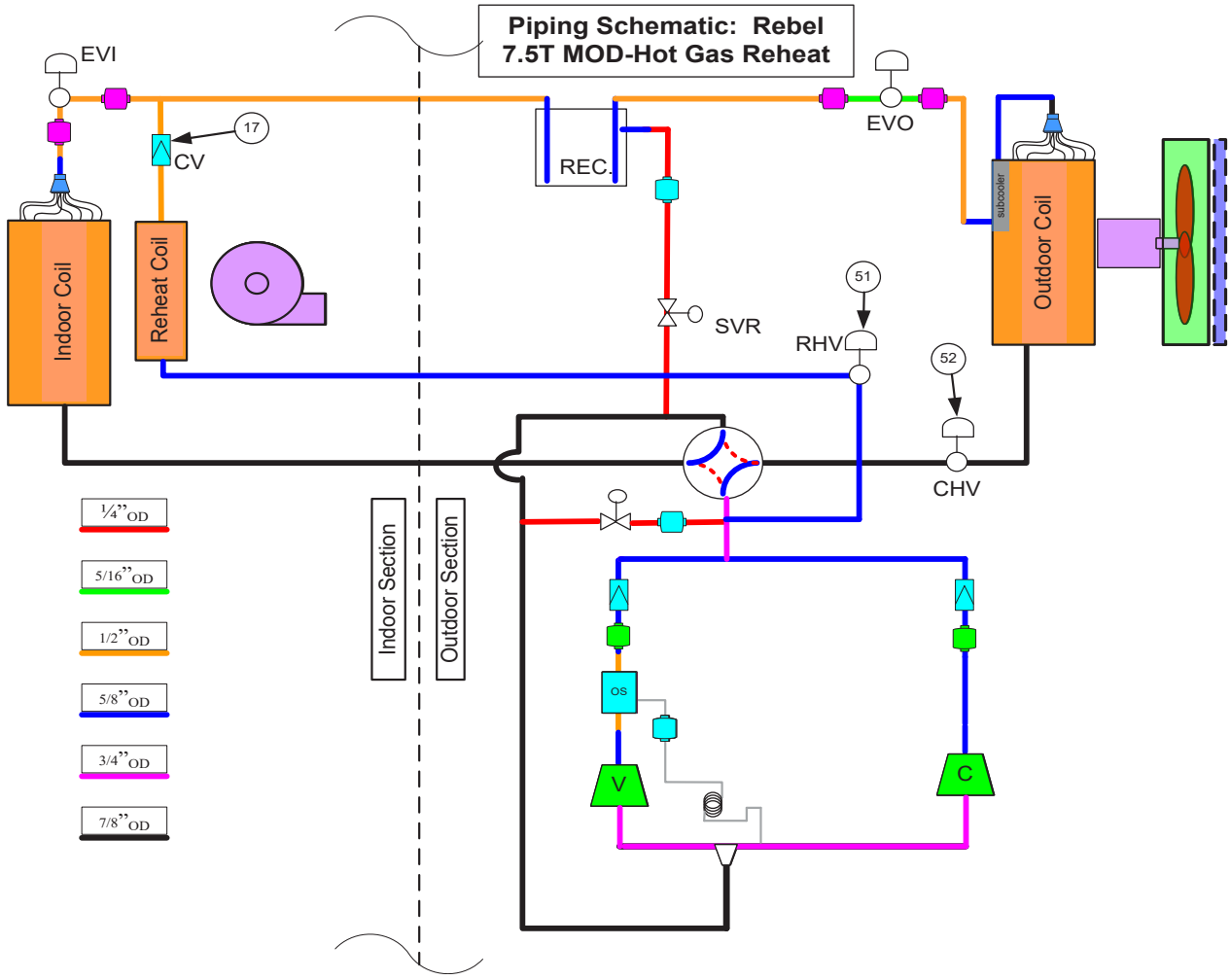


Figure 16: Typical Refrigeration Circuit for Heat Pump Unit with Modulating Hot Gas Reheat (DPS 007–015 shown)



Item	Description
EVI	Indoor coil electronic expansion valve
EVO	Outdoor coil electronic expansion valve
CV	Check Valve, size 3-15 only
REC	Refrigerant Receiver
IDF	Indoor fan
ODF	Outdoor fan
COMP1	Inverter compressor
COMP3	Fixed speed compressor (7½ thru 15 ton and 25-28 only)
SVB	Bypass solenoid valve
RHV	Reheat step valve
SVR	Receiver solenoid valve
CHV	Condenser step valve
OVI	Outdoor electronic expansion valve
4WV	4-way heat pump valve
OS	Oil separator, size 3-15 only

DPS Component Description

Compressor Compartment

Prior to start-up, verify all shipping brackets are removed and the compressor foot bolts are secured.

Figure 17: Piping Brackets

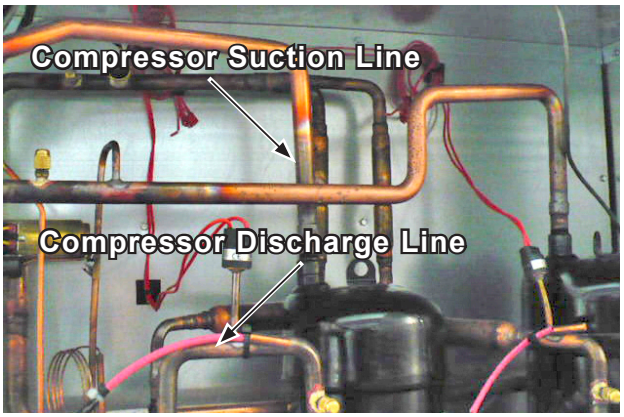
Figure 18: Compressor Brackets

Variable Speed Compressor

A variable speed compressor (COMP1) is used on all DPS(H) 003–015. On small cabinet units (3–6 Tons) the variable speed compressor will be the only one present. On medium cabinet units (7–15 Tons) the variable speed compressor will be on the left. The discharge of the variable speed compressor is located on the side and the suction is located on the top.

These pipes can also be identified by recalling that suction lines will always be larger than discharge lines. The side discharge design is used to create a positively pressurized crank case that returns oil to the scroll set even during low turn down conditions.

Figure 19: Compressor Suction and Discharge on Medium Cabinet (7.5T) Heat Pump (DPH)



Fixed Speed Compressor (DPS 007–015 only)

The fixed speed compressor (COMP3) is used on all medium cabinet (7–15 Ton), DPS, units. This compressor will always be located on the right and like the variable speed has the suction line on the top of the dome entering the scrolls and a discharge exiting from the side of the shell.

Figure 20: Compressor Tandem on Medium Cabinet

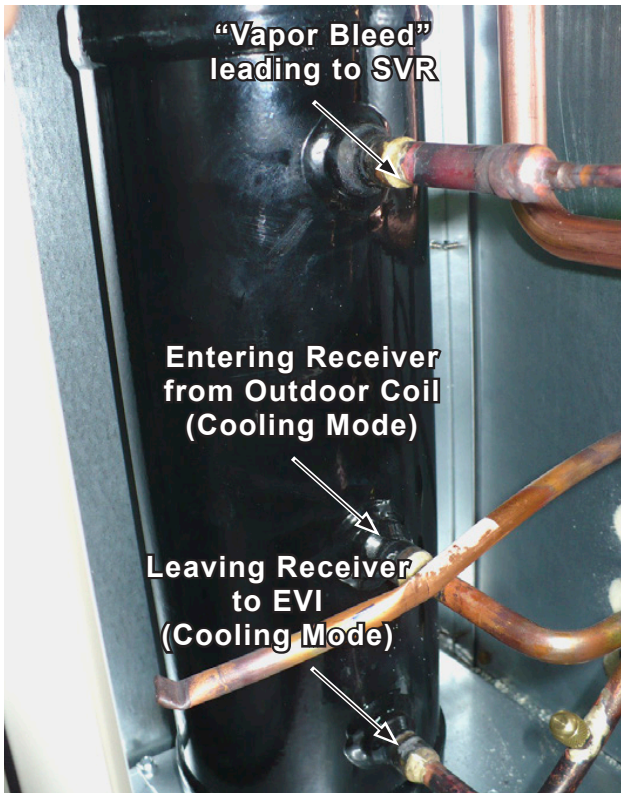
Receiver

Only Rebel Heat Pump units will have a receiver. Different volumes of refrigerant are required inside the system during Mechanical Cooling (or defrost) and Mechanical Heating. This is the results of the charge in operating temperatures in Cooling and Heating Mode. The receiver stores the excess refrigerant upstream, in Cooling Mode, of the Indoor Expansion Valve (EVI). Three refrigerant lines connect to the receiver.

In cooling mode the refrigerant leaves (Cooling Mode) the receiver from the bottom connection on its way to the Indoor Expansion Valve (EVI). The refrigerant enters the receiver by the middle connection from the Outdoor Expansion Valve (EVO). The top connection is linked to the Receiver Solenoid Valve (SVR) and is used to bleed refrigerant vapor out of the top of the vessel during the change over from Mechanical Heating to Cooling Mode (or defrost).

In heating mode the refrigerant flow path will be reversed and will enter the receiver at the bottom connection on its way from EVI. The refrigerant will leave the receiver from the middle connection towards EVO. The top connection will always be a vapor bleed connected to SVR regardless of the units operating mode.

Figure 21: Receiver on Medium Cabinet (7.5T) Heat Pump (DPH)



Oil Separator

All DPS(H) 003–015 and 016–020 heat pumps units will have an oil separator on the discharge line of the compressor. This device will remove oil from the compressor discharge gas and return it to the compressor suction line. The oil separator has three lines entering it. The connection on the side of the compressor is where the discharge gas enters. The hot gas continues on to the Outdoor Coil from the connection on the top of the separator. On the bottom is a small drain through which the oil returns after separation to the compressor suction. The refrigerant and oil path through the separator will not change depending on Heating or Cooling Mode.

Figure 22: Oil Separator

Figure 23: Secondary Oil Separator

Check Valve

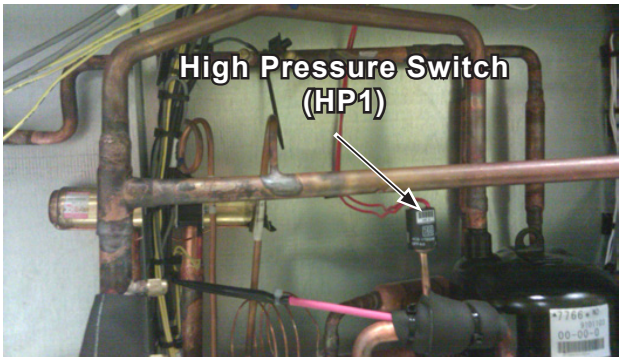
All DPS 003–015 will have check valves on each of the compressor discharge lines. On medium cabinet units (7–15 Tons), two valves, one on each compressor, prevent recirculation of refrigerant during part load conditions. On small cabinet units (3–6 Tons) a single check valve prevents migration of refrigerant into the scrolls during off cycles.

Figure 24: Discharge Line Check Valves on Large Cabinet (7.5T) Heat Pump (DPH)

High Pressure Switch

All Rebel Units will have a high pressure switch on each compressor. Medium cabinet units (7–15 Tons) will have an HP1 switch on the variable speed compressor (COMP1) and a HP3 on the fixed speed compressor (COMP3). These switches are normally closed devices that are brazed directly to the refrigerant piping. When the pressure at the switch exceeds 580 PSIG the switch will open. This opening will interrupt the control signal to the variable compressor drive or de-energize the contactor coil on the fixed speed compressor, both acts will shut down the compressors and generate an alarm at the MicroTech III keypad.

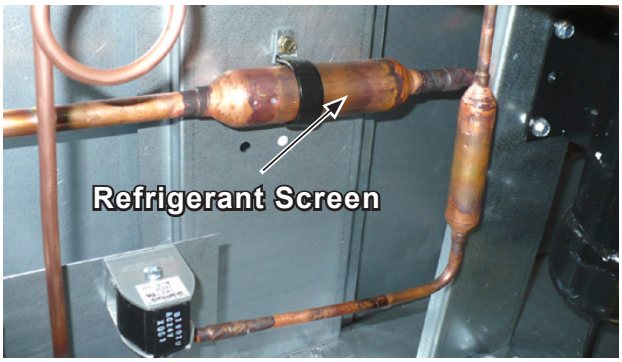
Figure 25: High Pressure Switch



Refrigerant Screen

During manufacturing, service, and repair there is always the potential for debris to accidentally enter the sealed refrigeration system. Filter screens are positioned around the refrigerant circuit to prevent any possible debris from entering critical components; expansion valves, compressors, etc. These screens are not bi-direction and must be installed in a specific direction if replaced. Please be aware that these screens are not desiccant filters and provide no moisture protection for compromised systems.

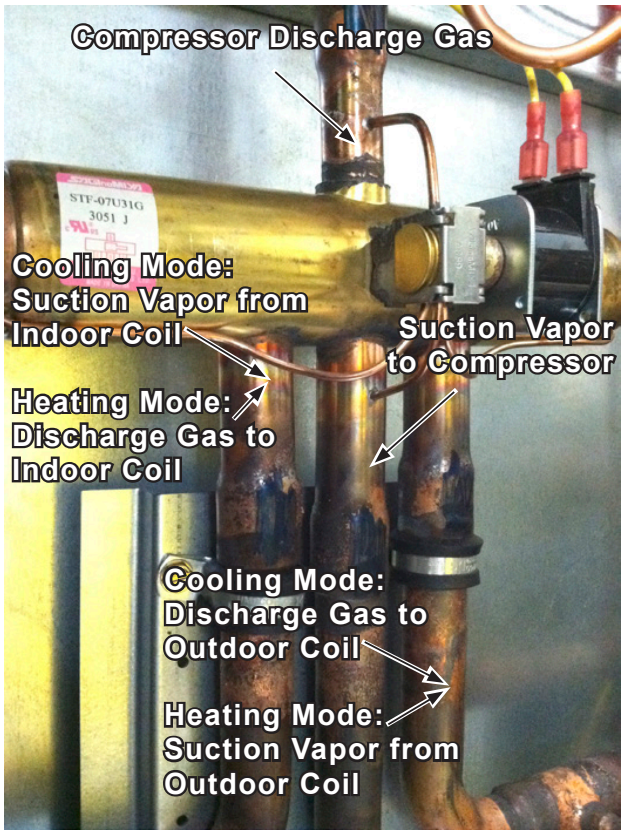
Figure 26: Refrigerant Screen



Four-Way Valve

The Four-Way Valve (4WV) also known as a Reversing Valve is a component only used on Heat Pumps. This device is used to direct the discharge gas from the compressor into the indoor coil (Heating Mode) or outdoor coil (Cooing Mode). This device is defaulted to cooling and when un-energized will direct the discharge gas into the outdoor coil.

Figure 27: Four-Way Valve



By-Pass Solenoid Valve

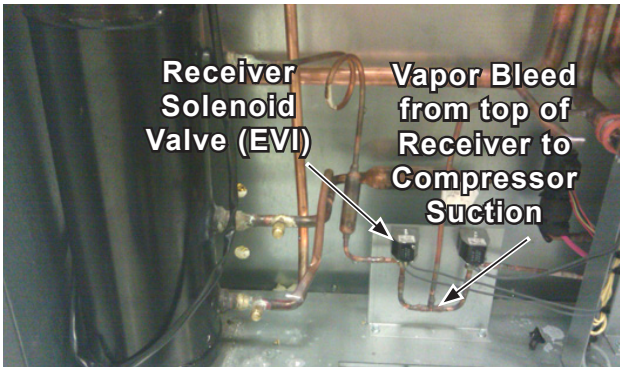
The By-Pass Solenoid Valve (SVB) is used to “short-circuit” the high pressure compressor discharge to the low pressure suction side during start-up. This increases compressor longevity by minimizing starting torque and inrush current.

Figure 28: By-pass Solenoid Valve

Receiver Solenoid Valve

The Receiver Solenoid Valve (SVR) is used to “bleed off” refrigerant vapor from the top of the Receiver during pump down or the transition between mechanical heating and defrost. Cooling only units will not have this component, only Heat Pumps .

Figure 29: Receiver Solenoid Valve



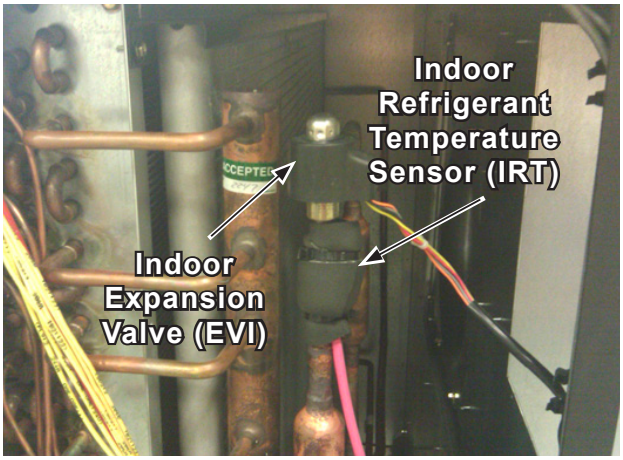
Indoor Expansion Valve

The Indoor Expansion Valve (EVI) is a 12 VDC stepper motor driven valve, used in heating and cooling mode. In cooling mode EVI is used to expand the refrigerant entering the Indoor Coil, operating as an evaporator, in much the same way as a TXV on a conventional air conditioner. In heating mode the EVI can operate in two different modes, configurable at the keypad.

When configured for Standard during heating mode the EVI will modulate to fully open and remain in this position. When configured for heating mode the EVI will modulate to maintain the Subcooling Set-Point.

DPS 016–028 unit use only an EVI to control suction super heat.

Figure 30: Indoor Expansion Valve



Outdoor Expansion Valve (DPS 003–015 only)

The Outdoor Expansion Valve (EVO) is a 12 VDC stepper motor driven valve, used in heating and cooling mode. Cooling only units will not have this component, only Heat Pumps. In heating mode the EVO is used to expand the refrigerant entering the Outdoor Coil, which is now and evaporator, in much the same way as a TXV on a conventional air conditioner. In Cooling Mode the EVO can operate in two different modes, configurable at the keypad. When configured for Standard during Cooling Mode the EVO will modulate to fully open and remain in this position. When configured for Cooling Mode the EVO will modulate to maintain the Subcooling Set-Point.

The outdoor expansion valve will regularly require an automated synchronization to maintain valve and motor alignment. Whenever the valve is commanded to either 0 or 100% the valves will automatically be over-driven closed or open by 10% of the maximum steps as defined by the motor, unless otherwise not recommended by manufacturer, then the process will only occur on 0% closed calls. In the event of a power interruption or indications of loss of synchronization, the MicroTech III controller can force synchronization to correct operation.

Suction Pressure Transducer

The Suction Pressure Transducer (PTS) is a refrigerant pressure sensor that screws onto a Schrader fitting on the suction line of the compressor deck. On single compressor units (3–6T) this sensor is located on the suction line. On tandem, two compressor units (7–15T), the PTS is located upstream of the joint suction.

This sensor is used to ensure that the compressor does not leave the operating envelope and is used to regulate the super heat leaving the indoor coil and entering the compressor.

Discharge Pressure Transducer

The Discharge Pressure Transducer (PTD) is a refrigerant pressure sensor that screws onto a Schrader fitting on the discharge line of the compressor system. On single compressor units (3–6T) this sensor is located on the discharge line. On tandem, two compressor units (7–15T), the PTD is located down stream of the joint discharge.

This sensor is used to ensure that the compressor does not leave the operating envelope and is used to regulate the outdoor fan speed and maintain head pressure.

Discharge Refrigerant Temperature

All Rebel units will have a Discharge Refrigerant Temperature Sensor (DRT1 / DRT3) on the discharge line of each compressor. This sensor is attached the piping with a metal clip and wrapped in insulation. The purpose of this device is to increase compressor life by preventing it from running outside of the operating envelope.

Suction Refrigerant Temperature

All Rebel units will have a Suction Refrigerant Temperature Sensor (SRT). This sensor is located on the suction line. Unlike DRT1 or 3 there is only one SRT for tandem compressor units. This sensor is used to determine the suction super heat entering the compressor and is the control input for the EVI in cooling mode (EVO in heating mode).

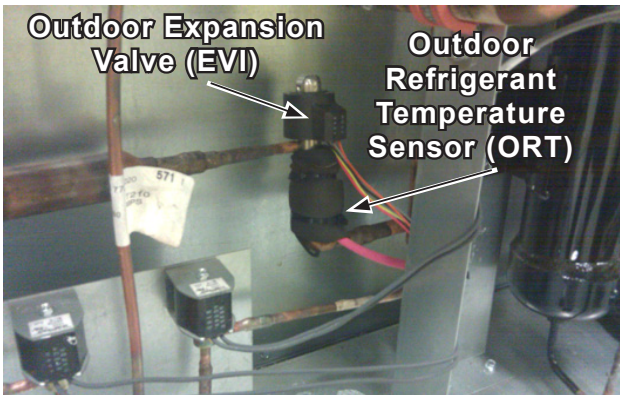
Indoor Refrigerant Temperature (DPS 003–015 only)

Only Rebel Heat Pump units will have an Indoor Refrigerant Temperature Sensor (IRT). This sensor is used in Heating Mode when htgEVImethod is set to control subcooling. This sensor is attached to the refrigerant piping downstream (Cooling Mode) of the Indoor Expansion Valve (EVI).

Outdoor Refrigerant Temperature (DPS 003–015 only)

Only Rebel Heat Pumps units will have an Outdoor Refrigerant Temperature Sensor (ORT). This sensor is used in Cooling Mode when ClgEVOmethod is set to control subcooling. This sensor is attached to the refrigerant piping upstream (Cooling Mode) of the Outdoor Expansion Valve (EVO).

Figure 31: Outdoor Expansion Valve



Defrost Temperature Sensor

Only Rebel Heat Pump, DPH, units will have a Defrost Temperature Sensor (DFT). This sensor is used in Heating Mode and Defrost Mode to determine the amount of frost accumulated on the Outdoor Coil.

Heating

The unit's heating mode of operation is determined by the control temperature and the heating setpoint temperature. The unit enters the heating mode of operation by comparing the control temperature to the heating setpoint.

The control temperature can be either the return temperature or the space temperature.

The return temperature is typically used for VAV units and the space temperature is typically used for CAV units.

The unit goes into the heating mode of operation when the control temperature (return or space temperature) is below the heating setpoint by more than ½ the deadband.

For example, a standard air conditioning unit with supplemental gas, electric, or hot water heat with a heating setpoint of 68.0ºF and a deadband of 1.0ºF would enter heating mode if the control temperature reached 67.4ºF. When this takes place, the heating mode of operation will begin and the 1st Stage of heating operation will start.

Heat Pump (DPS 003–015 only)

The heating mode of operations will be slightly different for heat pump units. It is the manufacturer's recommendation that all Rebel heat pump units be purchased with supplemental gas, electric, or hot water heat. When the control temperature drops below the heating setpoint by half the deadband the unit will energize the four way valve and initiate mechanical heating.

On heat pumps mechanical heating is the primary source of heat and will always be the unit's first attempt to meet the application's load. After start-up the variable compressor will ramp up to meet the DAT Setpoint. If the mechanical heating capacity at the ambient conditions is capable of meeting the building load the variable speed compressor will stabilize at some value. If the heat pump's capacity is insufficient at the ambient conditions the supplemental (gas, electric, hot water) heat will be enabled and gradually ramp/stage on to make up the capacity shortage. If the combined capacity of the heat pump's mechanical and supplemental heating is greater than the building load the supplemental supply will ramp/stage down. The unit will always seek to operate with mechanical heating as much as possible.

Periodically during heating operations the unit will need to enter defrost to remove frost build up from the outdoor coil. During defrost mechanical heating will be unavailable and the supplemental heat will ramp/stage up to meet the DAT set-point.

Defrost

Defrost is a temporary and infrequent period during normal heating operations on Rebel heat pumps. The purpose of defrost is to remove frost that has built up on the outdoor coil during mechanical heating. In heating mode the outdoor coil acts as an evaporator to “pull” heat out of the ambient air. As a result the surface temperature of the outdoor coil is below the ambient temperature and depending on conditions maybe below freezing. During prolonged mechanical heating while the surface temperature of the outdoor coil is below 32ºF, dew point frost will form.

The defrost operation is similar to mechanical cooling. In defrost the four way valve will de-energize and the hot gas from the compressor will be forced into the outdoor coil, rejecting heating to the ambient, and melting any frost formed on the coil. To speed up the melting process during a defrost cycle the OA damper will close and the outdoor fan will de-energize. During this period the supplemental (gas, electric, hot water) heat will ramp/stage up to maintain the unit’s DAT Setpoint.

Rebel heat pump unit’s have demand based defrost control and will operate in defrost only as long as necessary to remove frost from the outdoor coil.

Charging

Rebel units have advanced charge management systems that obsolete many common techniques for determining over or under charged conditions. The charge management system means that super heat and subcooling values will float to achieve the peak real time energy efficiency possible at current operating conditions (building load and ambient temperature). Rebel units also use electronic expansion valves that can not be adjusted manually. Refrigerant should never be added or removed from the system based on the desire to achieve an arbitrary subcooling value. It will always be Daikin's recommendation that unit’s suspected of being over/under charged have all of their refrigerant removed, leak tested with nitrogen, and then re-charged based on the unit name plate.

Table 11: Refrigerant Charge

Unit size	Refrig. charge - cooling model		Refrig. charge - heat pump model	
	Standard unit	Standard unit w/MHGRH	Standard unit	Standard unit w/MHGRH
3	8.6	11.3	12.0	14.4
4	8.5	11.3	12.6	15.0
5	15.3	18.2	16.8	19.7
6	15.3	18.2	16.8	19.7
7.5	11.1	17.8	26.0	31.2
10	20.0	25.8	40.0	45.8
12	20.0	25.8	40.0	45.8
15	24.4	30.2	46.0	51.8
16	30.3	30.7	53.0	53.4
18	30.3	30.7	53.0	53.4
20	32.5	32.9	56.0	56.4
25	35.5	35.9	Not Available	
28	35.5	35.9		

DPS 016–028 Ton Component Description

Variable Speed Compressor

A variable speed compressor (COMP1) is used on all DPS 016-028. On DPS 16–20 ton units, the variable speed compressor will be the only one present, and be on the right. The discharge of the variable speed compressor is located on the top and the suction is located on the side.

These pipes can also be identified by recalling that suction lines will always be larger than discharge lines. The side suction design is used to cool the motor with cold refrigerant.

Figure 32: Compressor Suction and Discharge on DPS 025–028 units

Fixed Speed Compressor (DPS 025–028 only)

Like the variable speed compressor, it has the suction line on the side of the dome entering the scrolls and a discharge exiting from the top of the shell.

High Pressure Switch

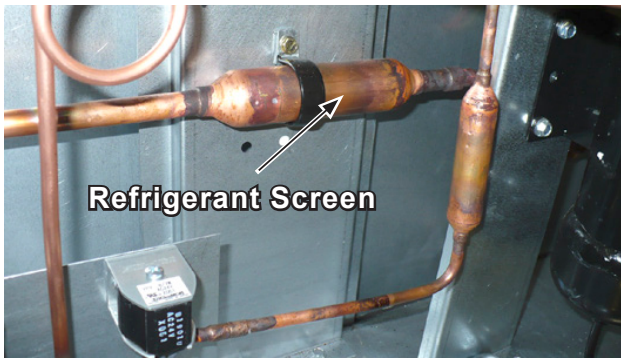
All Rebel Units will have a high pressure switch on each compressor. HP1 switch is on the variable speed compressor (COMP1) and HP3 is on the fixed speed compressor (COMP3). These switches are normally closed devices that are brazed directly to the refrigerant piping. When the pressure at the switch exceeds 580 PSIG the switch will open. This opening will interrupt the control signal to the variable compressor drive or de-energize the contactor coil on the fixed speed compressor, Both acts will shut down the compressors and generate an alarm at the MicroTech III keypad.

Figure 33: High Pressure Switch

Refrigerant Screen

During manufacturing, service, and repair there is always the potential for debris to accidentally enter the sealed refrigeration system. Filter screens are positioned around the refrigerant circuit to prevent any possible debris from entering critical components; expansion valves, compressors, etc. These screens are not bi-direction and must be installed in a specific direction if replaced. Please be aware that these screens are not desiccant filters and provide no moisture protection for compromised systems.

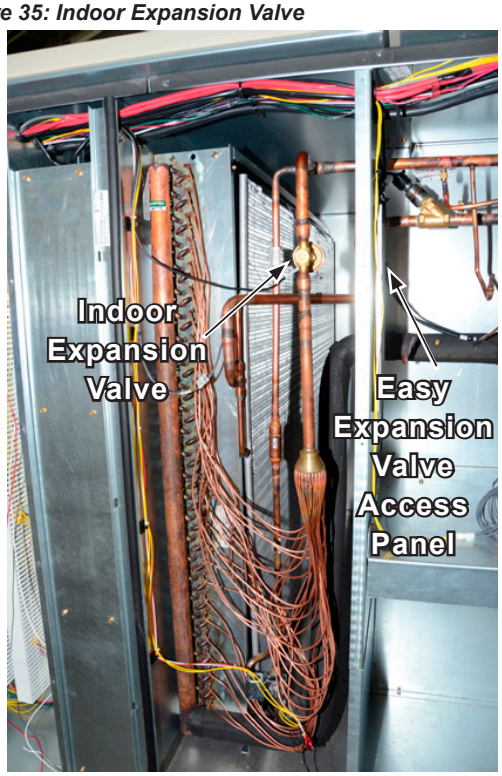
Figure 34: Refrigerant Screen



Indoor Expansion Valve

The Indoor Expansion Valve (EVI) is a 12 VDC stepper motor driven valve. In cooling mode EVI is used to control the superheat and expand the refrigerant entering the Indoor Coil, operating as an evaporator, in much the same way as a TXV on a conventional air conditioner.

Figure 35: Indoor Expansion Valve



Suction Pressure Transducer

The Suction Pressure Transducer (PTS) is a refrigerant pressure sensor that screws onto a Schrader fitting on the suction line of the compressor deck. On single compressor units (DPS 016–020) this sensor is located on the suction line. On tandem, two compressor units (DPS 025–028), the PTS is located upstream of the joint suction.

This sensor is used to ensure that the compressor does not leave the operating envelope and is used to regulate the super heat leaving the indoor coil and entering the compressor.

Discharge Pressure Transducer

The Discharge Pressure Transducer (PTD) is a refrigerant pressure sensor that screws onto a Schrader fitting on the discharge line of the compressor system. On single compressor units (DPS 016–020) this sensor is located on the discharge line. On tandem, two compressor units (DPS 025–028), the PTD is located downstream of the joint discharge.

This sensor is used to ensure that the compressor does not leave the operating envelope and is used to regulate the outdoor fan speed and maintain head pressure.

Discharge Refrigerant Temperature

All Rebel units will have a Discharge Refrigerant Temperature Sensor (DRT1/DRT3) on the discharge line of each compressor. This sensor is attached the piping with a metal clip and wrapped in insulation. The purpose of this device is to increase compressor life by preventing it from running outside of the operating envelope.

Suction Refrigerant Temperature

All Rebel units will have a Suction Refrigerant Temperature Sensor (SRT). This sensor is located on the suction line. Unlike DRT1 or 3 there is only one SRT for tandem compressor units. This sensor is used to determine the suction super heat entering the compressor and is the control input for the EVI in cooling mode.

VFD Compressor Operation (DPS 016–028 only)

VFD compressor modulation is controlled by a Mobus® signal from the unit controller. The minimum VFD compressor speed is 25 rps (1500 rpm) and the maximum VFD compressor speed is 100 rps (6000 rpm), but the minimum and maximum limits per unit may vary depending on operating conditions and unit model size.

The VFD compressor is a 4 pole motor design that operates off a frequency signal from the VFD between 50Hz and 200Hz. At start-up the VFD compressor has a 65 second initiation period where it will ramp to 50 rps for 10 seconds, aiding in oil circulation, then ramp back down to 25 rps for the remainder of the initiation period.

Crankcase heating for VFD Compressor is performed by the VFD via DC-holding current through the motor windings.

VFD compressor modulation is additionally monitored and adjusted in order to maintain operation within the approved compressor operating envelope.

Table 12: VFD Compressor Modulation Ranges

DPS Unit Model	VFD Modulation Range		
	VFD Min RPS	VFD Max RPS	
		VFD and Fixed Comp(s) ON 1 Fixed ON VFD1Max RPS	VFD Comp Only VFDMax RPS
016	25 rps	NA	92 rps
018	25 rps	NA	100 rps
020	25 rps	NA	100 rps
025	25 rps	78 rps	100 rps
028	25 rps	100 rps	100 rps

DPS Size 025 & 028, Two Compressor Units

If the VFD compressor were to become inoperative, the unit can continue to operate on the remaining fixed speed compressor until the unit can be serviced.

When the VFD compressor is at its maximum speed and more capacity is required, a fixed speed compressor is started while the VFD compressor is reduced to minimum speed at which point it resumes modulating to maintain the discharge temperature. When the VFD compressor is at its minimum speed and less capacity is required, a fixed speed compressor is turned OFF while the VFD compressor is increased to maximum speed at which point it resumes modulating to maintain discharge temperature.

VFD Compressor Control

Control of the VFD compressor is accomplished with a digital output enable signal and Modbus control signal.

General VFD Compressor Start Sequence

On a call for VFD compressor operation the VFD enable output is energized (ON) Modbus signal is set. During this 10 second initial period the VFD compressor's internal logic ramps the compressor to 50 rps to insure compressor startup oil lubrication. After 10 seconds the VFD compressor control signal begins modulation to maintain the cooling discharge set point.

Compressor Stage Up Transition (DPS 025 & 028 Only)

When the VFD compressor has been operating at maximum capacity for the cooling stage time period and there is a call for more cooling capacity the following transition sequence is followed when staging up.

During the fixed compressor stage UP sequence, the VFD compressor speed is reduced to its minimum, as a fixed speed compressor is turned on. Note that the VFD compressor speed range is extended for these staging points to assure smooth transition and to minimize capacity gaps. Typically, the VFD compressor is overdriven (higher speed than normal full load rating speed) before staging up the fixed compressor. The VFD is held at minimum speed for 30 seconds before normal modulation resumes.

Compressor Stage Down Transition (DPS 025 & 028 Only)

When the VFD compressor has been operating at minimum capacity for the cooling stage time period and there is a call for less capacity the following transition sequence is followed when staging down.

During the fixed speed compressor stage DOWN sequence, the VFD compressor speed is increased to maximum speed (which varies with unit size and number of operating fixed compressors) as the fixed speed compressor is turned off. Note that the VFD compressor speed range has been extended for these staging points to assure smooth transition and to minimize capacity gaps. Typically, the VFD compressor will be overdriven (higher speed than normal full load rating speed) when staging down the fixed compressor.

Dehumidification Transition During Cooling State

When dehumidification operation becomes active while the unit is in the Cooling operating state, The VFD compressor is ramped to its maximum capacity. If the VFD capacity at this point is already above 75% of its full modulation a fixed compressor is also turned on. The compressors are held at this capacity for 1 minute before normal modulation resumes, to maintain leaving coil temperature (LCT).

- VFD compressor will load up completely before starting any fixed speed compressors to achieve LCT of 45F (default) with the VFD compressor option. LCT may be set between 45F to 52F.
- If reheat signal is at 100% for 10 minutes and the unit is unable to raise the DAT to desired point, the controller will stage off the fixed compressor and modulate the VFD compressor speed to achieve the DAT set point.

Oil Balance/Boost Operational Sequence

When a low oil level is indicated in the VFD compressor sump, the unit switches to either an oil balance or oil boost state. The VFD compressor speed is increased during these modes to promote the return of refrigerant oil to the VFD compressor.

To avoid short cycling of the oil balance/boost sequence, no action is taken until a low oil indication has been present for 5 consecutive run minutes.

The unit determines whether to enter the oil balance or oil boost mode based on the running conditions when a low oil indication is experienced. The balance mode is only used when a VFD compressor is part of a tandem compressor set. The balance mode is usually entered first, and is utilized to move oil from the fixed speed compressor to the VFD compressor. If this mode fails to resolve the low oil indication issue, the unit will then go into the boost mode. The boost mode is utilized to return oil from the refrigerant system to the compressors. VFD compressors that are not part of a tandem compressor arrangement will skip the balance mode and only utilize the boost mode.

The balance mode will be entered if the VFD compressor is part of a tandem arrangement and there is a low oil indication with the fixed speed compressor is running. Oil balance mode will turn OFF the fixed speed compressor and the VFD compressor speed is increased to the oil boost speed. The VFD compressor will operate at this condition until the optical oil sensor verifies that oil is present for 3 uninterrupted minutes.

If the oil balance mode fails to resolve the low oil condition, or the fixed speed compressor was not running when the low oil indication occurred, or the VFD compressor was not part of a tandemized compressor set, when the low oil indication occurred, the unit will enter boost mode

Upon entering oil boost mode, the VFD compressor speed is increased to the oil boost value shown in Table 20. If the VFD compressor is part of a tandem arrangement, the fixed speed compressor is started as well. The VFD compressor runs at this condition until the optical oil sensor verifies that oil is present for 3 continuous minutes. Unit Controller default is set for a 10 minute max boost.

During the oil balance/boost sequence the DAT temperature is overridden to allow the VFD compressor to continue operating until oil balance/boost sequence termination.

Oil balance/boost sequences and durations are logged in the unit controller.

If low oil indication does not clear, the VFD compressor will be shut down and oil level will be monitored for an additional 15 minutes. If low oil indication still does not clear within these 15 minutes, the VFD compressor will be locked out on alarm.

The low oil problem is also generated and the VFD compressor circuit is disabled if the oil boost sequence is initiated more than 24 times in a 24 hour period. If the oil balance/boost sequence successfully restores the VFD compressor oil level the fixed compressor stage is returned to its pre-oil balance/boost condition and normal compressor sequencing and modulation resumes

VFD Compressor Protection Unloading Control

There are several modulating control functions that adjust the speed control range of the VFD compressor to protect it from damage under abnormal operating conditions. The following functions are provided by the unit controller

- High Pressure Unloading Control
- High Discharge Line Temperature Unloading Control
- High/Low Discharge Superheat Control
- Condenser Coil Splitter Valve Control (For Low Ambient Option)

High Pressure Unloading Control

Cooing mode:

The VFD compressor has an upper operating sat discharge pressure limit of 569 PSIG. If the discharge pressure exceeds 569 PSIG, or 540 PSIG while the inverter compressor is operating greater than 90Rps the compressor speed is reduced 1 rps every 10 seconds until the discharge pressure is at or below 540 psig.

If the discharge pressure does not drop below 579 PSIG with the VFD compressor operating at minimum speed (30 rps), the compressor is locked out on alarm.

In addition, when the VFD compressor is operating above a sat discharge pressure of 540 PSIG, the VFD compressor maximum speed is limited to 90 rps and the minimum speed is limited to 30 rps.

A high side pressure transducer is standard on the VFD circuit allowing the discharge pressure of the refrigerant circuit to be viewed at the unit controller display.

If the unit controller needs to reduce the compressor speed in order to limit discharge pressure, the action is recorded in unit controller event log section.

Heating Mode:

The VFD compressor has an upper operating sat discharge pressure limit of 480.8 PSIG. If the discharge pressure exceeds 480.8 PSIG, the compressor speed is reduced every 10 seconds until the discharge pressure is at or below 540 psig.

In addition, when the VFD compressor is operating above a sat discharge pressure of 496.5 PSIG, the VFD compressor control PI loop becomes inactive and the value is set to EffMinINVCap, and any standard compressor is shut off.

To re-enter unlimited compressor operation the PTD needs to be less than 426.7 PSIG

If the PTD rises above 527.6 PSIG the compressor is disabled and put on standby.

High Discharge Line Temperature Unloading Control

A compressor discharge temperature sensor (Thermistor) is installed on the VFD compressor as standard. The temperature is used to measure discharge temperature and superheat levels at the VFD compressor discharge.

If the compressor discharge temp reaches 250F, and remains at that temperature continuously for 15 seconds, a warning will be logged in the controller, and the VFD compressor speed is reduced by 10 rps and monitored for 15 additional seconds. The unit controller will continue to reduce the VFD compressor speed by 10-rps increments every 15 seconds until the discharge temp drops below 220°F. If the compressor exceeds 250°F continuously for 3 minutes or reaches 275°F the compressor enters a state of standby for restart. The Inverter compressor HiDLTStandbyTmr = 100 minutes.

The root cause may be connected to several issues (low charge, blocked condenser coil, condenser fan failure, malfunctioning TEV, etc.) and service is required.

The VFD compressor discharge Temp has an upper limit of 275F. The VFD compressor will be shut down if discharge temp reaches 275F.

Low/High Discharge Superheat

With the high side pressure transducer and discharge thermistor, the unit controller is capable of monitoring the variable speed compressor discharge superheat. This feature protects the VFD compressor against flood back, undercharged conditions, overcharged conditions, malfunctioning TEV, etc. Typical compressor superheat range is 20F to 85°F. The discharge temperature of the VFD compressor can be viewed at the unit controller display.

Low Superheat

If the compressor discharge superheat falls below 20°F for 10 consecutive run minutes, the VFD compressor speed is increased by 10 rps increments up to a 60 rps operating speed. Superheat is monitored at each speed for 5 minutes and if superheat remains below 20°F, the VFD compressor speed is increased an additional 10 rps. When compressor discharge superheat level is at 20F or above, the compressor speed is no longer increased. If speed correction resolves problem, the unit controller will have logged that a speed correction was needed for superheat in the event log. If increasing speed does not correct issue, the VFD compressor is locked out and an alarm is logged in the unit controller.

High Superheat

If the VFD compressor discharge superheat rises to 85°F for 15 consecutive minutes, the VFD compressor speed is reduced by 10 rps increments down to a 40 rps operating speed. Superheat is monitored at each speed for 10 minutes and if superheat remains above 85°F the VFD compressor speed is decreased an additional 10 rps. When compressor discharge superheat level is at 85°F or below, the compressor speed is no longer decreased. If speed correction resolves problem,

the unit controller will have logged that a speed correction was needed for superheat in the event log. If decreasing speed does not correct issue, the VFD compressor is locked out and an alarm is logged in the unit controller.

Manual Control (with VFD Compressor)

For service and troubleshooting the unit controller has capability to allow the VFD compressor to be operated manually. Refer to the controller OM-920 for more detail.

The basic manual operations include the following:

- Start or Stop the VFD compressor
- Modulate VFD compressor from 0 – 100% speed
- Ability to energize condenser coil splitter solenoids (Only for low ambient option)
- Ability to initiate or terminate oil boost sequence

If an electrical issue with the VFD compressor is suspected, the winding resistance can be checked at the motor terminals.

Table 13: VFD Compressor Winding Resistance

Compressor Model	Voltage	Winding Resistance (Ohms)
VZH-088B-X	208-230V	0.03
	460V	0.10
	575V	0.10
VZH-117*	208–230V	0.02
	460V	0.08
	575V	0.08

* Size 020 only

VFD Compressor Emergency Stop Control

If the VFD compressor enable output signal has been ON for 30 seconds and the controller fails to receive the VFD run verification input, VFD Compressor Emergency Stop Control is activated. When this function is active, VFD compressor enable output will be turned OFF for 5 seconds and then turned ON and ramp VFD compressor speed to 45Hz. If controller receives a VFD run verification input, a log event is set on VFD Emergency Stop Control. If controller fails to receive the VFD run verification input after 3 attempts in 30 minutes, the VFD compressor is locked out and the problem is logged.

Once active the VFD Compressor Emergency Stop Control function remains active until one of the conditions are met.

- VFD compressor enable output signal has been ON for 30 seconds and VFD compressor status Input is ON
- VFD compressor is OFF

If the controller fails to receive the VFD run verification input after the VFD compressor enable output signal has been ON for 30 seconds, the circuit is shut OFF on VFD Compressor Emergency Stop Control alarm.

Whenever this protection function becomes active a VFD Compressor Emergency Stop Control event is recorded in the Event Log with date and time stamp. Whenever this protection function returns to normal a VFD Compressor Emergency Stop Control return to normal event is recorded in the Event Log with date and time stamp.

Variable Speed Scroll Compressor

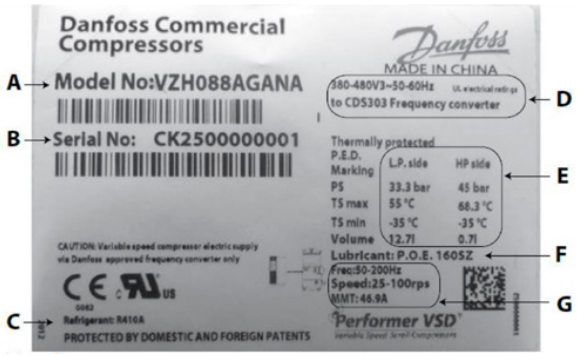
WARNING

The compressor must only be used for its designed purpose(s) and within its scope of application (refer to the Operating Limits). Consult the Application Guidelines. Under all circumstances, the EN378 (or other applicable local safety regulations) requirements must be fulfilled.

Daikin units with variable speed inverter compressor are engineered with fixed speed compressor in such a way that the unit delivers only the required energy to satisfy space conditions and provides you with exceptional energy savings. It improves comfort through precise temperature and humidity control. Variable speed compressor enhances energy efficiency and capable of providing unit capacity modulation down to 20% and reduces compressor cycling and wear on compressor.

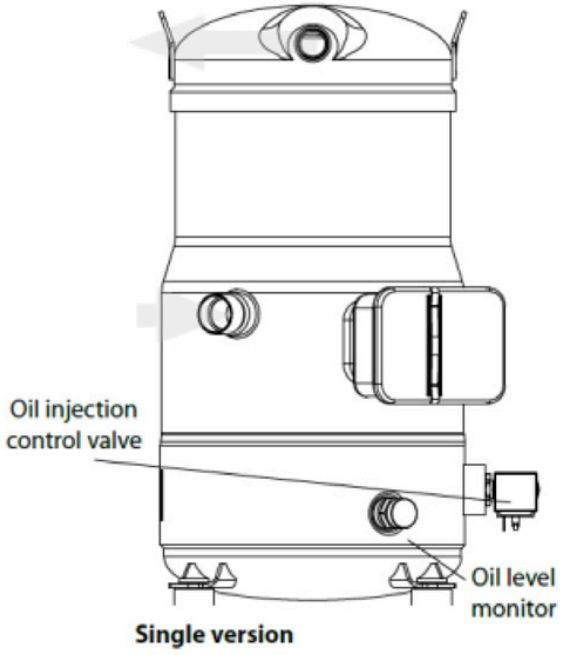
Daikin rooftop units with variable speed Inverter compressors are provided with Internal Permanent Magnet (IPM) motors. Compressors are designed to vary capacity by modulating the speed of the scroll set. The speed ratio for the IPM motor compressor is 4:1 (25 rps to 100 rps). Condenser fan modulation and an oil management/monitoring system are provided for reliable operation. The VFD compressor will always be first one ON and last one OFF.

Figure 36: Compressor Nameplate Information



A.	Model number
B.	Serial number
C.	Refrigerant
D.	Supply voltage to CDS303 frequency converter
E.	Housing service pressure
F.	Factory charged lubrication
G.	Compressor frequency and MaxMust trip current

Figure 37: Compressor Components



Oil Injection Control

The VFD compressor contains an oil injection valve and solenoid (SV11) as standard. The oil injection valve provides lubrication to the scroll set under low speed/low refrigerant velocity situations. The oil injection valve is a normally closed valve. Below 50 rps (100 Hz) the valve is closed and directs oil to the scroll set suction port. Above 50 rps (100 Hz) the solenoid is bypassed and sends oil into sump. The oil injection valve/ solenoid is mounted directly on the compressor and is controlled by the Compressor VFD (relay 1 output, terminals NO & Com). The coil voltage for the oil injection solenoid is 24 Vac.

The coil can be removed if required by carefully prying off the valve stem. The wiring connector is attached to the coil by a screw in the center of the housing. Refer to Figure 38 and Figure 39.

Figure 38: Assembly Components

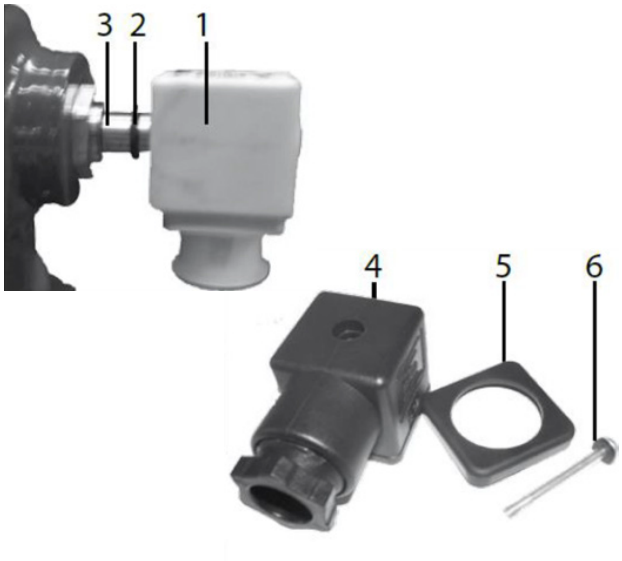
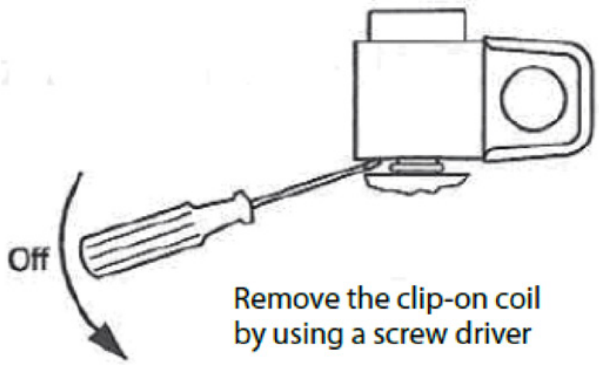


Figure 39: Oil Injection Control Dismanteling



Optical Oil Level Sensor

An optical oil sensor is used to monitor oil level in VFD compressor sump. The sensor is mounted directly to a fitting on the VFD compressor shell and can be removed without having to depressurize/reclaim the refrigeration system. Optical oil indication signal is sent to MTIII Expansion Module 'C' (terminals X3 & M). Normal oil indication will provide a contact closure from relay R40. Relay R40 will de-energize during low oil indication, removing signal to terminal X3 and will start the unit in an oil boost sequence. Refer to Figure 40 and Figure 41

Figure 40: Sightglass for Optical Oil Sensor/Switch

Figure 41: Optical Oil Level Sensor/Switch

NOTE: Testing of the optical oil sensor requires the use of a separate optical oil sensor prism.

Electrical Connections and Wiring

Basic Connections

Depending on the frequency converter version, the physical position of individual connectors may differ. Please review the wiring schematics provided with the unit.

The compressor motor cable is shielded and the armoured part of the cable is connected to a grounding point on both cable ends; the compressor and at the VFD side.

Variable Frequency Drive for VFD Compressor

⚠ WARNING

Never bypass the compressor drive or directly connect the VFD compressor to the main power supply.

⚠ WARNING

The compressor drive is preset to run the compressor clockwise.

⚠ WARNING

Variable Speed Inverter Compressor

The VFD is factory-programmed and should not be modified in the field. Any modifications will void the warranty. Compressors are compatible with the manufacturer's VFD only.

The compressor drive used for this option is specific series (CDS 303) that is intended for use with an IPM compressor motor and cannot be replaced with any off the shelf VFD.

The compressor drive is mounted in the main control box or the compressor compartment.

The compressor drive and the LCP (local control panel) are preset with parameters from the factory and should not need to be changed in the field. The LCP is removable and is interchangeable with any of the compressor drives used by any of the VFD compressors. If the need arises to replace the compressor drive, the parameters can be downloaded from the LCP to the new compressor drive.

The compressor drive is preset to run the compressor clockwise and must be connected as shown in the unit schematic.

The compressor drive is preset for an open loop configuration with 0-10Vdc reference corresponding to 1500-6000 Rpm.

The compressor drive generates a soft start with an initial ramp of 2 seconds. In-rush current (or LRA) to the VFD compressor is typically not more than a few percent more than rated nominal Current.

Compressor Speed, modulation signal %, frequency signal, compressor amperage are all displayed in real time on the compressor HMI. Alarms and descriptions will also be visible on the compressor drive screen.

Basic Operation of Compressor Drive:

Start= Connect terminals 12 & 18 for minimum of 5 secs, connect terminals 12 &27 and terminals 13 &37

Stop= Disconnect terminals 12 & 27

Emergency Stop= Disconnect terminals 13 & 37

Control/Modulation= 0 to 10Vdc signal to terminals 53 & 55

Run Verification= A contact closure from relay 02 (terminals 04 & 05) is provided when drive is running

Oil Injection= A contact closure from relay 01 (terminals 01 & 02) is provided when compressor speed is greater than 50 rps (3000 rpm) which energizes the oil solenoid coil.

The compressor drive contains protection for the compressor against short circuits at the compressor terminals, overload protection , phase loss and earth faults. The compressor drive is protected against short-circuits.

Modulating Hot Gas Reheat

The reheat coil option comes complete with an aluminum micro channel coil and modulating hot gas valves for leaving air temperature control. On a call for dehumidification, the unit will enable the supply to be over-cooled by the DX coil. Hot gas from the unit condenser will be routed to an indoor coil downstream of the DX coil to reheat the air. Hot gas reheat valves (Figure 42) will control how much hot gas is routed to the indoor coil to maintain a discharge air setpoint.

Figure 42: Dual 2-Way Valve Refrigeration Schematic (Cooling Model Shown)

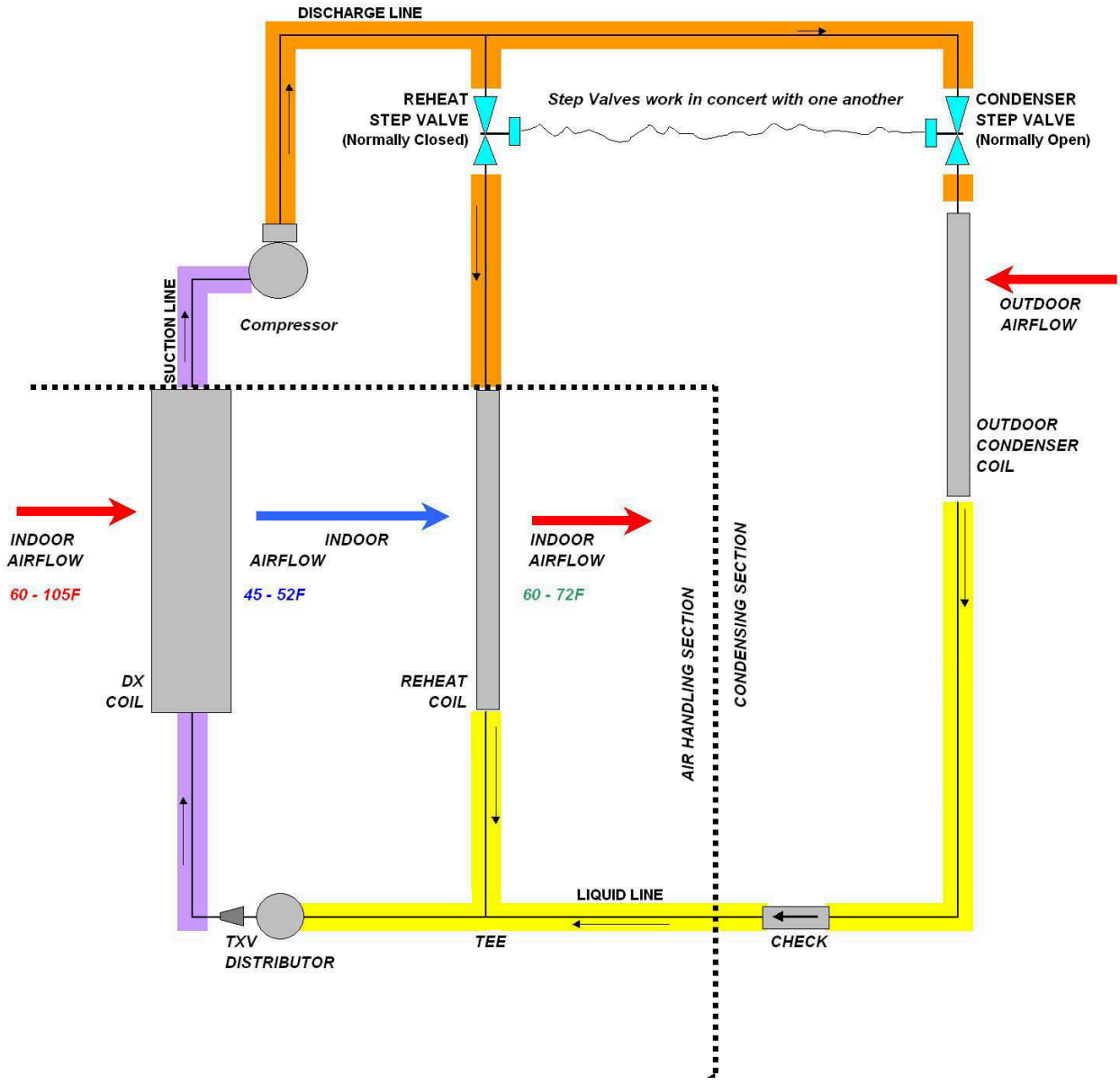
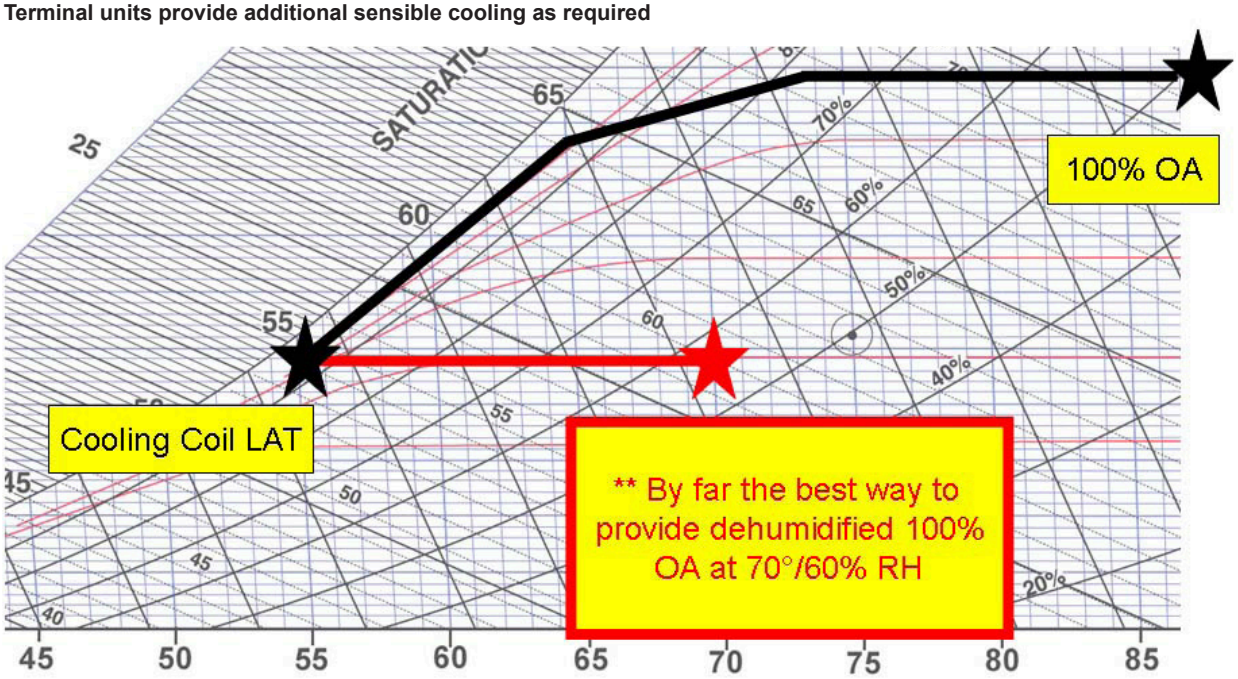


Figure 43: Ideal for Neutral Air Ventilation Control

- **The rooftop mainly dehumidifies the required ventilation air**
- **Terminal units provide additional sensible cooling as required**



Dehumidification Initiation

An analog sensor is mounted in the return duct, the space, or outdoors to sense Relative Humidity. The location is selected by setting the Sensor Location value on the keypad to Return, Space, or OAT. OAT can only be selected for units with DAT control. Dehumidification is disabled when the unit is in either the Heating or Minimum DAT state. When Dehumidification is enabled, Dehumidification operation is initiated when Humidity Control is set to either Relative Humidity or Dew Point and that value rises above the appropriate setpoint by more than half its deadband. Economizer operation is disabled in the Dehumidification mode so the unit immediately transitions to Cooling if Dehumidification is initiated in Economizer state.

Dehumidification Termination

Dehumidification is terminated if the selected variable, Relative Humidity or Dew Point, drops below the appropriate humidity setpoint by more than half its deadband. Dehumidification is also terminated if cooling is disabled for any reason or the unit enters either the Heating or Minimum DAT state. For units with compressors, the number of cooling stages is reduced by one and control reverts to normal control when dehumidification is terminated in the Cooling state. Another compressor stage change could then occur after one Cooling Stage Time has elapsed.

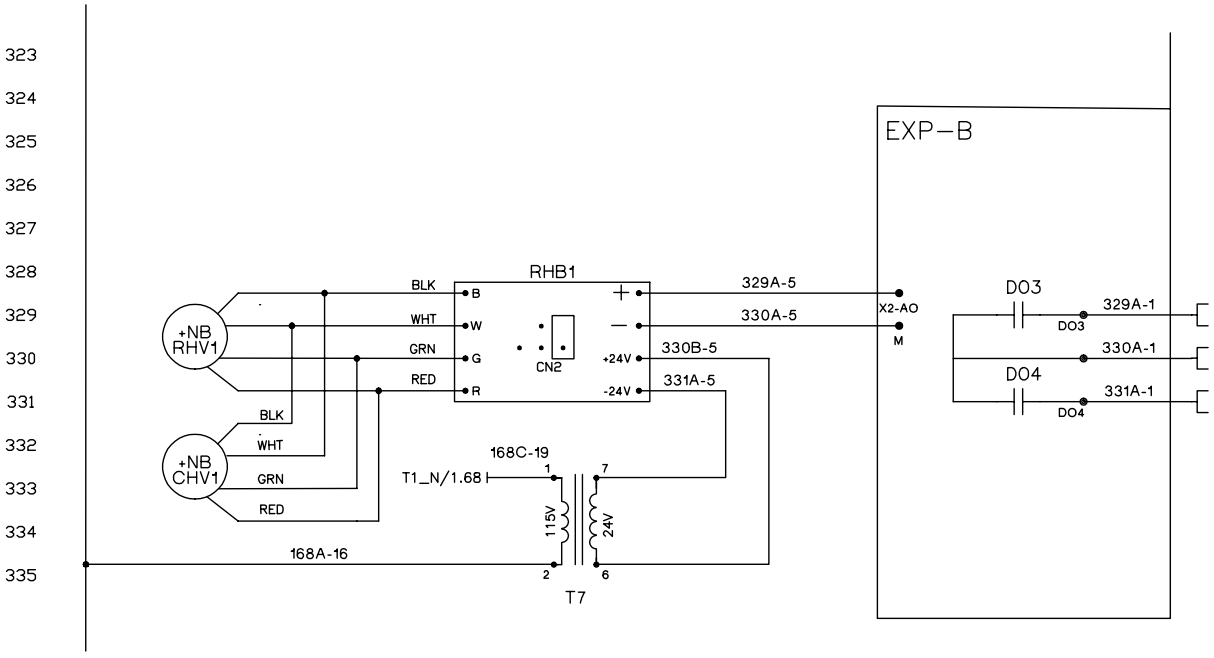
Control & Arrangement

In conjunction with dehumidification, MHGRH is used to raise the temperature of the cooled air to a desirable value. MHGRH is comprised of a parallel coil arrangement, with dual reheat valves (which operate in concert with one another) and a check valve.

During Dehumidification control with modulating Hot Gas Reheat (MHGRH) an analog signal (0-10Vdc) is controlled as described below.

- A PI Loop is used to control the HGRH valves to maintain the Discharge Air Temperature from the reheat coil.
- Compressor staging during reheat (or dehumidification) will be controlled by the Leaving DX Coil Temperature. For increased dehumidification during reheat, the standard default compressor staging range is 45 - 52°F.
- When dehumidification is active in the Cooling state, the reheat set point equals the DAT Cooling Setpoint. For DAT units, this is the normal DAT set point resulting from any reset. For Zone Control units, this set point is the result of a PI Loop based on the Control Temperature.
- Communication with the reheat control valves is accomplished by providing a 0-10Vdc signal to a pair of interface boards which in turn supply the control signal to the reheat valves (step type).
- In the Fan Only state, no sensible cooling is required, but dehumidification mode will still be enabled if the dew point or humidity sensor is not satisfied. Reheat set point varies from a maximum value (default 65°F) when the Control Temperature is at or below the heating changeover setpoint to a minimum value (default 55°F) when the Control Temperature is at or above the cooling changeover setpoint.
- In the reheat mode, the minimum position for the reheat valves is 1% (1.0 Vdc). The controller will modulate the reheat valves from this starting position.
- Upon termination of dehumidification (reheat), the maximum ramp down or decay rate of the reheat control valves shall be 1% per sec (or 0.1V per sec).
- Upon termination of dehumidification (reheat), staging of compressor(s) is delayed for 1 minute after reheat capacity = 0% (0 Vdc).
- Every 24 hours, the reheat control valves will be driven to their maximum position (10Vdc) and then returned to their normal operating position (0Vdc). If unit is operating in cooling or dehumidification (reheat) at the prescribed time it will be deferred to the next time.
- Dehumidification status can now be found under the MicroTech III main system menu. Reheat capacity (valve position) can also be found under the main system menu, display based on percentage (0-100%).

Figure 44: Modulating Hot Gas Reheat Schematic



Electric Heater Design

If the 10th digit in the model number is an “E”, the rooftop unit was furnished with a factory installed electric furnace (Example, DPS010AHCE). The Rebel rooftop units are available with 4-stage heat output (see capacities in Table 26. This packaged electric heat rooftop unit is designed for outdoor non-residential installations only.

The electric heat design consists of a heating coil, DDC staging control, and all operational safeties. The safety switches include high-limit temperature switches and individual coil fusing.

The high limit switch is an automatic reset switch. It opens the control circuit and shuts the heater down when the temperature reaches the high limit switch closes again allows the heater to run when the temperature gets below dead band. There is a second level of protection with an auxiliary high limit switch. This switch opens up and shuts the heater down when the temperature exceeds the set point. This switch requires a manual reset.

NOTE: It is not recommended to utilize the auxiliary electric heat as a reheat source for space control.

Electric Heating Capacity Data

Table 14: Heating Capacity – Electric Heaters

Unit	Stages	Option #1				Option #2				Option #3				Option #4				Option #5				Option #6				Option #7				Option #8				Option #9			
		KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm
003, 004	2, SCR	6	20.5	12.6	316	12	40.9	25.1	632	18	61.4	37.7	948	30	102.4	62.9	316	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
004				9.4				18.8				28.3				47.2																					
006				7.6				15.1				22.6				37.8																					
007	2, SCR	18	61.4	16.2	948	36	122.8	32.3	1896	54	184.3	48.5	2844	72 2	245.7	64.7	948	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
010, 012				12.6				25.2				37.7				50.3																					
015				10.3				20.6				30.9				41.2																					
016, 018	4, SCR	10	34.1	4.2	4	20	68.2	8.4	4	30	102.4	12.6	1580	45	153.5	18.9	2369	60	204.7	25.2	3159	72	245.7	30.2	3774	90	307.1	37.7	4739	120 2	409.5	50.3	6319	150 2	511.8	62.9	7898
020				3.3				6.6				9.9				14.9				19.9				23.8				29.8				39.7				49.7	
025, 028				3				6				9				13.5				18				21.6				27				35.9				44.9	

1. Temperature is calculated at nominal air flow
2. Not available in 208 & 230 Volt
3. 60 degree max rise
4. 2-stage in DPS 016–028 is only available with 10kW nominal heater

Daikin Tubular Heater Series

Package Heater Module

ANSI Z83.8-2013/CSA 2.6-2013

⚠ WARNING

Fire or explosion hazard.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

Failure to follow safety warnings exactly could result in serious injury, death or property damage. Be sure to read and understand the installation, operation and service instructions in this manual. Improper installation, adjustment alteration, service or maintenance can cause serious injury, death or property damage.

Do not store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.

What to do if you smell gas:

- Do not try to light an appliance
- Do not touch any electrical switch
- Do not use any telephone in the building
- Leave the building immediately
- Call the gas supplier immediately and follow the gas supplier's instructions
- If you cannot reach the gas supplier, call the fire department

NOTICE

DAT heater series modules are a recognized furnace component design certified by Intertek Testing Services (ETL).

For outdoor installation and installation downstream from refrigeration systems in cabinet applications.

This furnace must be installed in the designated non-combustible heat chamber of the cabinet. If it is removed, it is only to be replaced with an approved Original Manufacture Equipment Supplier furnace(s), installed and operated as specified by the approved Original Manufacture Equipment Supplier. It is not designed to have any portion of the heat exchanger outside the cabinet in which the furnace module is housed.

The Rating Plate/Name Plate has been permanently attached to the furnace assembly. It contains information including gas type, maximum and minimum input rating, manifold pressure, maximum and minimum inlet gas pressure, maximum and minimum airflow requirements, output capacity and electrical rating for the furnace. The plate also includes model number, serial number and scan code. This plate is to always remain attached to the furnace.

This furnace must be applied in accordance with the requirements of its listing.

Hooded and screened openings for combustion air have been provided in the furnace(s) access door. The air opening provides unrestricted combustion air to the burners and sized such that a minimum free area is maintained. The minimum free area is defined as 1 in^2 (625 mm^2) per 4000 BTUH (2.345 kW).

The access door provides direct access to the furnace vestibule where the burners, combustion inducer fan, ignition controls and ignition safeties are housed.

The vent discharge is sized such that it is equal to or larger than the discharge area of the combustion exhaust inducer fan.

A non-adjustable High Limit Switch will shut off the gas supply to the main burners should the outlet air reach a temperature exceed 250°F (121°C).

The cabinet supply air flow delivery package has been designed to provide sufficiently well distributed air flow across the heat exchanger to limit temperature rise as follows:

- Aluminized Steel: 1030°F (575°C)
- 409 Stainless Steel: 1080°F (600°C)

Clearance from combustibles to be no less than as listed below:

- Sides and back . . . . . 6 in (152 mm)
- Bottom . . . . . 2 in (51 mm)
- Top . . . . . 6 in (152 mm)
- Front. . . . . 36 in (914 mm)
- Vent pipe to any combustible surface . . . . . 6 in (152 mm)

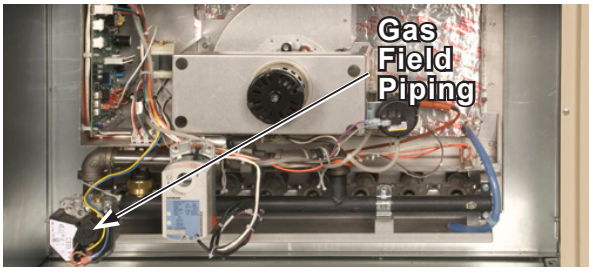
Do not use this package heater if any part has been under water. Immediately call a qualified service technician to inspect the heater and any gas control which has been under water.

Gas Furnace Design

If the 10th digit in the model number is a “G”, the rooftop unit was furnished with a factory installed furnace (Example, DPS010AHCG). The Rebel commercial rooftop units are available with either the low, medium and high heat input furnace (see capacities in Table 15). This packaged gas heat rooftop unit is designed for outdoor non-residential installations only. Furnace to be supplied with natural gas or LP only.

The gas heat furnace design consists of a tubular heat exchanger, in-shot burner manifold with gas valve, induced combustion blower, gas heat DDC control module and all operational safeties. The tubular heat exchanger can come with the standard aluminized steel construction or the optional stainless steel construction. The safety switches include a high-limit temperature switch, an auxiliary high-limit switch, a combustion blower proof of airflow, and the flame roll-out switch (see Figure 46).

Figure 45: Typical Gas Heat Section (Size 000 shown)



Gas Heating Capacity Data

Table 15: DPS 003-015 Gas Heating Capacities

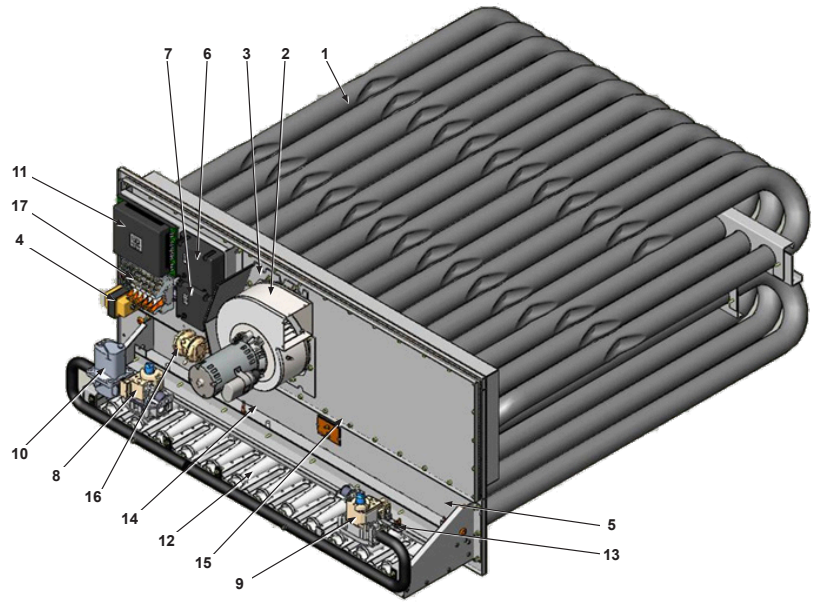
Data	Unit Size					
	003 - 006			007 - 015		
	Low Heat	Med Heat	High Heat	Low Heat	Med Heat	High Heat
Heating Input (MBh)	80	120	160	200	300	400
Heating Output (MBh)	64	96	128	160	240	320
Steady State Efficiency	80%					
Number of Stages	2					
Turndown[1]	5:1			10:1		
Maximum Temperature Rise[3]	60/100					
Gas Connection Size	1/2"			3/4"		
Min/Max External Static Pressure	0.5"/2.5"					
Gas Main Pressure						
Natural Gas (in. wc)	7-14	7-14	7-14	7-14	7-14	7-14
Propane (in. wc)	12-14	12-14	12-14	12-14	12-14	12-14
Manifold Pressure Natural Gas (per gas valve)						
Stage 1 (in. wc)	1.2	1.2	1.2	1.2	1.2	1.2
Stage 2 (in. wc)	3.2	3.2	3.2	3.2	3.2	3.2
Low fire[2]	0.4	0.4	0.4	0.4	0.4	0.4
Manifold Pressure Propane Gas (per gas valve)						
Stage 1 (in. wc)	2.3	2.3	2.3	2.3	2.3	2.3
Stage 2 (in. wc)	10.0	10.0	10.0	10.0	10.0	10.0
Low fire[2]	N/A	N/A	N/A	N/A	N/A	N/A

NOTE:
1. Modulating heat only.
2. Modulating heat not available with propane.
3. Aluminized steel 60°, Stainless steel 100°

Table 16: DPS 016–028 Gas Heating Capacities

Data	Unit Size					
	016–028					
	Low Heat					
Heating Input (MBh)	300	300	450	450	600	600
Heating Output (MBh)	240	240	360	360	480	480
Steady State Efficiency	80%					
Control (stage/modulating)	4	Mod	4	Mod	4	Mod
Turndown	4:1	12:1	4:1	12:1	4:1	12:1
Maximum Temperature Rise	100					
Gas Connection Size	¾"Ø					
Min/Max External Static Pressure	0.5"/2.5" wc					
Gas Main Pressure						
Natural Gas (in wc)	7-14	7-14	7-14	7-14	7-14	7-14
Propane Gas (in wc)	12-14	12-14	12-14	12-14	12-14	12-14
Manifold Pressure Natural Gas (per gas valve)						
Stage 1 (in wc)	0.88	0.88	0.88	0.88	0.88	0.88
Stage 2 (in wc)	3.5	3.5	3.5	3.5	3.5	3.5
Low Fire	0.88	0.26	0.88	0.26	0.88	0.26
Manifold Pressure Propane Gas (per gas valve)						
Stage 1 (in wc)	2.5	2.5	2.5	2.5	2.5	2.5
Stage 2 (in wc)	10.4	10.4	10.4	10.4	10.4	10.8
Low Fire	2.5	0.74	2.5	0.74	2.5	0.74

Figure 46: Typical Modulating Furnace Assembly (016–028 shown)



Item	Description
1	Furnace
2	Inducer Combustion Blower
3	Plate-Inducer Orifice
4	Transformer – 40 VA
5	Spark Igniter (2)
6	Ignition Control #1
7	Ignition Control #2
8	Gas Safety Valve #1
9	Gas Safety Valve #2
10	Gas Modulating Valve
11	Gas Modulating Control
12	Burner In-Shot (Typ)
13	Flame Roll-Out Switch (2)
14	Flame Sensor (2)
15	High Limit Temperature Switch
16	Proof of Airflow Switch
17	Control Relay (Typ)

Warranty Exclusion

Warranty is void if the furnace is operated in the presence of chlorinated vapors, if the airflow through the furnace is not in accordance with rating plate, or if the wiring or controls have been modified or tampered with.

⚠ WARNING

Hot surface hazard. Can cause severe equipment damage, personal injury, or death. Allow burner assembly to cool before servicing equipment.

⚠ WARNING

Units equipped with gas heating must not be operated in an atmosphere contaminated with chemicals which will corrode the unit such as halogenated hydrocarbons, chlorine, cleaning solvents, refrigerants, swimming pool exhaust, etc. Exposure to these compounds may cause severe damage to the gas furnace and result in improper or dangerous operation. Operation of the gas furnace in such a contaminated atmosphere constitutes product abuse and will void all warranty coverage by the manufacturer. Questions regarding specific contaminants should be referred to your local gas utility.

Horizontal Installations

⚠ WARNING

For installation on non-combustible floors only.

DPS 016–028 Rebel units are available with horizontal heat.

Ventilation & Flue Pipe Requirements

The Rebel rooftop unit is equipped with an outdoor air hood to supply adequate combustion air. The unit also has a flue outlet assembly and requires no additional chimney, flue pipe, Breidert cap, draft inducer, etc.

⚠ CAUTION

Snow levels must be controlled to prevent moisture and air flow blockage to the furnace enclosure and combustion air stream.

Installation

⚠ IMPORTANT

Connect this unit only to gas supplied by a commercial utility. This furnace must be installed by an experienced professional installation company that employs fully trained and experienced technicians. Install the gas piping in accordance local codes and regulations of the local utility company. In the absence of local codes, follow the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or the CSA B149.1, Natural Gas and Propane Installation Code – latest editions. Note: The use of flexible gas connectors is not permitted.

⚠ WARNING

Sharp edges hazard. Can cause personal injury or death. Sheet metal parts, self-tapping screws, clips, and similar items inherently have sharp edges, and it is necessary that the installer exercise caution when handling these items.

Electrical

The Daikin burner receives its electrical power from the main unit control panel. No additional power wiring must be routed to the burner. The sequencing of the burner is also controlled through this panel and therefore is factory wired. No additional wiring will be required.

⚠ DANGER

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS:

- Do not try to light any appliance.
- Do not touch any electric switch, do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

⚠ DANGER

The spark ignitor and ignition control are high voltage. Keep hands and tools away to prevent electrical shock. Shut off electrical power before servicing any of the controls. Failure to adhere to this warning can result in personal injury or death.

Gas Pressure Requirements

The pressure furnished to the main gas valve must not exceed 13.9" wc. When the supply pressure is above 13.9" wc, a high pressure regulator must precede the appliance gas pressure regulator. The inlet gas pressure must not exceed the maximum pressure rating of the high pressure regulator, and the outlet pressure must furnish gas to the appliance pressure regulator within the pressure range mentioned above.

Gas Piping

Gas piping must be sized to provide the minimum required pressure at the burner when the burner is operating at maximum input. Consult your local utility on any questions on gas pressure available, allowing piping pressure drops, and local piping requirements. The weight of field supplied gas piping must be supported by field supplied brackets or hangers.

The proper size piping must be run from the meter to the gas burner without reductions. Undersized piping will result in inadequate pressure at the burner. The pressure will be at its lowest when it is needed the most, at times of maximum demand. Therefore, it can cause intermittent hard-to-find problems because the problem may have left before the service technician has arrived. Avoid the use of bushings wherever possible.

Remove all burrs and obstructions from pipe. Do not bend pipe; use elbows or other pipe fittings to properly locate pipe.

A drip leg and a manual shut-off must be installed in the vertical line before each burner such that it will not freeze. Install unions so gas train components can be removed for service. All pipe threads must have a pipe dope which is resistant to the action of Propane gas. After installation, pressurize the piping as required and test all joints for tightness with a rich soap solution. Any bubbling is considered a leak and must be eliminated. Do not use a match or flame to locate leaks.

Auxiliary Limit Switch Function

The auxiliary limit switch is a manually resetable switch and is designed to trip in the event of a supply fan failure. It should not trip during any other conditions. In the event of a blockage to the return or discharge air, the primary limit, which is an automatic-reset type, is designed to trip.

Should there be a fan failure which results in the tripping of the auxiliary limit, the limit must be manually reset to resume function of the unit.

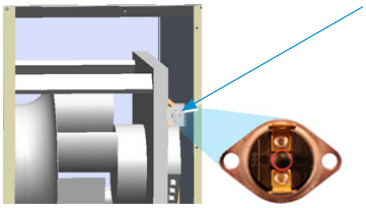
On the Rebel A cabinet (3-6 ton), the auxiliary limit resides in the fan compartment between the furnace heat exchanger and the fan. To access the switch, the fan compartment door must be opened. Be sure all power to the unit is disconnected before opening the fan compartment door.

Once the fan compartment door is opened the auxiliary limit switch can be found behind the supply fan on a bracket mounted to the cabinet wall.

Depressing the red button on the auxiliary limit will reset the limit and allow the furnace to be powered. The furnace should now respond to a call for heat.

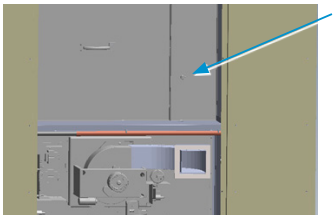
Again, the red button must be depressed in order to reset the limit and allow the furnace to be powered.

Figure 47: 3–6 Ton—Auxiliary Limit Switch



View of supply fan with aux limit behind, mounted on a bracket off the cabinet wall

Figure 48: 7–15 Ton—Auxiliary Limit Switch

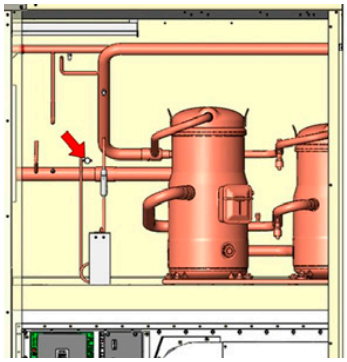


The auxiliary limit on the B cabinet (7-15 ton) is in the furnace compartment (vestibule) above the furnace

Figure 49: 016–028 Auxiliary Switch

The auxiliary limit on the C cabinet (17-28 ton) is in the compressor compartment above the furnace vestibule.

The red button of auxiliary limit switch must be depressed in order to reset the limit and allow the furnace to be powered.



DPS Modulating Burner Setup for VB1200 Burner Controllers.

DPS have two variations of burners 5-1 and 10- 1. 10-1 burners have a split manifold where one side is modulating and the other side is single stage. 5-1 burners have a single manifold with a modulating gas valve. Both burners are manufactured by Beckett or Heatco but their respective burner controllers vary in programming. When replacing a VB1200 board make sure to compare the tag on the original board to make sure the correct one is installed in the unit. If an incorrect board gets installed, an alarm for bad ID plug will occur.

When performing startup, even though it is not on the current startup forms, be sure to verify and usually adjust low fire rate accordingly.

Inlet gas pressures should be between name plate ranges of 7”-14”

Low fire should be between 0.25"-0.3"
Best Suggested adjustment from testing is 0.28”

At the ON/OFF regulator outlet, gas pressure should be 3.5”w.c

This is done by backing the screw out to decrease manifold pressure and screwing in to increase pressure.

Adjustments of these burners are done through the MANUAL CONTROL menu at the Microtech III controller. Low fire is set with 20% heating capacity, generating a 2 VDC output from Microtech. There will be a slight increase in pressure at each voltage increase from 2VDC to 10VDC. See air/gas graph below. Fine tune adjustments on gas pressure are done on the Maxitrol EXA modulator valve. The adjustments are done with the two electronic push buttons under the blue cover. Refer to the directions below on how to use these buttons.

Once a good stable flame is verified at low fire, adjust the burner to 100% heating capacity from the Microtech controller and check for high fire.

High Fire should be at 3.5”w.c
Best suggested adjustment is 3.5”w.c

At the ON/OFF regulator outlet, High fire should still maintain 3.5”w.c. This is done by backing the screw out to decrease manifold pressure and screwing in to increase pressure.

On the 10-1 burners, the single stage burner needs to output 3.5”w.c at all times when heating capacity is above 60%. Below 60% this section on the manifold does not get energized.

Figure 50: VB-1200 Modulating Control

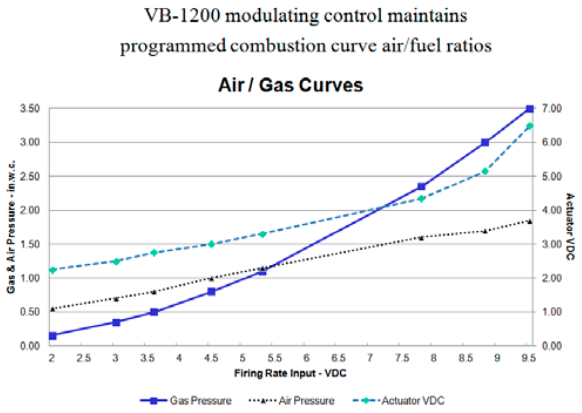
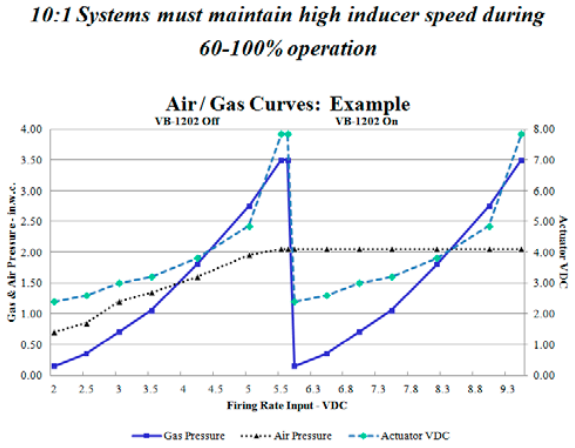


Figure 51: 10:1 Systems



Maxitrol EXA Star Controller

Operation

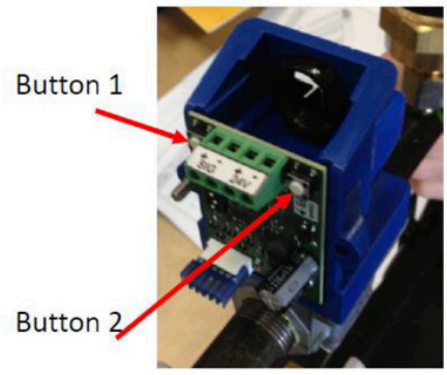
1. Remove the two screws holding the cover.
2. Connect switched OFF 24V (AC/DC) power source to Terminals 3 and 4.
3. Set DIP switches to match available control signal.
4. Connect seithched OFF control signal to Terminals 1 and 2. Observe polarity. Note that the return or signal ground must be connected to Terminal 2.
5. Switch power and control signal ON.
6. Set valve (see Valve Setting).
7. Replace cover.

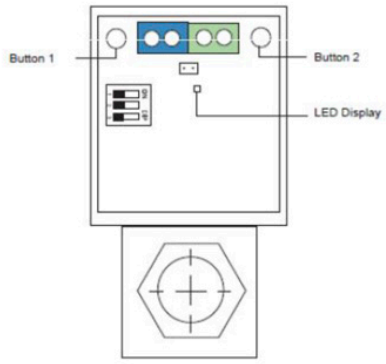
Valve Setting

The EXA Star modulating valve series has two buttons and an LED for the user interface. The buttons are used to set the valve for high and low fire settings (Figure XX).

- High fire setting: LED will be solid red
- Low fire setting: LED will be blinking red
- Operating mode: LED will be OFF

Figure 52: Maxitrol EXA Star LEDs





High Fire Setting – Button 1

To enter the high fire setting mode, press and hold button #1 until the LED lights solid red. Release. The valve is now in the high fire setting mode. Buttons #1 and #2 are used to set desired high fire settings.

Press or hold button #1 to increase gas flow. Each button press equates to the minimum available step size and will increase flow slowly. Holding the button down auto-steps and eliminates the need to repeatedly press the button. Use this feature to rapidly increase the flow.

Press or hold button #2 to decrease gas flow. Each button press equates to the minimum available step size and will decrease flow slowly. Holding the button down auto-steps and eliminates the need to repeatedly press the button. Use this feature to rapidly decrease the flow.

To save the high fire setting, simutaneously hold buttons #1 and #2 until the LED turns OFF.

NOTE: Controls left in any setting mode will default to the current setting and return to normal operating mode after 5 minutes of inactivity.

Low Fire Setting – Button 2

To enter the high fire setting mode, press and hold button #2 until the LED lights solid red. Release. The valve is now in the high fire setting mode. Buttons #1 and #2 are used to set desired high fire settings.

Press or hold button #2 to decrease gas flow. Each button press equates to the minimum available step size and will decrease flow slowly. Holding the button down auto-steps and eliminates the need to repeatedly press the button. Use this feature to rapidly decrease the flow.

Press or hold button #1 to increase gas flow. Each button press equates to the minimum available step size and will increase flow slowly. Holding the button down auto-steps and eliminates the need to repeatedly press the button. Use this feature to rapidly increase the flow.

To save the high fire setting, simutaneously hold buttons #1 and #2 until the LED turns OFF.

NOTE: Controls left in any setting mode will default to the current setting and return to normal operating mode after 5 minutes of inactivity.

Table 17: Capacity of Pipe Natural Gas (CFH)

With Pressure Drop of 0.3" Wc & Specific Gravity Of 0.60									
Pipe Length (ft.)	Pipe Size-inches (Ips)								
	½	¾	1	1¼	1½	2	2½	3	4
10	132	278	520	1050	1600	2050	4800	8500	17500
20	92	190	350	730	1100	2100	3300	5900	12000
30	73	152	285	590	890	1650	2700	4700	9700
40	63	130	245	500	760	1450	2300	4100	8300
50	56	115	215	440	670	1270	2000	3600	7400
60	50	105	195	400	610	1150	1850	3250	6800
70	46	96	180	370	560	1050	1700	3000	6200
80	53	90	170	350	530	990	1600	2800	5800
90	40	84	160	320	490	930	1500	2600	5400
100	38	79	150	305	460	870	1400	2500	5100
125	34	72	130	275	410	780	1250	2200	4500
150	31	64	120	250	380	710	1130	2000	4100
175	28	59	110	225	350	650	1050	1850	3800
200	26	55	100	210	320	610	980	1700	3500

NOTE: Use multiplier below for other gravities and pressure drops.

Table 18: Specific Gravity Other Than 0.60

Specific Gravity	Multiplier
0.50	1.100
0.60	1.000
0.70	0.936
0.80	0.867
0.90	0.816
1.00	0.775
PROPANE-AIR	
1.10	0.740
PROPANE	
1.55	0.622
BUTANE	
2.00	0.547

Table 19: Pressure Drop Other Than 0.3"

Pressure Drop	Multiplier	Pressure	Multiplier
0.1	0.577	1.0	1.83
0.2	0.815	2.0	2.58
0.3	1.000	3.0	3.16
0.4	1.16	4.0	3.65
0.6	1.42	6.0	4.47
0.8	1.64	8.0	5.15

Gas Piping Routing Into Unit

On-The-Roof Piping

1. Remove knockout on upright (refer to Figure 53, Figure 54 or Figure 55).
2. Route gas supply pipe through hole. Carefully plan pipe route and fitting locations to avoid interference with swinging of doors, etc.
3. The Rebel unit does not have an option for gas piping through the curb.
4. Field piping to be supported such that it does not generate a force (weight) and/or torque (twist) on the Factory gas manifold(s).

The appliance must be isolated from the gas supply system by closing off the manual shut off valve during any pressure testing less than 0.5 psi (3.5 kPa) of the gas supply piping system.

The appliance and its individual shut-off valve must be disconnected from the gas supply system during any pressure testing greater than or equal to 0.5 psi (3.5 kPa).

Regulator to be sized for the maximum total Btu input required for the heater(s).

Figure 53: Rebel A Cabinet 003–006 Gas Piping

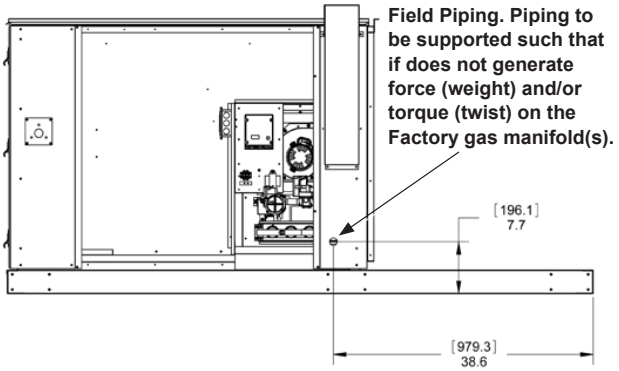


Figure 54: Rebel B Cabinet 007–015 Gas Piping

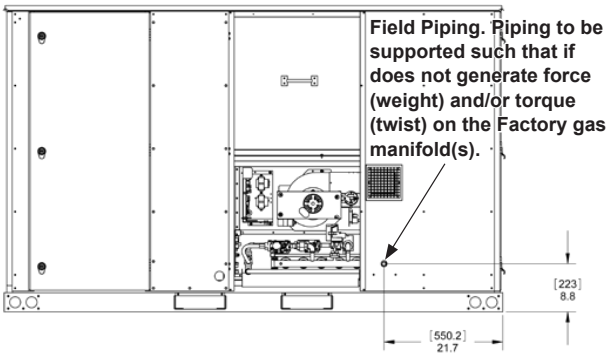
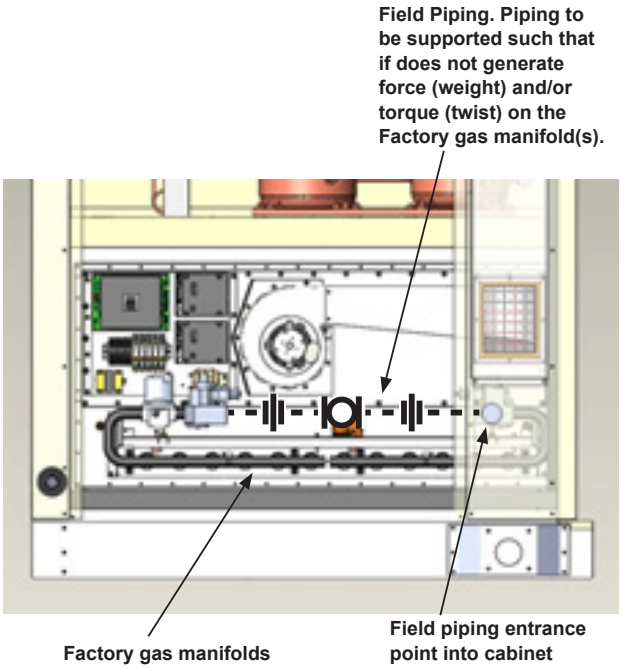
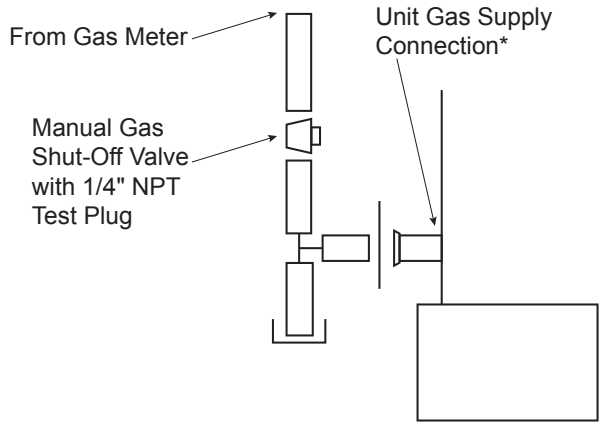


Figure 55: Rebel C Cabinet 016–028 Gas Piping



NOTE: Field piping to 2 manifolds may be required. 'T' piping to manifolds should be centered with independent unions to each. Follow all applicable NFPA and local code requirements for isolation, traps, and more between the regulator and 'T' piping.

Figure 56: Field Gas Heat Connections



DPS 016–028 Gas Pipe Manifold Pressure Adjustment

For Two Stage Furnace

1. Read gas pressure at the Inlet Pressure Tap of the Honeywell VR8305Q Gas Safety Control Valve (Figure 57) and confirm pressure is at 7.0" wc for natural gas or 11.0" for propane. Adjust upstream pressure reducing gas regulator as required to obtain 7.0" wc gas pressure for natural gas or 11.0" for propane.
2. The gas pipe manifold pressure for high fire (stage #2) should be set at 3.5" wc for natural gas or 10.0" for propane. Adjust the High Pressure Adjustment Honeywell VR8305Q Gas Safety Control Valve (Figure 57) as required. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.
3. The gas pipe manifold pressure for low fire (stage #1) should be set at 0.88" wc for natural gas or 2.5" for propane. Adjust the Low Pressure Adjustment Honeywell VR8305Q Gas Safety Control Valve (Figure 57) as required. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.

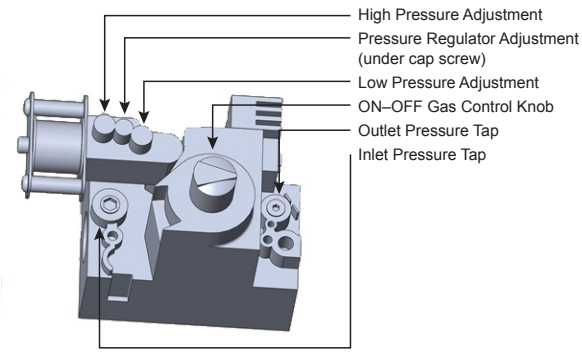
For Modulating Furnace:

1. Read gas pressure at the Inlet Pressure Tap of the Honeywell VR8305Q Gas Safety Control Valve (Figure 57) and confirm pressure is at 7.0" wc for natural gas or 10.0" for propane. Adjust upstream pressure reducing gas regulator as required to obtain 7.0" wc natural gas pressure or 10.0 for propane.
2. The gas pipe manifold pressure for high fire should be set at 3.5" wc for natural gas or 8.2" for propane. Adjust the High Pressure Adjustment on the Honeywell VR8305Q Gas Safety Control Valve (Figure 57) as required. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.
3. The gas pipe manifold pressure for low fire (stage #1) should be set at 0.26" wc for natural gas or 0.74" for propane.

   Adjust the Low Pressure Adjustment on the Honeywell VR8305Q Gas Safety Control Valve (Figure 57) as required until pressure at the Honeywell VR8305Q Gas Safety Control Valve Outlet Pressure Tap reads 0.26" wc for natural gas or 0.74" for propane. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.

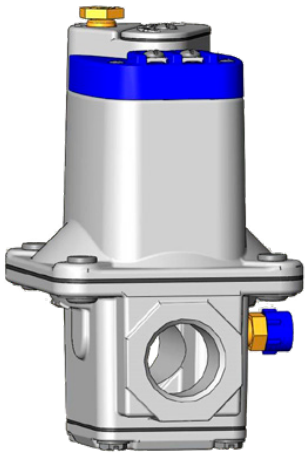
   Adjust the Maxitrol M520B Modulating Valve (Figure 58) Low Flow Adjustment screw until the gas pipe manifold pressure reads 0.26" w.c. for natural gas or 0.74" for propane.

Figure 57: Honeywell VR8305Q Gas Safety Control Valve Used for Both Staged and Modulating Furnaces



White Rogers is also used — functionally the same but different in appearance.

Figure 58: Maxitrol M520B Modulating Valve



DPS 003–015 Sequence of Operation

⚠ DANGER

Never test for gas leaks with an open flame. It can cause an explosion or fire resulting in property damage, personal injury, or death. Use a commercially available soap solution made specifically for the detection of leaks to check all connections.

⚠ WARNING

This unit is equipped at the factory for use with natural gas only. Conversion to LP gas requires a special kit supplies by Daikin Parts. Failure to use the proper conversion kit can cause fire, carbon monoxide poisoning, explosion, personal injury, property damage, or death.

Staged Control

The following details the sequence of operation for the low heat option.

1. Unit DDC control calls for heat.
2. Furnace DDC control module receives a call for heat.
3. High limit switch is checked for safe condition.
4. Proof of airflow switch is check for combustion airflow.
5. 60 second prepurge cycle starts.
6. Spark ignitor is activated for 3 seconds.
7. Gas valve receives a command for stage 1 of heat.
8. Burner is ignited.
9. Unit DDC controller calls for stage 2 of heat.
10. Furnace DDC controller receives a stage 2 heat command.
11. Gas valve receives a command for stage 2 of heat.

Modulating Control

The following details the sequence of operation for the low heat option.

1. Unit DDC controller calls for heat.
2. Furnace DDC control module receives a call for heat.
3. Furnace safety switches and DDC control are checked for safe conditions.
4. 45 second prepurge cycle starts. Proof of airflow switch is checked for combustion airflows.
5. Spark ignitor is activated.
6. Gas valve receives a signal to open fully.
7. Burner is ignited and runs for 20 seconds in high fire. Note: if call for heat is interrupted during this timing, the furnace will be locked in for the 20 seconds cycle.
8. Gas valve and induction blower motor receives a signal to modulate burner output to match the unit discharge air temperature setting.

LP Conversion (Staged Furnace Only)

For Rebel A and B Cabinets Only

Convert the furnace in this unit using the liquefied petroleum (LP) gas valve spring and burner nozzles supplied in the conversion kit. See Table 20 for part numbers.

The LP gas valve maintains the proper manifold pressure for LP gas. See Table 20. The correct burner orifices are included in the kit.

Table 20: Furnace Identification for LP Conversion

Unit Size	Staged Furnace
3 – 6 Ton Unit	300049725
7 – 15 Ton Unit	300049583

Altitude Conversion

For elevations up to 2,000 feet, rating plate input ratings apply. For high altitudes (elevations over 2,000 ft.), contact Daikin Parts. See Table 21 for part numbers.

NOTE: If the fuel source has been derated for altitude by the local utility provider then a conversion kit is not required.

Table 21: Furnace Identifications for Altitude (DPS 003–015)

Elevation	Part Number
Staged Operation	
2000–2999	300049578
3000–3999	300049579
4000–4999	300049580
5000–5999	300049581
6000–6999	300049582

DPS 016–028 Sequence of Operation

DANGER

Never test for gas leaks with an open flame. It can cause an explosion or fire resulting in property damage, personal injury, or death. Use a commercially available soap solution made specifically for the detection of leaks to check all connections.

WARNING

This unit is equipped at the factory for use with natural gas only. Conversion to LP gas requires a special kit supplies by Daikin Parts. Failure to use the proper conversion kit can cause fire, carbon monoxide poisoning, explosion, personal injury, property damage, or death.

Staged Control

The following details the sequence of operation for the low heat option.

1. Unit DDC control calls for heat.
2. Furnace DDC control module receives a call for heat.
3. High limits switch(s) are checked for safe conditions.
4. Proof of air flow switch is checked for combustion induced draft airflow.
5. 30 second pre-purge cycle starts.
6. Spark ignitor is activated for 3 seconds.
7. Gas valve receives a command for stage 1 heat
8. Burner is ignited.
9. Unit DDC controller calls for stage 2 of heat.
10. Furnace DDC controller receives a stage 2 heat command.
11. Gas valve receives a command for stage 2 of heat.

Modulating Control

The following details the sequence of operation for the low heat option.

1. Unit DDC control calls for heat.
2. Furnace DDC control module receives a call for heat.
3. High limits switch(s) are checked for safe conditions.
4. Proof of air flow switch is checked for combustion induced draft airflow. Combustion draft inducer fan will be operating at high speed.
5. 30 second pre-purge cycle starts.
6. Spark ignitor is activated for 3 seconds.
7. Gas safety shut-off valve is opened.
8. Gas modulating valve is run to 66% open.
9. Burner is ignited.
10. Gas modulating valve remains at 66% open for 30 seconds.
11. After 30 seconds have elapsed, modulating controller opens and closes gas control valves as required based on heat input requirement from Unit DDC control.
12. Unit DDC control input for 8–30% of span will result in heat input up to 30% of full heating capacity. The gas train with the modulating valve will be used to achieve the heating during this phase. Combustion draft inducer fan will be operating at low speed.
13. Unit DDC control input for 30–55% of span will result in heat input up to 50% of full heating capacity. The gas train with the modulating valve will be used to achieve the heating during this phase. Combustion draft inducer fan will be operating at high speed.
14. Unit DDC control input for 55–75% of span will result in heat input up to 75% of full heating capacity. The gas train with the modulating valve will be used to achieve the heating during this phase. The gas train with the two stage gas safety valve will be used to achieve the heating during this phase. Stage 1 coil of the two stage gas safety will be energized. Combustion draft inducer fan will be operating at high speed.
15. Unit DDC control input for 75–100% of span will result in heat input up to 100% of full heating capacity. The gas train with the modulating valve will be used to achieve the heating during this phase. The gas train with the 2 stage gas safety valve will be used to achieve the heating during this phase. Stage 1 coil and Stage 2 coil of the two stage gas safety will be energized. Combustion draft inducer fan will be operating at high speed.

Altitude Conversion

For elevations up to 2000 feet, rating plate input ratings apply. For high altitudes (elevations over 2000 ft) contact Daikin Applied Parts. See Table 22 for part numbers. Or contact local gas supplier to confirm gas heating value has been devalued for applicable elevations.

NOTE: if the fuel source has been derated for altitude by the local utility provider then a conversion kit is not required.

Table 22: Furnace Identification for Altitude (DPS 016–028)

Elevation	Part Number
Natural Gas Fired Furnace with 50 MBH Burners	
2000–2999	910166410
3000–3999	910166411
4000–4999	910166412
5000–5999	910166413
6000–6999	910166415
Natural Gas Fired Furnace with 45 MBH Burners	
2000–2999	910166412
3000–3999	910166416
4000–4999	910166417
5000–5999	910166415
6000–6999	910166418
LPG Gas Fired Furnace with 50 MBH Burners	
2000–2999	910166419
3000–3999	910166420
4000–4999	910166421
5000–5999	910166422
6000–6999	910166424
LPG Gas Fired Furnace with 45 MBH Burners	
2000–2999	910166425
3000–3999	910166422
4000–4999	910166427
5000–5999	910166428
6000–6999	910166429

Table 23: LP Gas Furnace Conversion (DPS 016–028)

Natural Gas to LP Gas: 2 Stage Furnace Conversion	
Furnace Size (MBH)	**Conversion Kit Part Number**
300	910191263
450	910191274
600	910191278
Natural Gas to LP Gas: 4 Stage Furnace Conversion	
Furnace Size (MBH)	**Conversion Kit Part Number**
300	910191270
450	910191274
600	910191278
Natural Gas to LP Gas: Modulating Furnace Conversion	
Furnace Size (MBH)	**Conversion Kit Part Number**
300	910191272
450	910191276
600	910191280

Start-Up Procedures

Start-Up Responsibility

⚠ DANGER

Overheating or failure of the gas supply to shut off can cause equipment damage, severe personal injury or death. Turn off the manual gas valve to the appliance before shutting off the electrical supply.

The start-up organization is responsible for determining that the furnace, as installed and as applied, will operate within the limits specified on the furnace rating plate.

1. The furnace must not operate at insufficient airflow or temperature rise greater than specified (refer to Table 15 on page 45). On variable air volume systems it must be determined that the furnace will not be operated if or when system cfm is reduced below the specified minimum airflow cfm.
2. It must be established that the gas supply is within the proper pressure range (refer to Table 15 on page 45).

Start-up and service of this equipment must be performed by trained and experienced technicians. It is highly recommended that the initial start-up and future service be performed by Daikin trained technicians who are familiar with working on live equipment. A representative of the owner or the operator of the equipment should be present during start-up to receive instructions in the operation, care and adjustment of the unit.

Before Start-Up

1. Notify inspectors or representatives who may be required to be present during start-up of gas fuel equipment. These could include the gas utility company, city gas inspectors, heating inspectors, etc.
2. Review the equipment and service literature and become familiar with the location and purpose of the furnace controls. Determine where the gas and power can be turned off at the unit and before the unit.
3. Determine that power is connected to the unit and available.
4. Determine that the gas piping, meter, and service regulator have been installed, tested, and meet the equipment requirements.
5. Determine that proper instruments will be available for the start-up. A proper start-up requires the following: voltmeter, manometer or gauges with ranges for both manifold pressure and inlet gas pressure.

Start-Up Preliminary

Close gas main.

1. Check the burner fan wheel for binding, rubbing, or loose setscrews.
2. Check power.
3. Purge the gas lines.
4. Leak check. Using a rich soap-water mixture and a brush, check the gas lines for leaks. Correct all leaks before starting furnace.

Operating Procedures

⚠ DANGER

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS:

- Do not try to light any appliance.
- Do not touch any electric switch, do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

1. Set the controller to the lowest setting.
2. Turn off all electric power to the appliance.
3. This appliance is equipped with an ignition device which automatically lights the burner. Do NOT try to light the pilot by hand.
4. Open the control access panel.
5. Turn the gas control clockwise to "OFF".
6. Wait five (5) minutes to clear out any gas. Then, smell for gas, including near the floor. If you smell gas, **STOP!** Follow step "B" in the DANGER label on this page. If you don't smell gas, proceed to the next step.
7. Turn the gas control counter-clockwise to "ON".
8. Close the control access panel.
9. Turn on all electric power to the appliance.
10. Set controller to full heat.
11. Verify manifold pressure and rate.
12. If the appliance will not operate, refer to "Turning Off Gas to the Appliance", and call a qualified service technician.

Turning OFF Gas to the Appliance

1. Set the controller to the lowest setting.
2. Turn OFF all electrical power to the appliance if service is to be performed.
3. Open the control access panel.
4. Turn the gas control knob clockwise to "OFF". Do not force.
5. Close the control access panel.

Service

The furnace DDC controller has diagnostic information for troubleshooting the furnace operation. The ignition control module has a LED light that will flash when an abnormal condition occurs. See Table 24 on page 57.

Maintenance

Planned maintenance is the best way to avoid unnecessary expense and inconvenience. Have this system inspected at regular intervals by a trained and experienced service technician. The following service intervals are typical for average situations but will have to be adjusted to suit your particular circumstances.

Fuel pressure settings and control settings should be made only by persons thoroughly experienced with the burner and control system, and must not be tampered with by persons without such experience.

Always replace covers on burner controls and boxes as the electrical contacts are sensitive to dust and dirt. Perform maintenance of controls, gas valves, and other components in accordance with instructions contained in the manufacturer's bulletins.

Monthly

Check air filters and replace if dirty.

Twice Yearly

1. **Burner Air -** Check burner fan wheel for dirt buildup and lint. Check combustion air intake louver and flue box/vent for dirt buildup and accumulation of wind borne debris.
2. **Cleaning -** Inspect flue tubes and combustion chamber, clean as required. Keep burner vestibule clean. Dirt and debris can result in burner air blockages.

Yearly

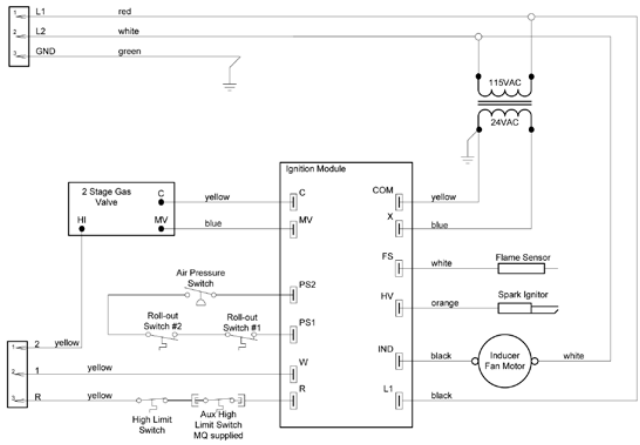
The heater and the venting system shall be inspected once a year by a qualified service agency

Gas Train - Check all valves, piping and connections for leakage. Inspect and clean flame rod, ignition electrode, and burner manifold.

Condensate Pan/Drain - Check pan and drain for accumulation of debris.

DPS 003–015 (only) Ignition Control Module for Staged Gas Furnace

Figure 59: Typical Staged Gas Furnace Electrical Schematic with Sensor



LED Diagnostic Information

Steady Off:	No power or Control hardware fault
Steady On:	Power applied, Control OK
1 Flash:	Combustion fan motor energized, Pressure switch open
2 Flashes:	Combustion fan motor off, Pressure switch closed
3 Flashes:	Ignition lockout from too many trials
4 Flashes:	Ignition lockout from too many flame losses within single call for heat
5 Flashes:	Control hardware fault detected

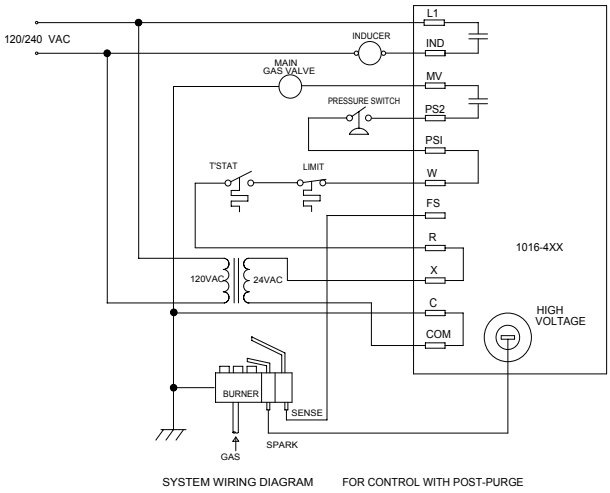
Ignition Control Module LED Diagnostics

The following LED indicators can be used to diagnose faults associated with the staged gas furnace.

Table 24: LED Indicator and Fault Conditions

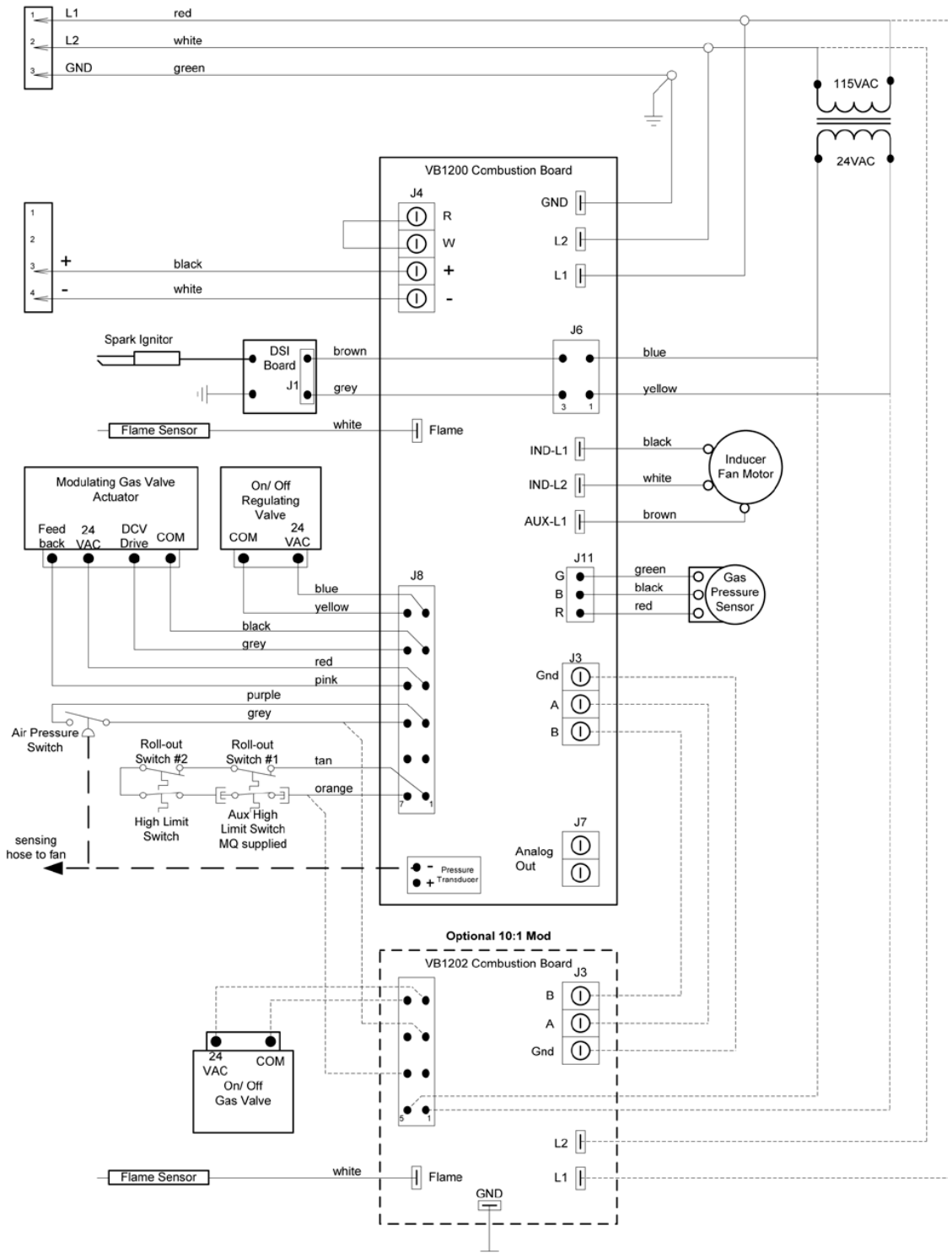
Indicator	Fault Condition
Steady Off	No power or control hardware fault
Steady On	Power applied, control OK
1 Flash	Combustion fan motor energized, pressure switch open
2 Flashes	Combustion fan motor off, pressure switch closed
3 Flashes	Ignition lockout from too many trials
4 Flashes	Ignition lockout from too many flame losses within single call for heat
5 Flashes	Control hardware fault detected

Figure 60: Ignition Control Wiring



DPS 003–015 (only) Ignition Control Module for Modulating Gas Furnace

Figure 61: Typical Modulating Gas Furnace Electrical Schematic with Sensor



DPS 003–015 (only) Gas Furnace Ignition and Control Troubleshooting

Variable Furnace Controller

Daikin's furnace controller is an electronic device that delivers full control of the modulating furnace. Control includes sequencing, ignition, safety, modulation of the control valve, and the induced draft motor. Inputs to the furnace control board are an a 0-10V signal. The analog signal will modulate the burner down to 25% of full load. Safety inputs include pressure line and electrical connection from the airflow proofing switch and electrical connection from the rollout switches. Control board outputs are to the igniter board, modulating gas valve, and to the induce draft motor.

Modulating Furnace Diagnostics

The Rebel furnace control that operates the furnace has built-in, self-diagnostic capability. The control continuously monitors its own operation and the operation of the system. The LED on the control indicates the current system state, warnings, failures and test modes.

NOTE: It is highly recommended if a replacement is required on the VB-1200 board or the draft inducer motor to replace both as a pair.

VB-1200 Trouble Shooting Guide

Table 25: Furnace I.D. Plug Information (Displayed on Power-up)

Display Information (example)	Description
C	Furnace series or model name, for example, C cabinet series.
CAb	
400	Furnace size in 1000's of BTU, for example, 400 kBTU.
nAt or LP	Burner fuel type, for example, natural gas or LP.
GAS or LP	
1.01	Software version, for example, v1.01

Table 26: Normal Furnace Operation

Display Information	Mode	Description
Off	OFF Mode	System Idle - Control board has power, no faults found, no call for heat.
Pur	PURGE Mode	System is purging the heat exchanger – No gas on, no flame, inducer runs for the specified purge timings. Purge cycles occur immediately before and after each burner operation.
Ign	IGNITION Mode	System is initiating burner operation – Igniter energized, modulating valve moved to ignition setting, gas on. Maintained for the trial-for-ignition period and the five second flame stabilization period.
HEA	WARM-UP Mode	Period between Ignition and Run – System checks completed before modulation control begins.
run	RUN Mode	Normal modulating operation.
ret	Ignition Retry	System has had a failed ignition attempt or has lost flame during burner operation and is beginning another ignition cycle.

Table 27: Functional Alerts — DPS 003–015 only

Display Information	Alert	Description	Possible Cause	Solution
A01	Failed ignition attempt *Maximum number of allowed retries not met*	The flame could not be established during the trial for ignition period. This alert indicates the maximum number of retries has not been exceeded and furnace operation will continue with another ignition attempt.	See "E 0 1" in the LOCKOUT ERRORS section.	See "E 0 1" in the LOCKOUT ERRORS section.
A02	Lost Flame	The flame sensor signal has been lost after flame is established during a call for heating. This alert is displayed during the ignition RECYCLE period prior to the next ignition attempt.	A. Flame sensor coated	1. Clean flame rod sensor.
			B. Flame sensor improperly mounted or grounded	1. Check flame sensor wiring integrity and ceramic for cracks. 2. Re-install / replace flame sensor.
			C. Unstable flame pattern	1. Check that all burner assembly components are properly installed. 2. Check that all seals between the vestibule area and the heat exchanger area are tight. 3. Insure that the combustion door gasket is in place and the door is properly installed.
			D. Insufficient intermediate gas manifold pressure through main gas safety valve	1. Check for faulty gas valve wiring. 2. Check 24 VAC to gas valve assembly. 3. Check inlet pressure to safety gas valve. 4. Check outlet pressure from the safety gas valve. 5. Replace safety gas valve if faulty.
			E. Insufficient gas manifold pressure to burner through modulating ball valve assembly	1. Check voltage to gas valve actuator. (2 – 10 VDC depending on model) 2. Check alignment and set screw connection between ball valve and actuator.
A03	Insufficient Combustion Air *Furnace Functional*	Furnace cannot achieve desired combustion air flow due to blockage or high altitude operation resulting in a de-rate of the furnace.	A. High altitude operation	1. Normal operation. Furnace automatically de-rates for high altitude conditions
			B. Partially blocked vent	1. Check air inlet and outlet for blockage. 2. Check venting configuration for excessive venting length, improper sizing, etc..
			C. Leak in sensing hose	1. Check sensing hose for cracks, crimps or loose connections.
			D. Low Line Voltage	1. Check sensing hose for cracks, crimps or loose connections.
			E. Faulty inducer assembly	1. Insure correct inducer assembly installed and functioning properly.

Table 27 continued: Functional Alerts

Display Information	Alert	Description	Possible Cause	Solution
A04	Limited Low Fire	Automatic adaptive program is currently limiting the lower range of modulation at avoid flame loss at minimum fire conditions. The alert is displayed during the run cycle once a flame-out condition has triggered the Limited Low Fire function. This function is reset by cycling power to the board.	A. Low gas line pressure	1. Insure gas supply is connected to furnace and check for proper line pressure.
			B. Insufficient intermediate gas manifold pressure through gas safety valve	1. Check for faulty gas valve wiring. 2. Check 24 VAC to gas valve assembly. 3. Check inlet pressure to safety gas valve. 4. Check outlet pressure from the safety gas valve – adjust as needed. 5. Replace safety gas valve if faulty.
			C. Faulty burner operation	1. Check for proper mounting of the burner assembly. 2. Check burner orifice for proper size and blockage.
			D. Faulty flame sensor	1. Check flame rod wiring and connections. 2. Check for proper alignment of flame rod. 3. Clean flame rod sensor.
			E. Improper alignment of the modulating actuator and the gas ball valve	1. Check that the alignment of the actuator to the ball valve is correct. The ball valve must be in the fully open position when the actuator is fully energized ("ACTUATOR DRIVE" = 9.6 VDC or greater). 2. Insure that the set screw on the actuator is tightened to the ball valve stem.
			F. Blocked or improper venting	1. Check air inlet and outlet for blockage. 2. Check venting configuration for excessive venting length, improper sizing, etc.
A05	Weak Flame Signal	The flame signal level is less than optimal for this furnace. Maintenance of the flame sensing components is advised.	A. Flame sensor coated	1. Clean flame rod sensor.
			B. Flame sensor improperly mounted or grounded	1. Check flame sensor wiring integrity and ceramic for cracks. 2. Re-install / replace flame sensor.
			C. Unstable flame pattern	1. Check that all burner assembly components are properly installed. 2. Check that all seals between the vestibule area and the heat exchanger area are tight. 3. Insure that the combustion door gasket is in place and the door is properly installed.

Table 28: Lockout Errors — DPS 003–015 only

Display Information	Alert	Description	Possible Cause	Solution
888	Ignition Board Failure	Ignition board start-up checks have detected an error.	A. Faulty transformer	1. Check 24-volt transformer for correct output. 2. Check connections and wiring to control board and other components connected to the 24 volt source. 3. Replace if necessary.
			B. Faulty control board	1. Turn off power to the furnace, wait 30 seconds and turn power back on. Re-try ignition sequence and see if the system responds. 2. Replace control board if necessary.
E01	Failed Ignition Maximum Retries Exceeded	The flame could not be established during multiple trial-for-ignition periods. The maximum number of retries has been exceeded and the furnace is in a lock-out condition.	A. Insufficient gas line pressure	1. Insure gas supply is connected to furnace and check for proper line pressure.
			B. Gas valve control turned "OFF"	1. Turn gas valve to the "ON" position.
			C. No spark from direct spark ignition	1. Check ignition voltage (115 VAC from board to transformer) and wiring. 2. Check 24 VAC transformer for DSI board.
			D. Insufficient intermediate gas manifold pressure through gas safety valve	1. Check for faulty gas valve wiring. 2. Check 24 VAC to gas valve assembly. 3. Check inlet pressure to safety gas valve. 4. Check outlet pressure from the safety gas valve – adjust as needed. 5. Replace safety gas valve if faulty.
			E. Insufficient gas manifold pressure to burner through modulating ball valve assembly	1. Check voltage to gas valve actuator. (7 – 10 VDC depending on model) 2. Check alignment and set screw connection between ball valve and actuator (See Modulating Gas Valve Alignment procedure).
			F. Burners do not light	1. Check spark rod assembly for proper location, spark gap, etc. 2. Check for proper mounting of the burner assembly. 3. Check burner orifice for proper size and blockage.
			G. Burners light and remain lit for about 5 seconds	1. Check flame rod wiring and connections. 2. Check for proper alignment of flame rod. 3. Clean flame rod sensor.

Table 28 continued: Lockout Errors

Display Information	Alert	Description	Possible Cause	Solution
E02	Primary Limit / Fuse Failure	The control board safety fuse has blown or the primary temperature limit has opened indicating safe operating temperatures for this furnace have been exceeded.	A. Improper circulating airflow	1. Check filter / replace if dirty. 2. Check for improperly sized duct system. 3. Check for faulty blower motor. 4. Check for faulty blower motor wiring.
			B. Primary limit switch failure	1. Check for an open primary limit switch at ambient temperature.
			C. Fuse is blown	1. Check and replace fuse on the board. 2. Make sure fuse socket is tight, crimp fuse terminals if necessary.
			D. Faulty primary limit switch wiring	1. Check primary limit wiring continuity from the switch to the control board.
E03	Modulation Valve Failure	The control lost the position feedback from the modulating gas valve actuator.	A. Faulty modulation valve actuator wiring	1. Insure wiring is connected per unit wiring diagram.
				2. Check for loose pins or bad connections.
				3. Check for frayed wiring or shorts to ground.
			B. Modulation valve actuator failure	1. Insure actuator has 24 V power.
				2. Insure actuator is receiving valid drive signal from the control board (2 – 10 VDC).
				3. Check for actuator feedback to the control board (2 – 10 VDC).
E04	Air Sensor Failure *Pressure Sensor Reading Low*	The air sensor reading is too low for operating conditions or the air pressure switch closed when the sensor indicates low flow. *The pressure switch MUST be open prior to inducer activation.*	A. Faulty wiring or connections	1. Check pressure switch wiring. 2. Check inducer wiring. 3. Check for plugged or disconnected vacuum hoses.
			B. Faulty pressure switch	1. Replace pressure switch.
			C. Faulty pressure sensor, located on the board	1. Replace board.
E05	Air Sensor Failure *Pressure Sensor Reading High*	The air sensor reading is too high when the inducer is off or the air pressure switch open when the sensor indicates high flow. *The pressure switch MUST close to initiate an ignition sequence.*	A. Faulty wiring or hose connections	1. Check pressure switch wiring. 2. Check inducer wiring. 3. Check for broken or disconnected vacuum hoses.
			B. Blocked or improper venting	1. Check air inlet and outlet for blockage.
				2. Check venting configuration for excessive venting length, improper sizing, etc.
			C. Faulty pressure switch	1. Replace pressure switch.

Table 28 continued: Lockout Errors

Display Information	Alert	Description	Possible Cause	Solution
E06	Gas Sensor Failure Pressure Sensor Reading Low	The gas sensor reading is too low compared to the expected value for the modulating gas valve actuator position. *When the furnace is operating at 75% or higher – greater than 8 VDC analog input voltage – the manifold pressure sensor must read 1.4" w.c. or higher*	A. Modulating actuator / ball valve not properly aligned	1. Perform Modulating System Gas Valve Alignment procedure as defined in the service manual.
			B. Line pressure too low	1. Insure line pressure is properly adjusted for the gas and application. Correct as necessary.
			C. Intermediate regulated pressure too low	1. Insure the safety gas valve(s) are properly adjusted to the specified outlet pressure. Adjust per the installation instructions as necessary.
			D. Wrong gas pressure sensor installed	1. Insure the proper gas sensor – either Natural Gas or LP – is installed. Replace as needed.
			E. Gas pressure sensor faulty	1. Insure gas sensor is installed properly and wired per the unit wiring diagram. Replace as necessary.
E07	Gas Sensor Failure *Pressure Sensor Reading High*	The gas sensor reading is too high compared to the expected value for the modulating gas valve actuator position. *When the furnace is operating at 75% or lower – less than 8 VDC analog input voltage – the manifold pressure sensor must read 2.8" w.c. or lower*	A. Modulating actuator / ball valve not properly aligned	1. Perform Modulating System Gas Valve Alignment procedure as defined in the service manual.
			B. Line pressure too high	1. Insure line pressure is properly adjusted for the gas and application. Correct as necessary.
			C. Intermediate regulated pressure too high	1. Insure the safety gas valve(s) are properly adjusted to the specified outlet pressure. Adjust per the installation instructions as necessary.
			D. Wrong gas pressure sensor installed	1. Insure the proper gas sensor – either Natural Gas or LP – is installed. Replace as needed.
			E. Gas pressure sensor faulty	1. Insure gas sensor is installed properly and wired per the unit wiring diagram. Replace as necessary
E08	Improper Flame Signal	Control senses flame present when the gas valve is commanded off.	A. Flame remains lit in "Off" cycle	1. Gas valve leaks - check wiring to remove continuous 24V to gas valve. 2. Gas valve is stuck open – remove, repair or replace gas valve.
E09	No Firing Rate Input	Call for heat is sensed (R & W closed) but firing rate is below defined voltage threshold for furnace operation.	A. Faulty wiring into the "Analog +" and "Analog –" terminals	1. Insure wiring is connected per unit wiring diagram. 2. Check for loose pins or bad connections. 3. Check for frayed wiring or shorts to ground.
			B. No signal from source.	1. Check firing rate input voltage – must be greater than 1.5 VDC. 2. Troubleshoot controller providing firing rate input to the VB-1200 control board.
E1d	Invalid I.D. Plug	The installed I.D. plug is not valid for this control board.	A. Incorrect I.D. plug installed	1. Insure I.D. plug is correct for the furnace – check label. 2. Insure I.D. plug is properly inserted into the mating connector on the control board. 3. With the I.D. plug installed, cycle power to the furnace. The board will display the I.D. plug identity upon power-up. 4. Install correct I.D. plug as needed.

DPS 016–028 Gas Furnace Ignition Troubleshooting

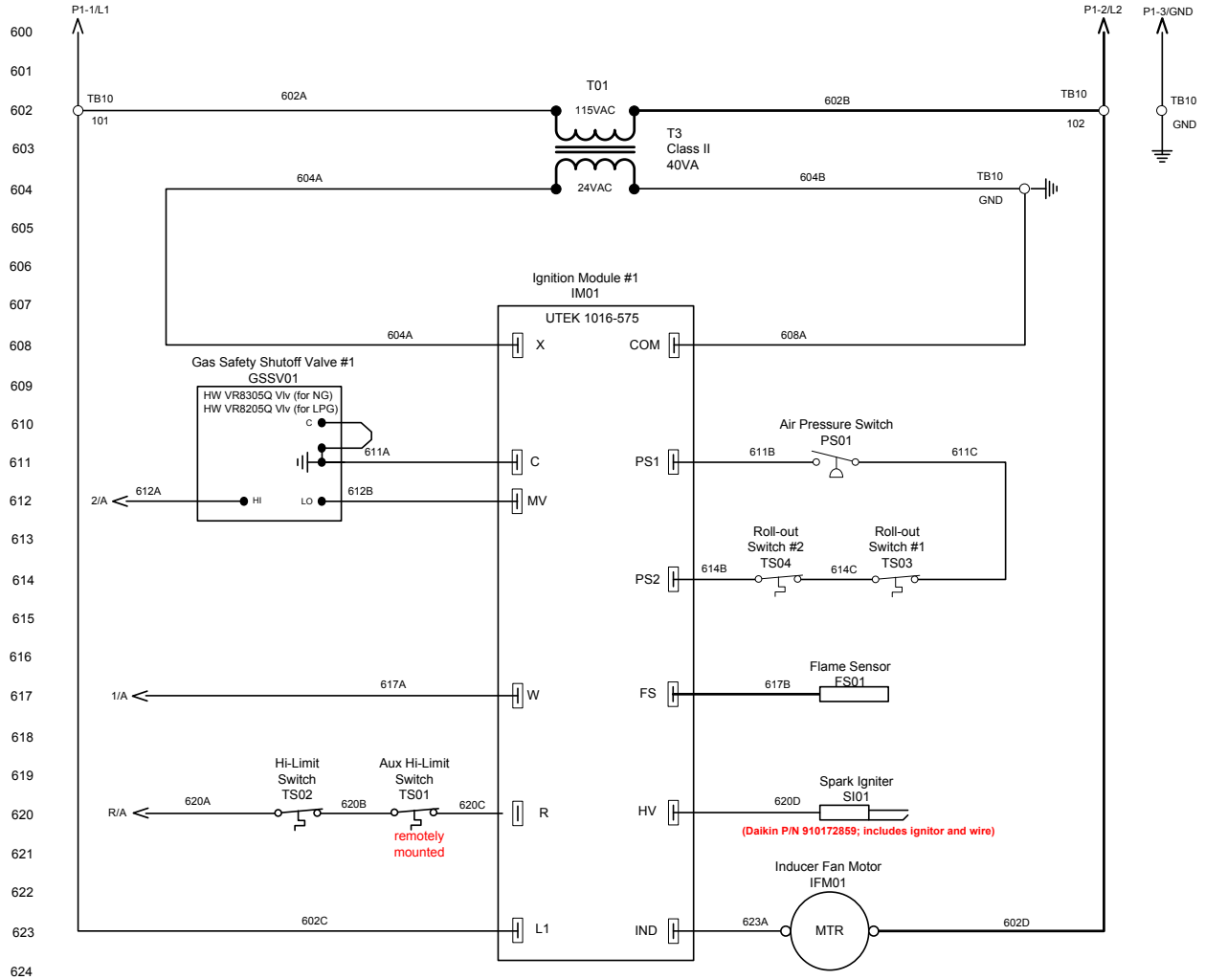
Table 29: 300/450/600 MBH Staged Ignition Control Troubleshooting Guide (UTEC 1016 Ignition Board)

LED Indicator	System Status	Fault Description	Possible Causes and Corrective Action
Steady ON	System Normal	N/A	N/A
LED OFF	Lockout	LED is OFF	1. Check 120V is being supplied to heater transformer. 2. Check that 24 VAC is being supplied by transformer. Replace transformer if not being supplied 24 VAC.
1 Flashes	Lockout	Combustion air pressure switch contact is open with inducer fan running.	1. Check air pressure switch hose and hose connection between switch and fan. 2. Check reset switch is not tripped for rollout switch(s). 3. Check high limit switch is not open 4. Replace pressure switch if contact does not close when fan is running.
2 Flashes	Lockout	Combustion air pressure switch contact is closed when inducer fan is not running.	1. Check wiring between PS1 and PS2 on ignition control board for correct connection and proper wiring. 2. Check pressure switch functions correctly with and without pressure. 3. Replace pressure switch if fails to function correctly.
3 Flashes	Lockout	Ignition locked out from too many ignition attempts	1. Verify gas supply is present. 2. Verify gas safety valve is working correctly. 3. Verify gas manifold pressure is adequate and correct. 4. Check spark igniter is not cracked or dirty. Check spark igniter wire is not covered with oil and debris or cracked. Check wire is connected correctly. 5. Check flame sensor wiring. Check to see if flame sensor is grounded.
4 Flashes	Lockout	Ignition lockout from too many flame losses within a single heat.	1. Check pressure switch hose for leaks or poor connection 2. Check for condensate in pressure switch hose. 3. Check pressure tap on combustion blower and combustion pressure switch for blockage. 4. Check functionality of combustion inducer fan.
5 Flashes	Lockout	Control hardware fault detected	1. Change ignition board.

Table 30: Modulating Control LED Status Indicator

LED Indicator	PCB Label	Color	Functionality Description
Main Power	PWR	Blue	Light ON: Controller has received a call for heat and is powered.
AFS	AFS	Green	Light ON: Combustion Inducer Blower is running
Start Up	SU	Yellow	Light ON: Controller has received signal that ignition has commenced and gas modulating valve has moved to 66% open position. Valve will be held at this position for 30 seconds to insure burner ignition is stable.
Modulation	MOD	Green	Modulating section is operational and modulating
Relay 1 (energized)	R1	Red	Relay 1 is energized and combustion inducer blower is operating at low speed. **NOTE:** When Relay 1 is not energized combustion inducer fan has permissive to operate at high speed.
Relay 2 (energized)	R2	Red	Relay 2 is energized and Non-modulating (Staged) gas train is operational. 1st coil of two stage gas safety valve is energized. **NOTE:** When R2 LED is on the two stage gas safety valve is at low fire.
Relay 3 (energized)	R2	Red	Relay 3 is energized and Non-modulating (Staged) gas train is operational. 2nd coil of two stage gas safety valve is energized. **NOTE:** When both R2 & R3 LED are on the two stage gas safety valve is at high fire.

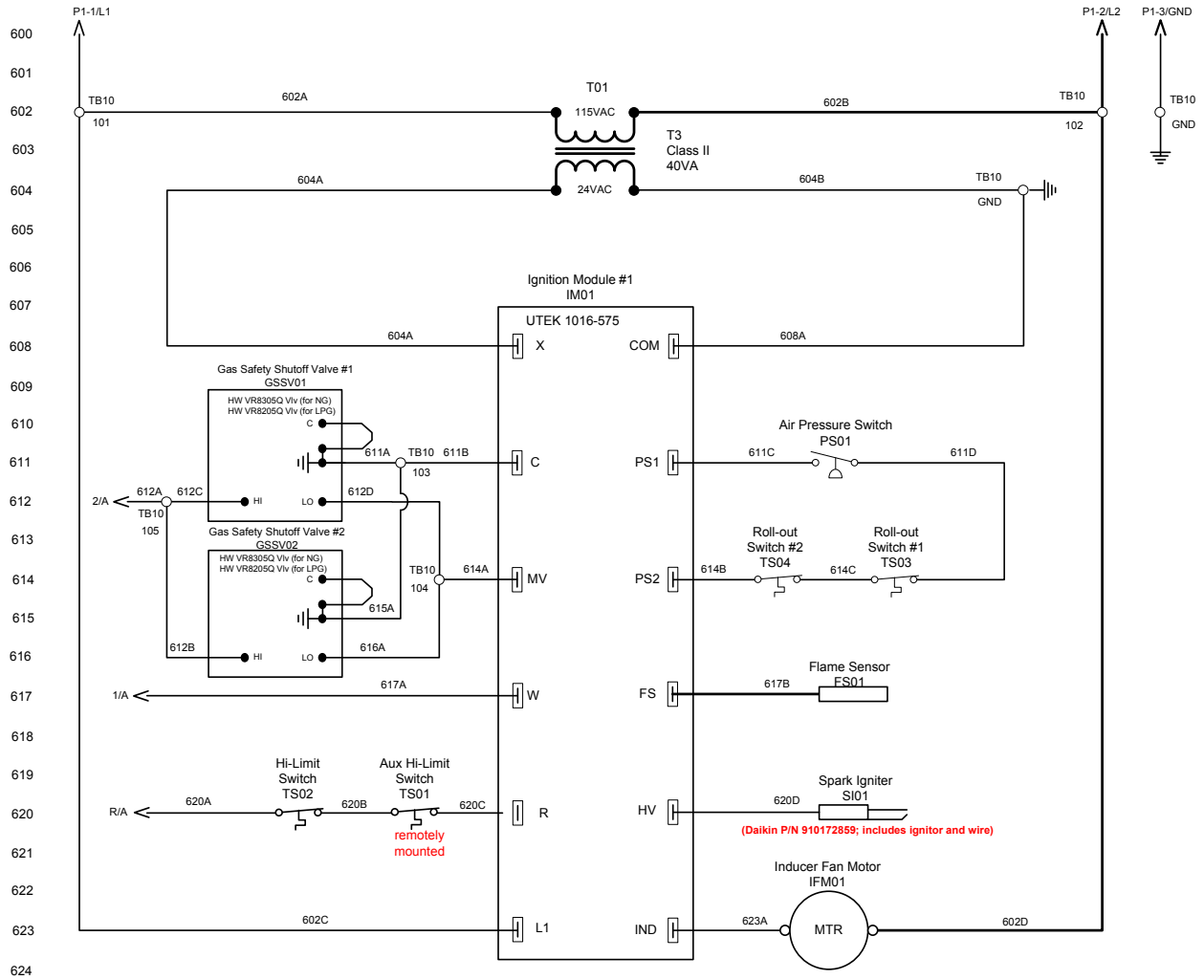
Figure 62: Typical 2 Stage Control Gas Furnace, 300 MBH — DPS 016–028 shown



LED Diagnostic Information

Steady Off: No power or Control hardware fault
Steady On: Power applied, Control OK
1 Flash: Combustion fan motor energized, Pressure switch open
2 Flashes: Combustion fan motor off, Pressure switch closed
3 Flashes: Ignition lockout from too many trials
4 Flashes: Ignition lockout from too many flame losses within single call for heat
5 Flashes: Control hardware fault detected

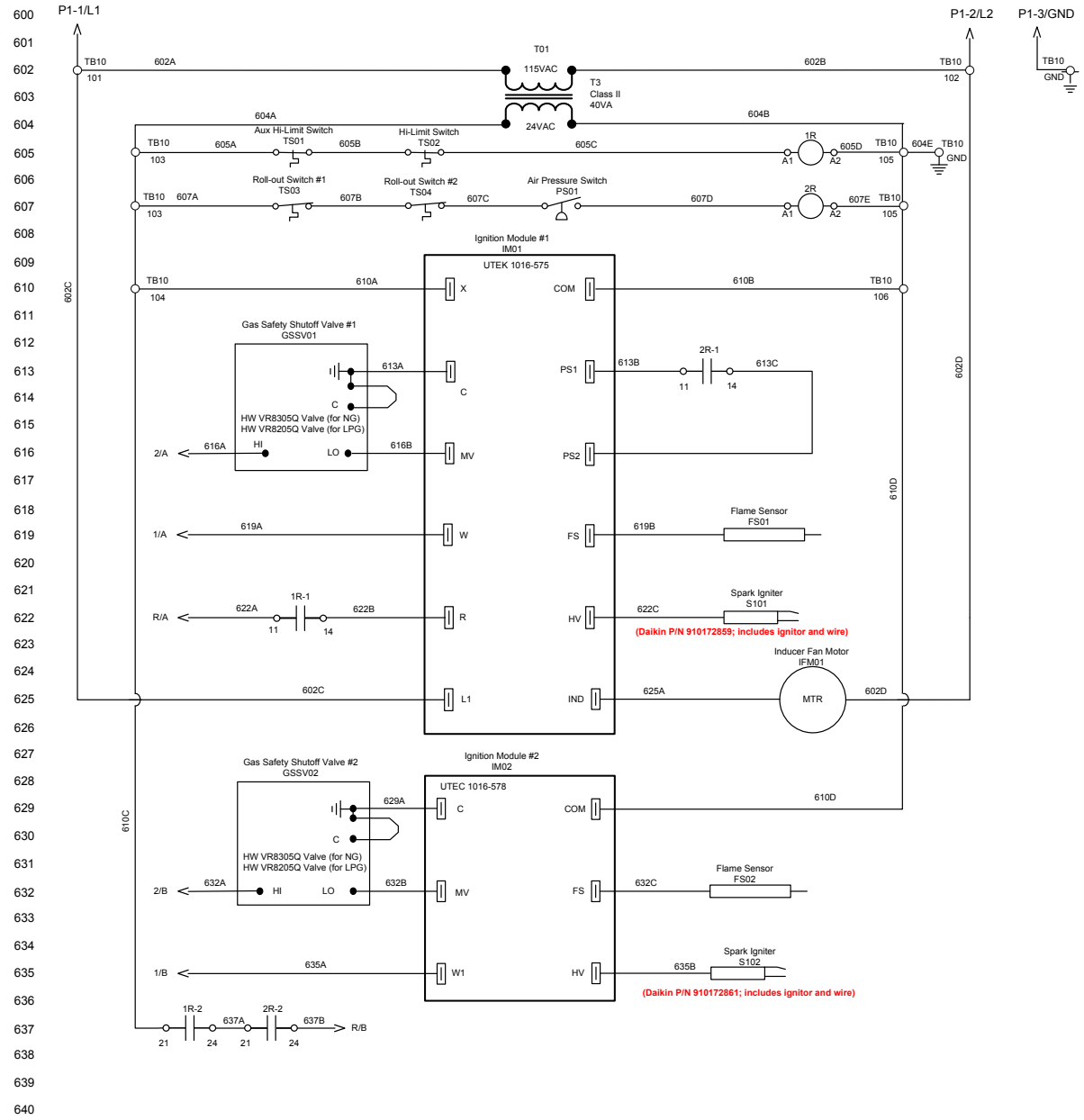
Figure 63: Typical 2 Stage Control Gas Furnace, 450/600 MBH — DPS 016–028 shown



LED Diagnostic Information

Steady Off: No power or Control hardware fault
Steady On: Power applied, Control OK
1 Flash: Combustion fan motor energized, Pressure switch open
2 Flashes: Combustion fan motor off, Pressure switch closed
3 Flashes: Ignition lockout from too many trials
4 Flashes: Ignition lockout from too many flame losses within single call for heat
5 Flashes: Control hardware fault detected

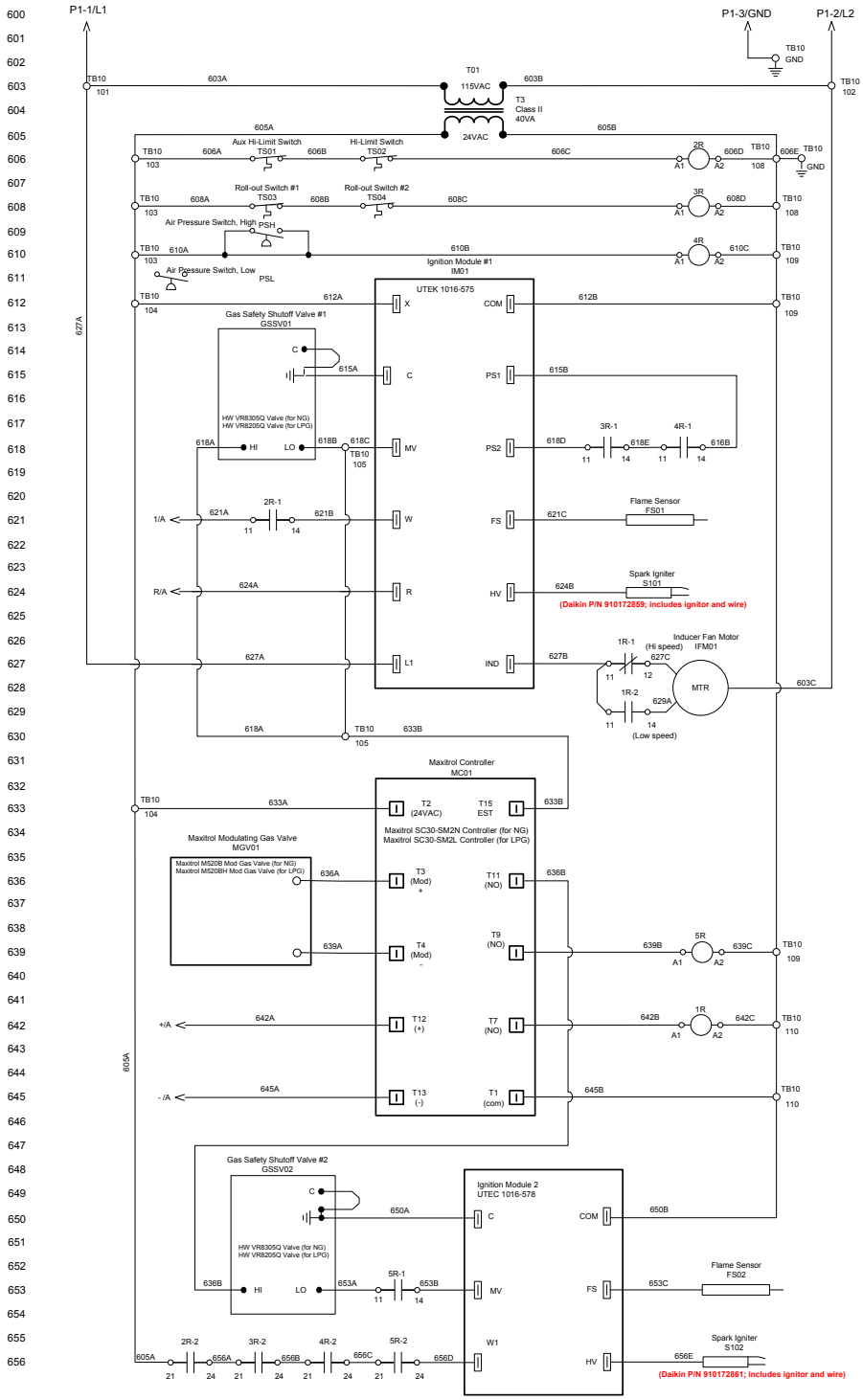
Figure 64: Typical 4 Stage Control Gas Furnace, 300/450/600 MBH — DPS 016–028 shown



LED Diagnostic Information

Steady Off:	No power or Control hardware fault
Steady On:	Power applied, Control OK
1 Flash:	Combustion fan motor energized, Pressure switch open
2 Flashes:	Combustion fan motor off, Pressure switch closed
3 Flashes:	Ignition lockout from too many trials
4 Flashes:	Ignition lockout from too many flame losses within single call for heat
5 Flashes:	Control hardware fault detected

Figure 65: Typical Modulating Control Gas Furnace, 300/450/600 MBH — DPS 016–028 shown



LED Ignition Module Diagnostic Information

Steady Off: No power or Control hardware fault
Steady On: Power applied, Control OK
1 Flash: Combustion fan motor energized, Pressure switch open
2 Flashes: Combustion fan motor off, Pressure switch closed
3 Flashes: Ignition lockout from too many trials
4 Flashes: Ignition lockout from too many flame losses within single call for heat
5 Flashes: Control hardware fault detected

LED Modulating Control Status

PWR (blue): Main Power
SU (yellow): Start Up
R1 (red): Relay 1 energized
R2 (red): Relay 2 energized
R3 (red): Relay 3 energized
AFS (green): AFS (Air Flow Switch)
MOD (green): Modulation

Hot Water Heater Design

⚠ CAUTION

Coil freeze possible. Can damage equipment.

Follow instructions for mixing antifreeze solution. Some products have higher freeze points in natural state than when mixed with water. The freezing of coils is not the responsibility of Daikin Applied.

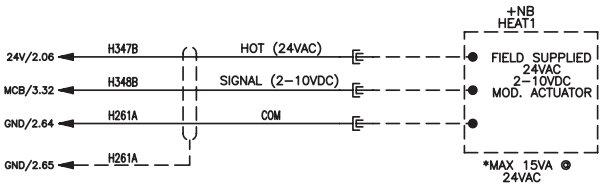
If the 10th digit of the model number is a "W", the rooftop unit was furnished with a factory installed hot water coil (Example: DPS010AHCW). The hot water coil comes with a piping vestibule for field supplied and installed control valve and piping. The coil is furnished with ODM copper connections. The Rebel commercial rooftop units are available with a low heat (one row coil) or a high heat (two row coil) configuration (3 rows also offered on DPS 016–028).

Hot water coils are not recommended for use with entering air temperatures less than 40°F (4°C). No control system can guarantee a 100% safeguard against coil freeze up. Glycol solutions or brines are the only freeze-safe media for operation of water coils at low entering air temperatures.

See certified drawings for the recommended piping entrance locations. Seal all piping penetrations to prevent air and water leakage.

NOTE: Factory installed piping is copper. Dissimilar metal within the plumbing system can cause galvanic corrosion. To avoid corrosion, provide proper di-electric fittings as well as appropriate water treatment.

Figure 66: Hot Water Heating Schematic



Field Installed Freeze Stats

Field installed freeze stats can be added. The freeze stat contacts should be wired to the MicroTech III. MicroTech III will turn the fans OFF, shut the outdoor air damper, open the valve and issue an alarm when the normally closed contact opens between terminals 111 and 112 on Rebel units 003–015, 220 and 221 for DPS 016–028..

Figure 67: Field Installed Freeze Stat Schematic (003–015)

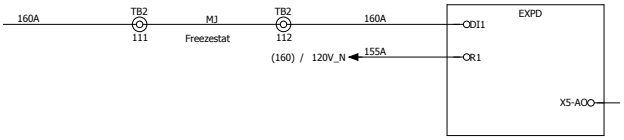


Figure 68: Field Installed Freeze Stat Schematic (016–028)

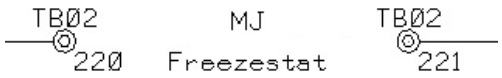


Table 31: Heating Capacity and Water Pressure Drop – Hot Water Coils

Unit	MBH	GPM	WPD	Connection Size
3	61.4	6.1	1.0	¾" Sweat
4	72.9	7.3	1.4	¾" Sweat
5	82.6	8.2	1.7	¾" Sweat
6	91.6	9.2	2.2	¾" Sweat
7.5	149.7	15.0	3.1	¾" Sweat
10	176.9	17.8	4.2	1" Sweat
12	195.9	19.6	5.1	1" Sweat
15	221.4	22.1	6.4	1⅝" Sweat
16	347	35.5	0.7	1⅝" Sweat
18	376	38.4	1.2	1⅝" Sweat
20	403	41.1	1.3	1⅝" Sweat
25	464	47.3	1.4	1⅝" Sweat
28	497	50.7	1.6	1⅝" Sweat

Nominal airflow, 60°EAT, approximately 180°–160° water. WPD does not include a field supplied valve pressure drop. 2-row performance shown, 1-row coil also available.

System Description

When a unit is equipped with an optional enthalpy wheel, energy recovery is provided by drawing outside air across half of the enthalpy wheel and drawing exhaust air across the other half. Latent heat and sensible heat are transferred from the hotter and moist exhaust air to the colder and dry outside air during winter conditions. Latent heat and sensible heat are transferred from the hotter and moist outside air to the cooler and dry exhaust air during summer conditions. Energy recovery control consists of starting and stopping an exhaust fan, modulating the speed of the exhaust fan, starting and stopping an enthalpy wheel, optionally controlling the speed of the enthalpy wheel and opening and closing a set of bypass dampers. The outdoor dampers are controlled in the normal manner.

Definitions

The following are descriptions of various components related to the enthalpy wheel construction (Figure 69):

Bearing, external - The wheel and bearing rotate on the shaft, no field lubrication is required.

Brush seal - The seal used for both the circumferential seal and the inner seal in the cassettes. They are constructed of nylon brush and configured to seal against the enthalpy wheel band in the case of the circumferential seal, and against the wheel face in the case of the inner seal. These seals are full contact seals, have an integral clip, and they are clipped to the cassette face panel cutout (circumferential) or to the (inner) post.

Cassette - The steel structure that houses the rotor. Cassettes are of punched sheet metal panel construction.

Enthalpy wheel - A generic name for an energy conservation wheel. The term “enthalpy” refers to an air stream’s total energy (temperature and humidity level).

Exhaust air - The air stream that is exhausted to the outside. Exhaust air is building return air that has been run through the enthalpy wheel.

Heat wheel - Synonymous with an enthalpy wheel, energy conservation wheel, or total energy recovery wheel. Some heat wheels are sensible only wheels and should not be confused with Daikin total energy recovery wheels.

Hub - The center support of an enthalpy wheel.

Latent energy - Latent energy, in the context of enthalpy wheel discussions, is the work done by the wheel to transfer moisture from one air stream to another. Latent work is accompanied by humidity changes in the air streams.

Media - The chemical composite part of the enthalpy wheel which actually performs the latent and sensible exchange.

Outdoor air - The air stream that is brought in from the outside. Outdoor air becomes supply air after going through the enthalpy wheel.

Purge - A small segment of supply air defined by the gap between the inner seal on the outdoor air edge of the center post and the supply air edge of the center post. The purge angle is adjustable. The purge captures the small amount of supply air captive in the enthalpy wheel when the wheel moves from return to supply and routes it to return to minimize cross contamination.

Return air - The air stream that is returned from the building. Return air becomes exhaust air after going through the enthalpy wheel.

Rotor - The part of an enthalpy wheel that performs the energy exchange and consists of the wheel media, hub, spokes and band.

Sensible heat - Sensible energy, in the context of enthalpy wheel discussion, is the work done by the enthalpy wheel to transfer heat from one air stream to another. Sensible work is accompanied by temperature changes in the air stream.

Supply air - The air stream that is supplied to the building space. Supply air is outdoor air that has been run through the enthalpy wheel.

Arrangements

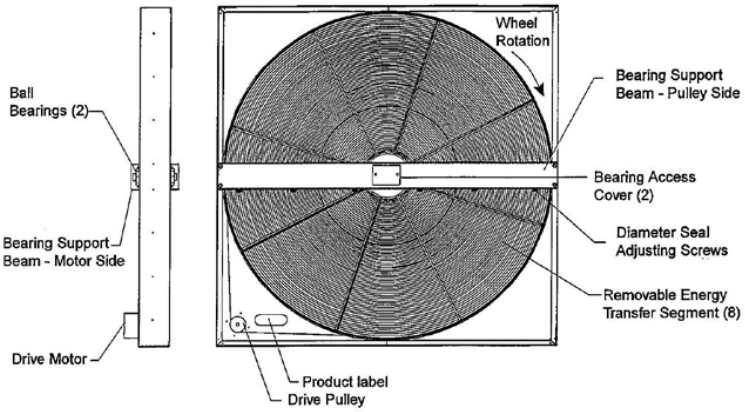
Two arrangements are offered for the enthalpy wheel:

1. Single enthalpy wheel with economizer and bypass (Figure 69). This arrangement is available for all units.
2. Single enthalpy wheel without economizer (100% outdoor air unit).

Wheel Construction

Your Daikin enthalpy wheel is delivered completely assembled and ready to run. The wheel is built to provide many years of trouble free service following proper installation and performance of the minimal maintenance requirements.

Figure 69: Wheel Construction (Side-by-Side)



(1) Currently, only the Over-Under configuration is offered on Daikin rooftop systems and air handlers.

Purge and Pressurization

Pressurization is critical to minimize crossover from exhaust to supply and to allow the purge to operate.

Figure 70: Purge and Pressurization

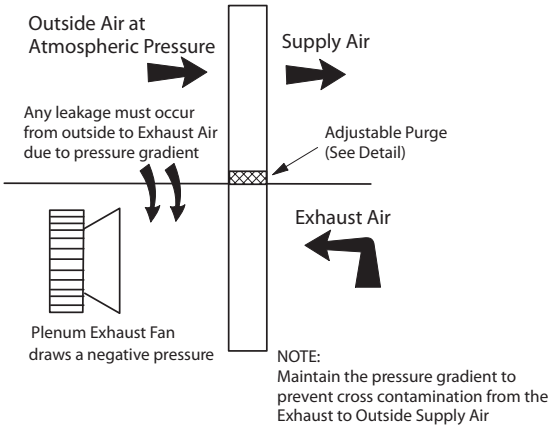
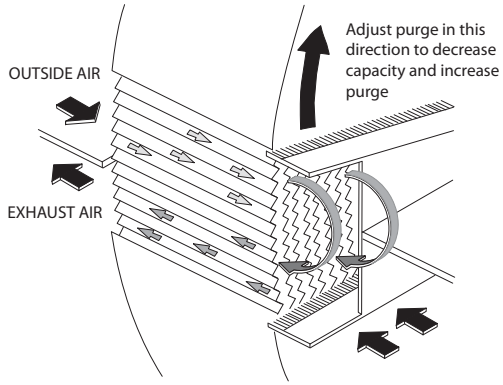


Figure 71: Purge Detail



Drive Motor

The enthalpy wheel comes standard with a constant speed drive motor which is pre-wired to turn in the proper direction.

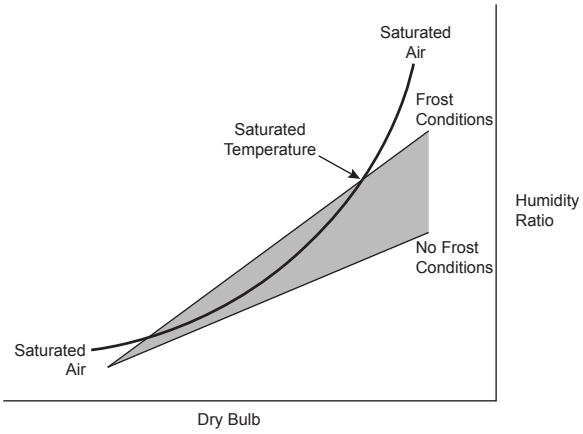
Frost Protection Option

During extremely cold winter conditions, exhaust air stream To circumvent this possibility, Daikin offers three factory installed frost protection options with the MicroTech III system.

Defrost ON/OFF Control (Standard)

With this method the enthalpy wheel is stopped periodically for a defrost time duration when the outdoor air temperature is below an outdoor frost temperature threshold setpoint.

Figure 72: Frost Prevention Psychrometric Chart



Constant Speed Frost Prevention

When there is a threat of frost on the enthalpy wheel, the wheel is jogged so that less enthalpy transfer occurs and frosting of the wheel is avoided. Frosting can occur on the enthalpy wheel when the exhaust air leaving the wheel is saturated. This condition occurs when two lines intersect on a psychrometric chart, and it does not occur when these two lines do not intersect (see Figure 72).

Variable Speed Frost Prevention

When there is a threat of frost on the enthalpy wheel, the wheel is slowed down so that less enthalpy transfer occurs and frosting of the wheel is avoided. Frosting can occur on the enthalpy wheel when the exhaust air leaving the wheel is saturated. This condition occurs when two lines intersect on a psychrometric chart, and it does not occur when these two lines do not intersect (see Figure 72).

Energy Recovery Exhaust Hoods

Units with the optional energy recovery section have one or two exhaust hoods (depending on model). Each hood is shipped in three pieces, consisting of one top and two sides. Install exhaust hood over the barometric relief dampers by installing two sides first and then install the top.

Variable Speed Frequency Control

A variable frequency drive is included with the frost protection option and it controls the speed of the enthalpy wheel. The unit has also been programmed for the recommended range of wheel speed operation. Typical wheel speed is 45 RPM, but the programming can allow for wheel speeds above or below 45 RPM. Check all factory settings to make sure they are consistent with the application.

Enthalpy wheel speed will be controlled by exhaust temperature measurement.

Slide-Out Wheel

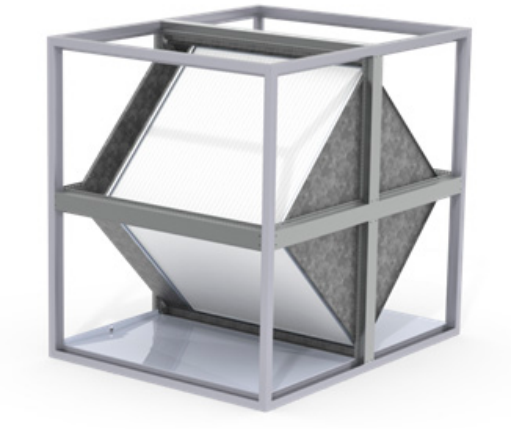
The wheel can be pulled out to facilitate cleaning and servicing (Figure 73). Unplug the control wires before sliding the wheel out of position.

Figure 73: Slide-Out Energy Recovery Wheel

CORE® Construction

Your Daikin enthalpy heat exchanger is delivered completed assembled and ready to run. The core is built to provide many years of trouble free service with minimal maintenance following proper installation and commissioning.

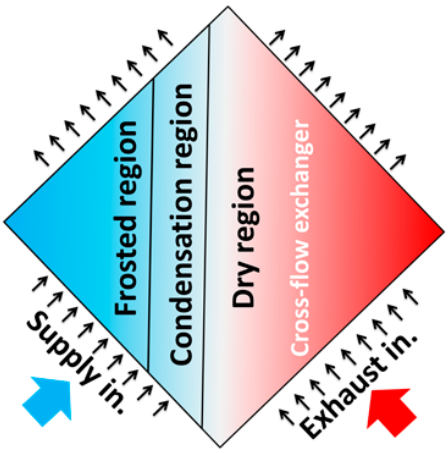
Figure 74: Enthalpy CORE with Outdoor Air Bypass



Frost Protection Option

During extremely cold winter conditions, the bypass is opened on the outdoor air side of the core. This minimizes the cold air across the core allowing the warm exhaust air to warm the heat exchanger and prevent the accumulation of frost build up on the unit. This is internally controlled with the MicroTech III controller

Figure 75: Enthalpy CORE Frost Region



Defrost Control

With this method the enthalpy core's outdoor air is bypassed around the heat exchanger periodically for a defrost time duration when the outdoor air temperature is below an outdoor frost temperature threshold setpoint.

Cleanable Core

The heat exchanger can be accessed from the side access doors. The exchanger is water washable and can be cleaned in-place or easily slid out along the built-in track for better access to the opposite end of the CORE. It is important to wash the CORE at least once a year using tap water and mild detergent.

1. Do not use a high-pressure water source
2. If the CORE is heavily soiled, prepare a solution of less than 1:100 parts water to mild detergent. Otherwise clean water will suffice.
3. It is suggested to clean the COREs in the vertical orientation external to the unit, but not required. Verification of adequate draining is required prior to washing
4. Rinse until the presence to dirt and detergent is no longer present.
5. Allow the plates to dry.

Unit cleaners that are acceptable and not acceptable to come in contact with CORE.

Table 32: Cleaner Recommendations

Cleaner	Recommendation
Viper Expanding Foam	OK
CalSpray–nu-Brite	Avoid Contact
CalSpray–evap foam	OK
HD CalClean 1:40	OK
HD CalClean 1:5	Avoid Contact
Fantastik w/ Bleach	Avoid Contact
Fantastik Original	Avoid Contact

Thermal Dispersion Airflow Measurement Technology

Thermal dispersion technology relates the velocity of the air to the power and rise in temperature of a heated element in a moving airstream. A precise bead-in glass thermistor probes the airflow rate and air temperature. Multiple sensing points are used to produce an average velocity for true volumetric airflow (CFM/LPS). Each individual sensor node is calibrated to NIST traceable airflow standards at 16 points, resulting in a accuracy of 2% of the reading.

Figure 76: Bead-in-Glass Thermistor

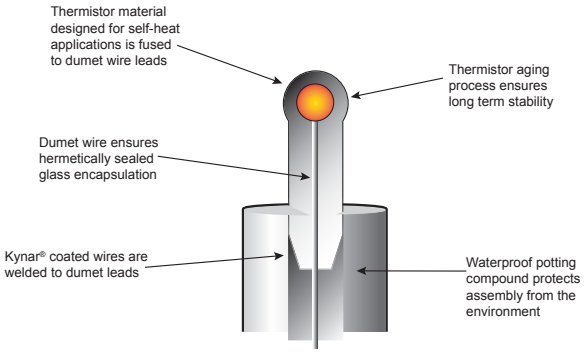
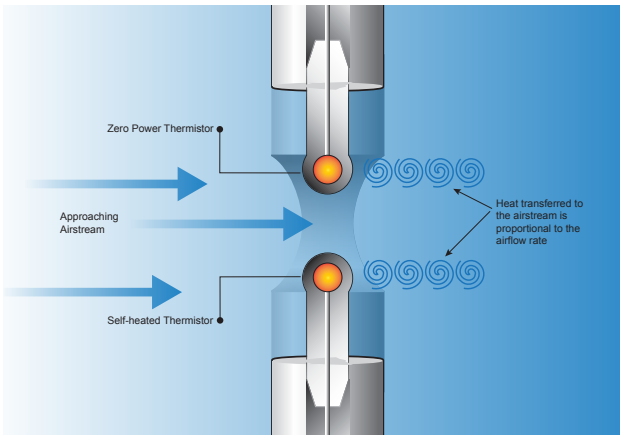


Figure 77: Bead-in-Glass Thermistor Probe



Connecting to MicroTech III Controllers

Wiring

1. Connect analog control wires from the MicroTech III Controller to the outdoor air monitor controller.
   a. MicroTech III controller (X1 on the MCB or X11 on the EXP_D) to the controller's analog output terminal 1.
   b. MicroTech III controller (M on the MCB or M on the EXP_D) to the controller's analog output terminal COM.
2. Power Wires (24 VAC) to the outdoor air monitor controller.
   a. 24VAC from the unit control panel to the controller terminals L1 and L2.

Outdoor air monitor controller settings

1. Set Controller SW1 switch to Vdc.
2. Set power switch to ON.

Outdoor air monitor controller configuration/set up

(see Appendix, Figure 98 on page 136 for navigating the Controller keypad)

1. Set LCD1 U/M to "CFM"
2. Set AR1 (see Table 33)
3. Set OUT1 U/M =CFM
4. Set OUT1 =0–10V
5. Set FSI (see Table 33)

Table 33: Settings by Cabinet Size

Model	Unit Size	Area sq.ft. (AR1)	Full scale output CFM (FS1)
003–006	Small cabinet	2.25	2,400
007–015	Medium cabinet	4.5	6,000
016–028	Large Cabinet	10.25	11.0

Figure 78: MicroTech III Controller

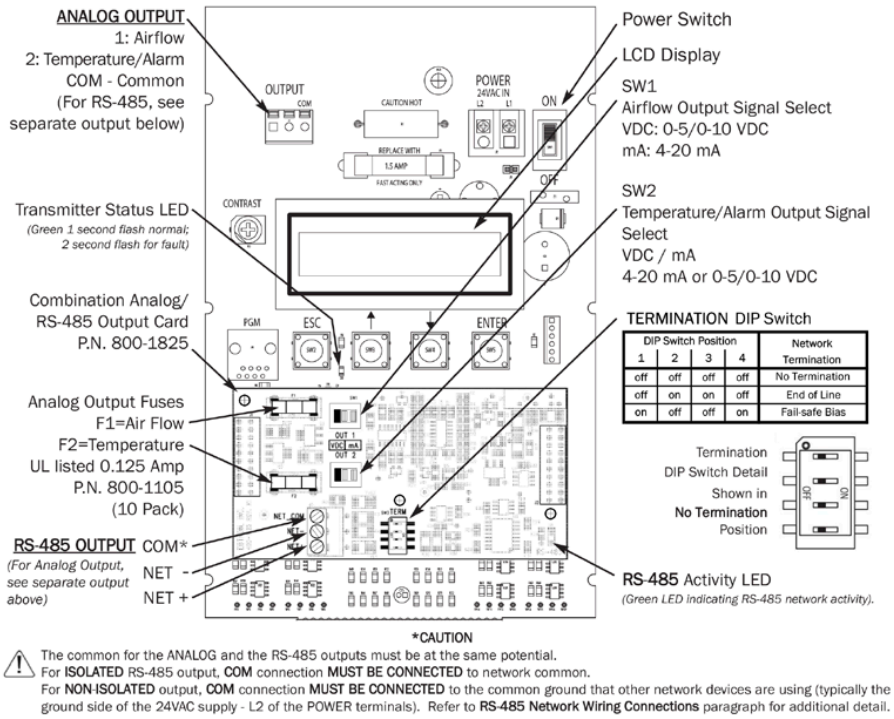
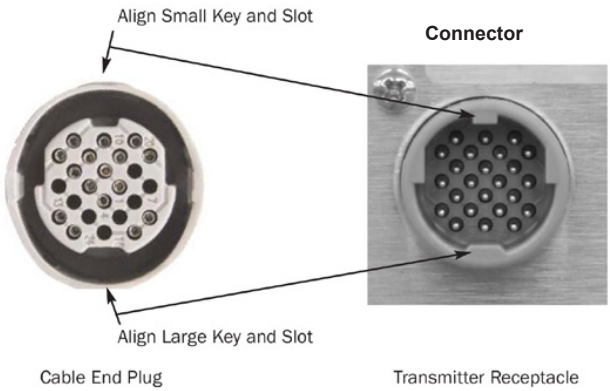
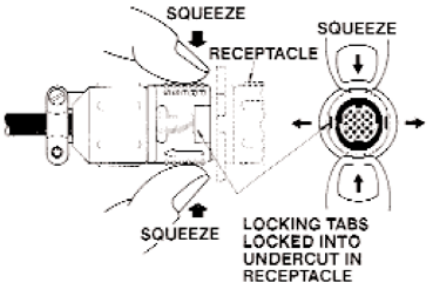


Figure 79: Transmitter and Connector Detail

Transmitter

Accepts 1 or 2 probes up to 8 sensors each.





Squeeze and Pull to Remove
DO NOT TWIST!

Changing the System of Units

The transmitter is provided with the system of units set to I-P. To change to S.I., simultaneously press and release the “UP” and “DOWN” arrow buttons during normal operation. “IP/SI UNITS” will be indicated on the LCD display. Press “ENTER” three times and use the “UP” and “DOWN” arrow buttons until the system of units desired is indicated. Press the “ENTER” button to select changes then press “ESC” twice to return to the normal operating mode. See Appendix, Figure 97 on page 134.

LCD Display Notifications

Following a brief initialization at power up, the LCD display automatically displays airflow and temperature as all upper case (caps) characters. The display provides additional information on system status and alarm conditions as follows:

Last LCD Character Shown in Lower Case (Probe Malfunction)

If the last character of the flow rate units on the LCD display is lower case (for example FPm or CFm), this indicates that an improper/malfunctioning probe is connected to the transmitter.

All LCD Characters Shown in Lower Case

When all characters of the flow rate units are displayed in lower case (for example cfm) the transmitter is operating in the Field Calibration Wizard mode.Daikin McQuay users do not need to use this function.

*LCD Blinks ** LOW ALARM **, ** HIGH ALARM ** or ** TRBL ALARM**

The LCD will alternately flash to indicate an active alarm condition for the type of alarm that has been set. The LCD displays airflow/temperature readings between the alarm notifications. Alarm will cease when the alarm is cleared.

Converting the Analog Output Signal from FPM to CFM (MPS to LPS for SI units scaling)

The transmitter is shipped from the factory with analog output “OUTPUT 1” set to indicate velocity in FPM. To automatically convert this analog velocity output to volumetric flow (CFM or LPS), simply set the *OUT1 U/M from FPM (default) to CFM in the Setup Menu (See Appendix, Figure 95 on page 130). If you wish to manually convert the velocity output to volumetric flow (CFM or LPS), simply multiply the indicated output velocity (in FPM or MPS) by the free area of the air flow probe installation location (free area × 1000 for SI units when area is calculated in square meters). For -P sensors, the total free area is programmed into the probe at the factory and is printed on the probe hang-tag. For -F and -B sensor probes, determine the free area following installation in accordance with the installation guidelines.

NOTE: The full scale analog output (OUTPUT1) value is determined by the FS1 setting within the SETUP MENU.

Altitude Correction Adjustment

The Altitude Correction Adjustment allows for correction of airflow readings at the installed site altitude and more precise readings regardless on installed altitude. Refer to the SETUP MENUS of Figure 102 for the *ALT= menu item, and set this vale to the installation altitude.

Adjusting The Digital Output Filter

The digital output filter is useful for dampening signal fluctuations resulting from transient wind gusts on outdoor air intakes or excessive turbulence generated from duct disturbances. The digital output filter range can be set between 0 (OFF) and 99%. Increasing the filter percentage limits the allowable change of the output signal. To change the amount of filtering, enter the Setup menu and set “*FILTER1={desired value}” as shown in Figure 102.

IMPORTANT

Fluctuations in the airflow output signal are normal. Laboratory research indicates that dampening true fluctuations will result in poor control and a larger dead-band of operation. Therefore, the use of the dampening filters in control devices is not recommended. Warnings indicate potentially hazardous situations, which can result in property damage, severe personal injury, or death if not avoided.

Table 34: General Troubleshooting

Problem	Possible Cause	Remedy
No LCD display indication and the green Transmitter Status LED (D3) on the main circuit board is not illuminated.	Power switch not in the "ON" position.	Move the power switch to the "ON" position.
	Improper supply voltage to the power input terminal block.	Ensure that 24VAC power is connected to L1 and L2 of the POWER terminal block and that the voltage with the power switch in the "ON" position is between 22.8 and 26.4 VAC.
	Blown fuse.	Check power wiring. Ensure that multiple devices wired on a single transformer are wired "in-phase". Replace fuse only with a 1.5 amp, fast-acting fuse after the problem has been identified and corrected.
No LCD display indication and the green Transmitter Status LED (D3) on the main circuit board is flashing.	LCD contrast too low.	Turn “Contrast” potentiometer on the main circuit board "clockwise".
The LCD display is scrambled or there is no LCD display indication after touching the switches, LCD display or circuit board.	Static electricity.	Touch an earth-grounded object, such as a duct, to discharge static electricity then reset the power. Avoid direct contact with the LCD display or circuit board.
The LCD display indicates "No Probes".	The power switch on the transmitter was moved to the "ON" position before the sensor probes were connected.	Reset 24VAC power by moving the power switch from the "ON" to "OFF" position and then back to the "ON" position.
The LCD display indicates "DiffSensor Type".	Sensor probes have been mismatched.	Transmitters must have the same sensor type connected (GP1, GF1 or GB1 sensor probes).
The LCD display indicates "Too Many Sensors".	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
The last digit of the flow rate unit is displayed as a lower case letter. (When the Field Calibration Wizard is engaged, the last character of the flow rate units is displayed as an upper case letter.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe's hang tag.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
The green Transmitter Status LED (D3) on the main circuit board is "ON" but not flashing.	The microprocessor is not running.	Reset 24VAC power by moving the power switch from the "ON" to "OFF" position and then back to the "ON" position.
The green Transmitter Status LED (D3) on the main circuit board is flashing at 1-second intervals.	No problem, normal operation.	No remedy required.
The green Transmitter Status LED (D3) on the main circuit board is flashing at 2-second intervals.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe's hang tag.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
The transmitter indicates airflow when the HVAC system is not operating.	Sensors are sensitive and can measure very low air velocities. If a reading is indicated, there is airflow present where the airflow measuring station is located.	Do not attempt to adjust zero ("offset"). Doing so will result in an error in airflow measurement. The Low Limit airflow cutoff value can be set to force the output signal to zero.
No output signal can be measured at the OUTPUT terminal block of the transmitter.	Output card is not securely mounted on main circuit board.	Turn the transmitter power "OFF", and then press the output card firmly onto main circuit board. Turn the transmitter power back "ON".
	Blown output fuse (output 1 and output 2 are fused and protected independently on the transmitter).	Make sure that power has not been connected to the output terminal block. Correct the problem and replace with 0.125 amp, fast acting fuse only.
		Make sure that the host control system is not configured for a 2-wire device (no excitation voltage should be present on the signals from the host controls). Correct the problem and replace with 0.125 amp, fast acting fuse only.
	The Low Limit airflow cutoff value is above the actual airflow reading.	Decrease the Low Limit airflow cutoff value in the Setup menu until it is below the actual airflow reading.
The output signal on the transmitter fluctuates while the flow and/or temperature readings on the LCD are steady.	Electrical interference from other devices is creating noise in the signal wires to the host control system.	The output signal wiring must be shielded. Individually ground one or more of the following points: the signal wire shield at host controls; signal wire shield at the transmitter, or L2 of the power terminal block of the transmitter.
The LCD display does not match the readings indicated by the host control system.	The scaling in the host control system is incorrect.	Compare the current configuration of the transmitter with that of the host control system. Compare the minimum and full scale settings for each output by navigating through the Setup menu.

Table 35: Transmitter Troubleshooting

Problem	Possible Cause	Remedy
The host control system is unable to communicate with the transmitter.	Output card is not securely mounted on main circuit board.	Turn the transmitter power "OFF" and press the output card firmly onto main circuit board. Turn the transmitter power back "ON".
	Network signal wiring is not properly connected to the transmitter or the host controls.	Verify that the network signal wires from the host controls are connected to the proper terminals of the OUTPUT block. On the transmitter OUTPUT terminal block, NET+ is for A, NET- is for B and COM for common.
	Network protocol is not properly set on the transmitter.	Set network protocol based on the network requirements and reset transmitter power.
	Network address is not properly set on the transmitter.	Set address based on network requirements and reset transmitter power. The address must be unique for the network.
	Network termination is not properly set on the transmitter.	Set transmitter termination based on network requirements and reset the transmitter power.
The LCD display does not match the readings indicated by the host control system.	The Area or K factor of the transmitter does not match that of the host controls.	Compare the value of the Area or K factor of the transmitter with that of the host control system and make adjustments to ensure a match.
The returned value for airflow is zero when airflow is indicated on the LCD display of the transmitter.	The Low Limit airflow cutoff value is above the actual airflow reading.	Decrease the Low Limit airflow cutoff value in the Setup menu until it is below the actual airflow reading.
The status point from the transmitter has a Trouble value.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe's hang tag.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
There is no value for the differential pressure point	Differential pressure is only available from transmitters that have a Bi-directional Bleed Airflow Sensors connected.	If a differential pressure measurement is required, contact your local Daikin Representative about a Bi-directional Bleed Airflow Sensor.

Rebel (size 003–015) SAFs and all EAFs utilize ECM [electronically commutated external rotor] motors. ECM motor speed is controlled by unit mounted, MicroTech III, static pressure and temperature controls to reliably maintain comfort conditions.

These ECM motors include locked rotor, phase failure, low voltage, high temperature and short circuit protection as well as built in soft start logic. Details are provided in the vendor's IOM manual.

Customer design speed is programmed into the ECM motor based on desired CFM and ESP. Design speed can be changed as follows as long as the fan's maximum RPM is not exceeded per Table 36.

- Go into the MicroTech III keypad / display [see OM 1141 for detailed instructions]
- On the main menu, go to commission unit
- Go to SF [or RF/EF] set up menu
- find Max SAF [or EAF] RPM
- Enter the desired maximum RPM

Table 36: ECM Motor Fan Size Maximum RPM

Wheel Diameter (mm)	SAF Max RPM	EAF Max RPM
12" (310)	2580	2580
14" (355)	2600	2600
16" (400)	2040	2550
22" (560)	1750	NA

NOTE: 2-16" (400 mm) EAFs are available on sizes 016–028. Each uses the same valves.

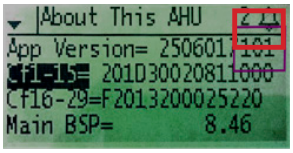
ECM Motor Setup

(Required when replacing exhaust fans)

ECM - Electronically Commutated Motor communicates via modbus RS485 twisted pair cables to the Microtech III controller. Microtech III can address the ECM for a supply, return, or exhaust fan operation based on a unique modbus address. A replacement ECM is shipped out from the warehouse with an address of "1" which is a direct replacement for a supply fan and does not require additional setup. If the ECM is being used as a return or exhaust fan, it needs to be setup with an address of "2"

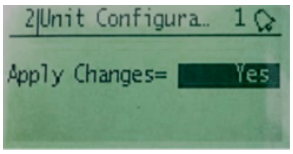
Addressing Return Or Exhaust ECM

1. Close the MMP or shut the circuit breakers to the supply and energy recovery drives to keep modbus communication enabled only at the return/exhaust ECM.
2. Verify the RS485 output on the Microtech III controller is connected at terminals A and B to TB1 terminals 39 and 40 respectively.
3. Make sure the shield for the twisted pair cable is terminated at TB terminal 41 only.
4. At the drive, verify wires from the controller side terminals 39 and 40 are terminated at the ECM terminals RSA and RSB. See Detail B on page 90.
5. At the Microtech III controller enter a level 2 password of 6363 and click on "About This AHU" to verify if code 101 is being used (310 for Maverick). If any other codes are being used, please consult with McQuay Warranty Service group for technical support.



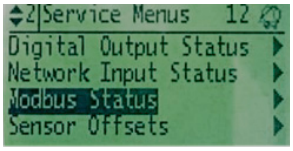
6. Press the middle rectangular button to go back to the main menu.

7. Scroll down and click on the "Unit Configuration Menu"
8. Scroll to the "SAF type" and set it to EBM VAV
9. Scroll to the "RAF type" and set it to EBM VAV
10. Scroll up to "Apply Changes" and set it to Yes. Wait for the controller to restart.

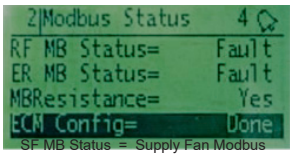


11. Enter the level 2 password again and go into "Service Menus"

12. Click on the “Modbus Status” menu

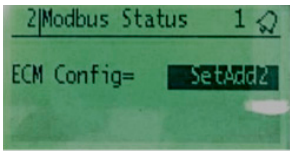


13. If the drive return drive is wired correctly and is communicating then the SF MB status will show “OK” while the RF MB status will show “Fault”. Verify wiring connections and 3-phase power to the ECM if both SAF and RF status show “Fault.”

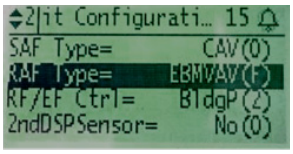


SF MB Status = Supply Fan Modbus
RF MB Status = Return Fan Modbus
ER MB Status = Energy Recovery Modbus

14. Click on the “ECM Config” menu
15. Set “ECM config” to “SetAdd2”



16. The controller will revert back to the “ECM Config” menu but now the SF MB Status will show fault while the RF MB Status will show ok.
17. Hit the middle rectangular button to go back to the main menu.
18. Click on the “Unit Configuration” menu and set the SAF type back to the original setting.



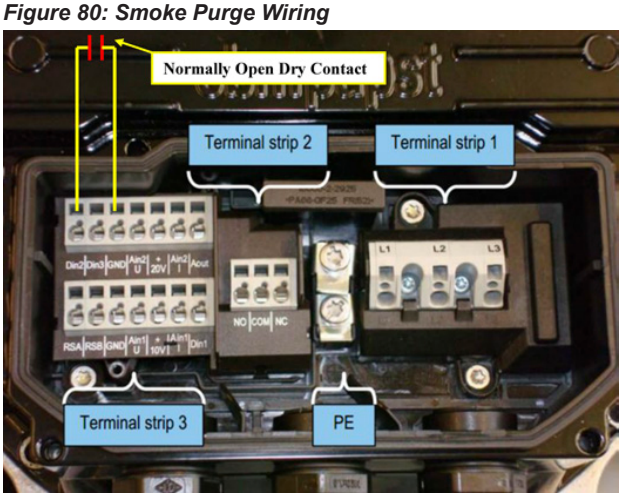
19. Scroll up and set “Apply changes” to yes.
20. Reset MMPs for the supply and energy recovery drive to observe ER MB Status and SF MB Status show “OK”

For further clarification on fan addressing see service information letter SIL-ALL-18-003.

ECM Smoke Purge or Ventilation Override

Microtech III has been configured via modbus to perform a ventilation override if terminals Din2 and GND at Terminal strip 3 on the ECM are made. Install an isolation relay that would make a dry NO contact across the return/exhaust fan Din2 and GND per Detail A on page 89.

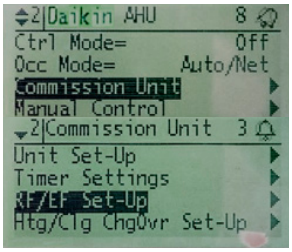
Figure 80: Smoke Purge Wiring



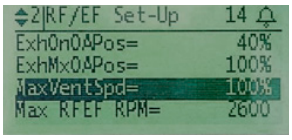
In a smoke situation, the field wired smoke detector would eliminate 24VAC to the DI4 terminal at the Microtech controller issuing an emergency fault at the Microtech keypad. The entire unit would shut down in which case the field would need to configure the NO to close upon a smoke shutdown and allow the return/exhaust fan to run. Setting the speed of the drive during ventilation override is described below.

Setting the RF/EF max vent speed:

1. After entering the controller password 6363, click on “Commission Unit”
2. Scroll down and click on “RF/EF Set-Up”



3. Scroll down to “MaxVentSpd” and select the desired speed for the ECM during a smoke shutdown.



Economizer Enthalpy Control

The economizer can be ordered with the optional differential enthalpy control. With this option a solid-state humidity and temperature sensing device is located in the return and outdoor airstreams. These devices are labeled RAE and OAE respectively. When the outdoor enthalpy is lower than the return air enthalpy, the economizer operation will be initiated. If the outdoor air enthalpy is higher than the return air, the outdoor air damper position will be at the minimum setpoint. See OM 1141 for further information on the economizer operation.

External Time Clock

You can use an external time clock as an alternative to (or in addition to) the MicroTech III controller's internal scheduling function. The external timing mechanism is set up to open and close the circuit between field terminals 101 and 102 on Rebel units 3 to 15 ton on larger Rebel units 16 to 28 ton they are terminals 200 & 201. When the circuit is open, power is not supplied to binary input DI3. This is the normal condition where the controller follows the programmable internal schedule. When the circuit is closed, power is fed to DI3. The MicroTech III controller responds by placing the unit in the occupied mode, overriding any set internal schedule.

Exhaust Fan Option

Economizer units may include exhaust fan options. For units with CAV applications, the exhaust fans can be ordered as staged control or they may be ordered with building pressure control. The building pressure control option has an inverter that runs the exhaust fan motors and is controlled by the static pressure sensor number 2 (SPS2). The units are only available with building pressure control on VAV units.

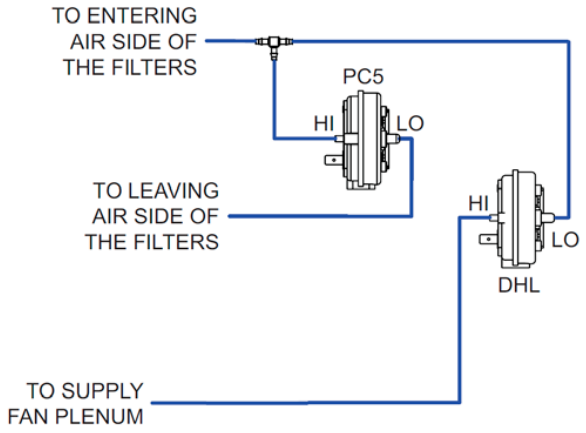
The exhaust fan motors are permanently lubricated and do not require any additional periodic lubrication.

Proof-of-Airflow and Dirty Filter Switch

Proof of air flow is accomplished through Modbus communications with the ECM motor/VFD for proof of air flow. The Dirty filter switch senses the pressure difference across the filter; from the entering air side of the filter to the leaving air side of the filters. The switch is factory set at 1.0". When the pressure difference across the filters is sensed at this value, the dirty filter alarm will appear on the DDC controller. Typically the dirty filter switch and the Duct High limit (DHL) are tied together with Polly tubing to direct the proper static pressures to the proper ports. (Figure 81). The DHL is Factory set at 3.5" WC. When this differential pressure is sensed the normally closed contacts will open on the switch giving the DHL alarm at the unit controller.

The DHL is factory set at 3.5". When this differential pressure is sensed the normally closed contacts will open on the switch giving the DHL alarm at the unit controller.

Figure 81: Pressure Tubing Diagram



Duct High Pressure Limit

The duct high pressure limit control (DHL) is provided on all VAV units. The DHL protects the duct work, terminal boxes, and the unit from over pressurization, which could be caused by, for example, tripped fire dampers or control failure.

The DHL control opens when the discharge plenum pressure rises to 3.5" wc (872 Pa). This setting should be correct for most applications and should not be adjusted.

If the DHL switch opens, digital input ID9 on the Unit Control Board will be de-energized. The MicroTech III controller then shuts down the unit and enters the Off-Alarm state. The alarm must be manually cleared before the unit can start again. Refer to the operation manual supplied with your unit for more information on clearing alarms (refer to OM 1141).

Convenience Receptacle (Field Powered)

A Ground Fault Circuit Interrupter (GFCI) convenience receptacle is provided in the main control box on all units. To use this receptacle, connect a separate field-supplied 115 V power wiring circuit to the outlet.

Convenience Receptacle (Unit Powered)

A Ground Fault Circuit Interrupter (GFCI) convenience receptacle is provided in the main control box on all units. The receptacle shall be powered by a factory installed and wired 120V, 20 amp power supply. The power supply shall be wired to the line side of the unit's main disconnect, so the receptacle is powered when the main unit disconnect is off. This option shall include a GFI receptacle, transformer, and a branch circuit disconnect. The electrical circuit shall be complete with primary and secondary overload protection. See Figure 82 for a branch circuit diagram.

Figure 82: Unit Powered GFCI Receptacle Schematic

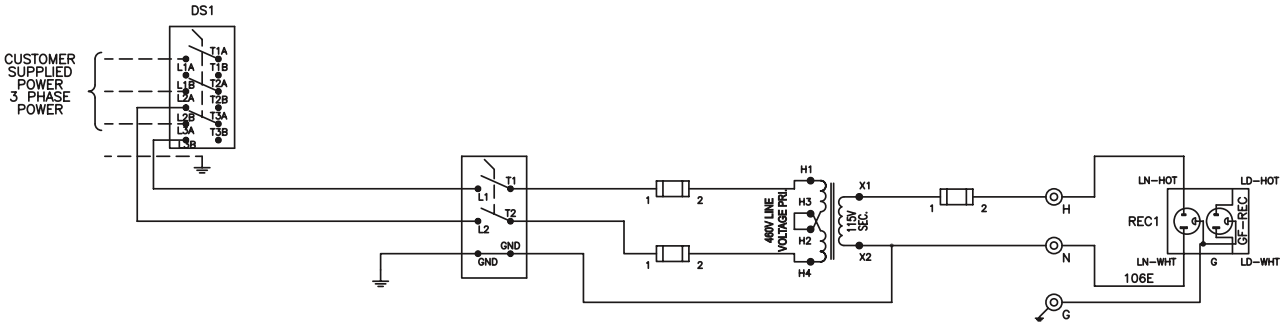


Figure 83: Typical CAV_VAV 208-230 VAC Wiring (1 of 4) — DPS 003–006 shown

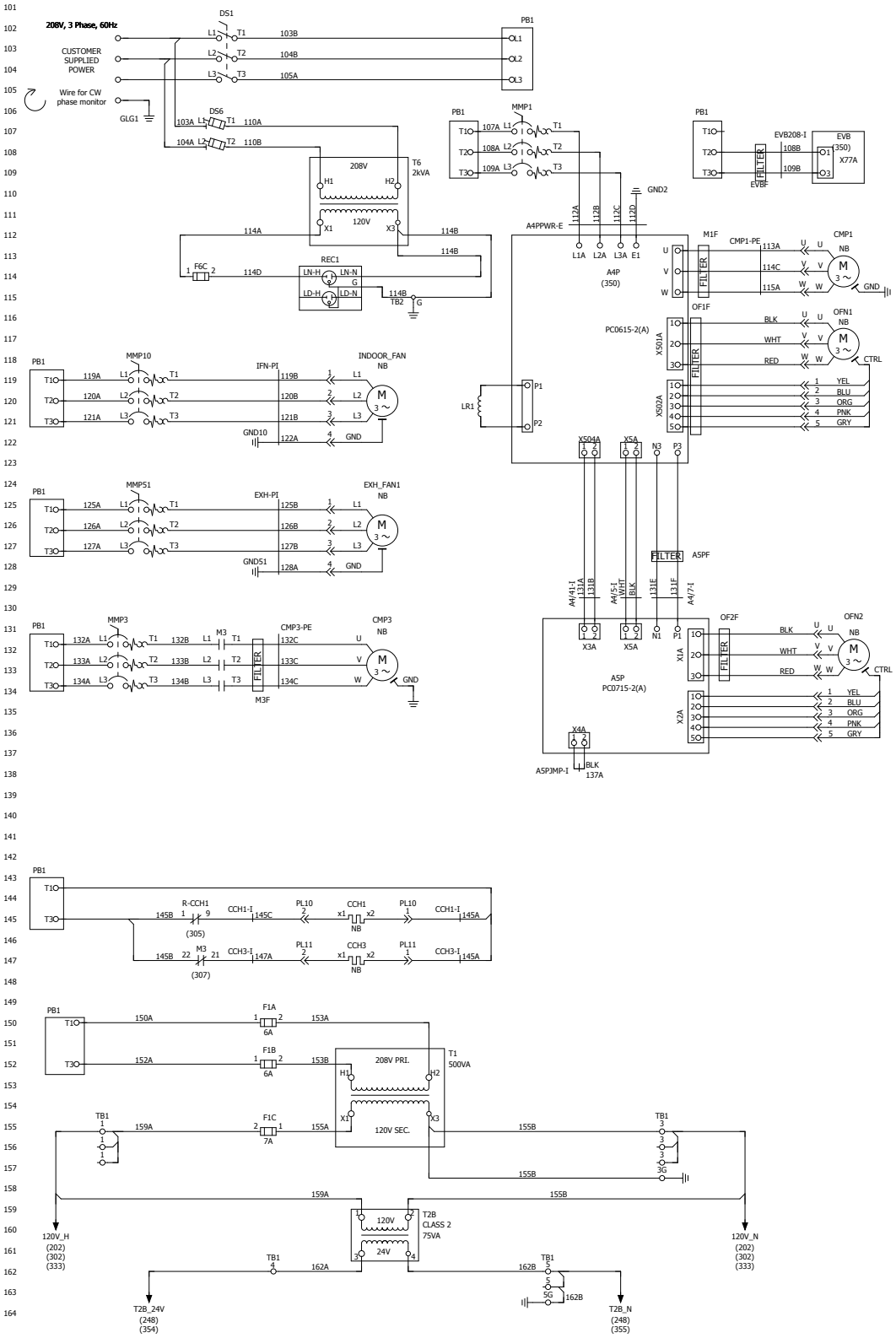


Figure 83 continued: Typical CAV_VAV 208-230 VAC Wiring (2 of 4) — DPS 003–006 shown

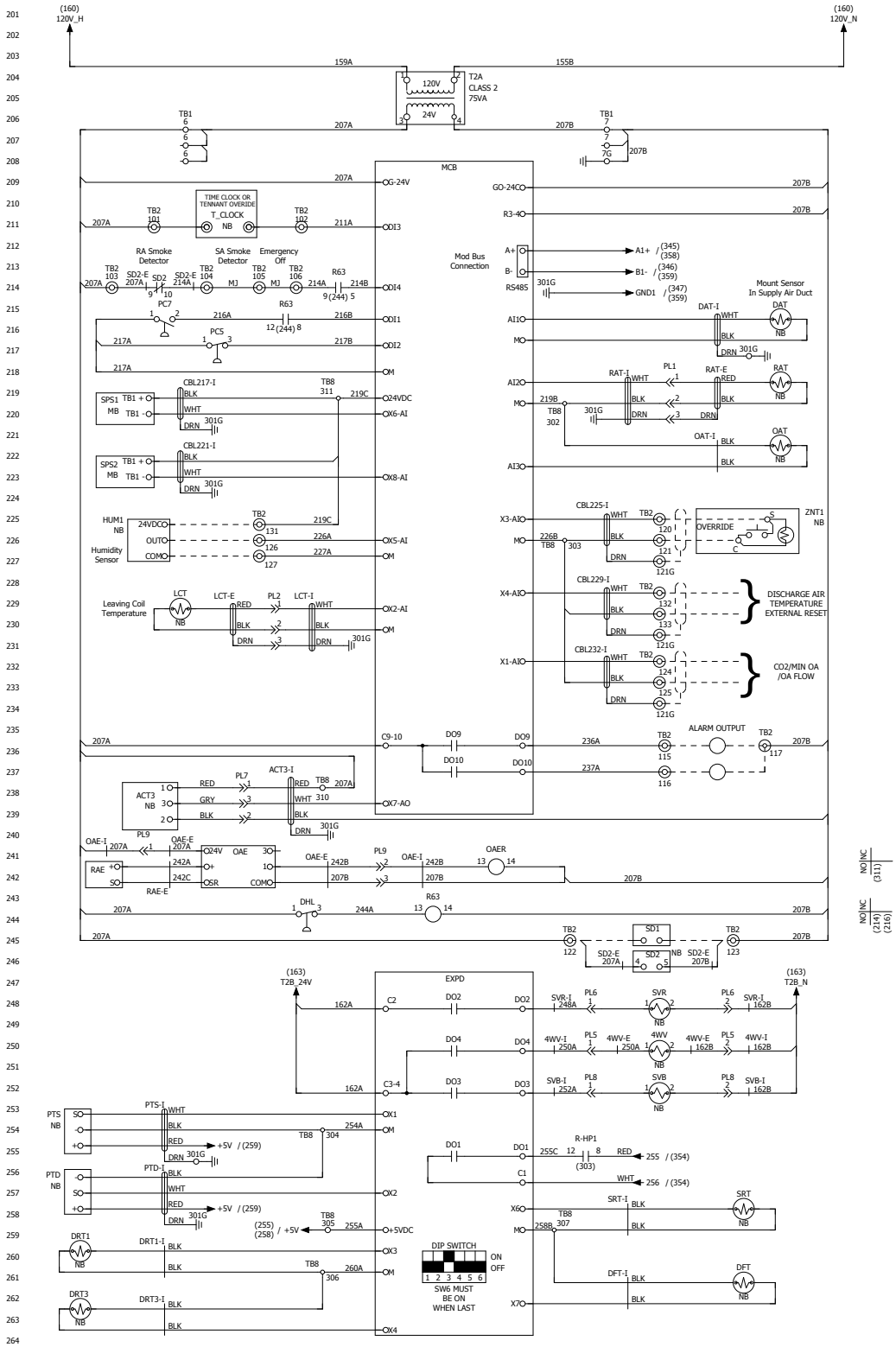


Figure 83 continued: Typical CAV_VAV 208-230 VAC Wiring (3 of 4) — DPS 003–006 shown

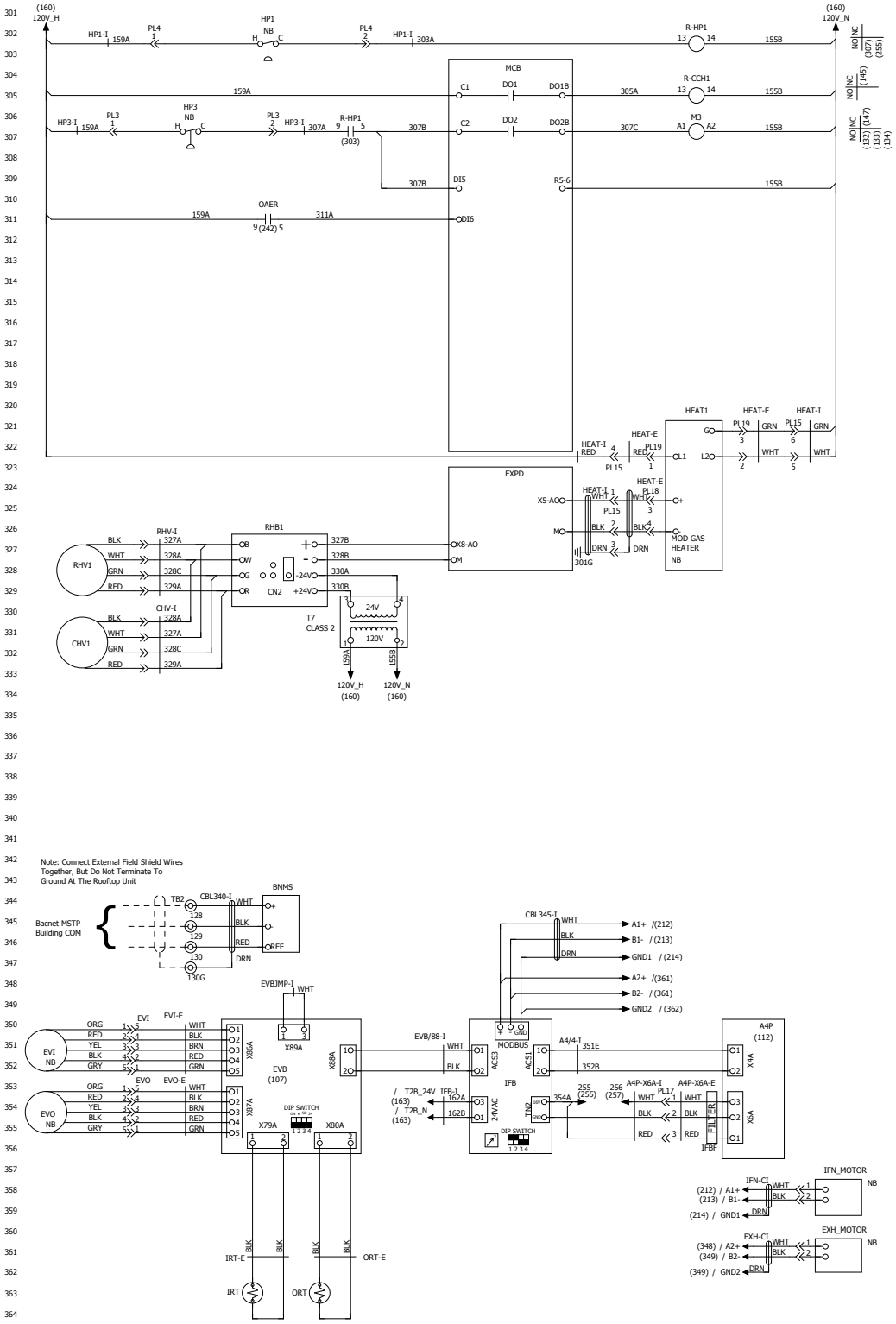
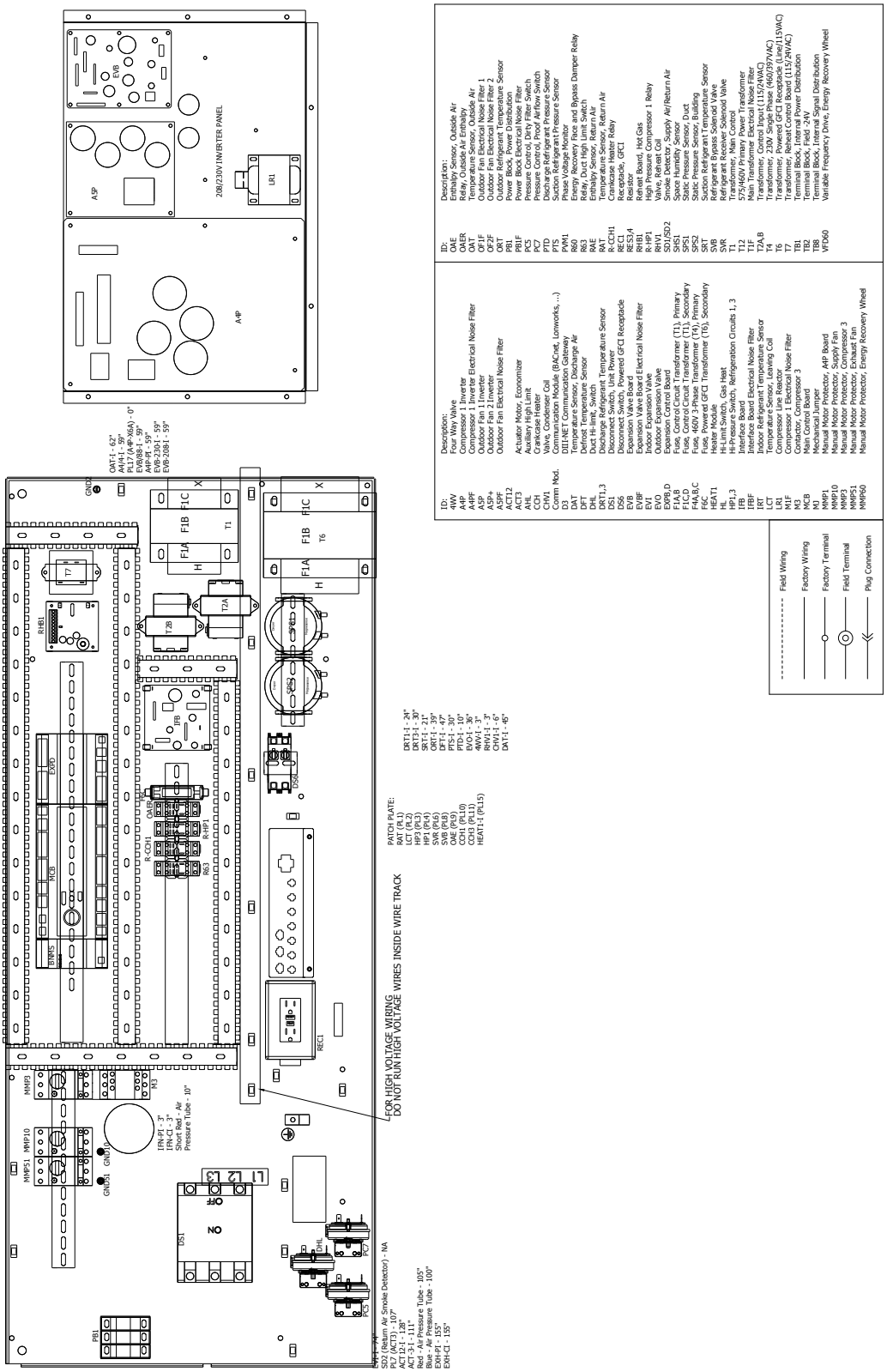


Figure 83 continued: Typical CAV_VAV 208-230 VAC Wiring (4 of 4) — DPS 003–006 shown



ID:	Description:
4WV	Four Way Valve
A1P	Compressor 1 Inverter
A2P	Outdoor Fan 1 Inverter Electrical Noise Filter
A3P	Outdoor Fan 1 Inverter
A5P	Outdoor Fan 2 Inverter
A5PF	Outdoor Fan Electrical Noise Filter
ACT12	Actuator Motor, Economizer
ACT3	Actuator Motor, Exhaust
AHL	Auxiliary High Limit
CCH	Crankcase Heater
CHV1	Valve, Condenser Coil
Comm Mod.	Communication Module (BACnet, Lonworks, ...)
D3	DIII-NET Communication Gateway
DAT	Temperature Sensor, Discharge Air
DFT	Defrost Temperature Sensor
DHL	Duct Hi-limit, Switch
DRT1,3	Discharge Refrigerant Temperature Sensor
DS1	Disconnect Switch, Unit Power
DS6	Disconnect Switch, Powered GFCI Receptacle
EVB	Expansion Valve Board
EVBF	Expansion Valve Board Electrical Noise Filter
EVI	Indoor Expansion Valve
EVO	Outdoor Expansion Valve
EVPB,D	Expansion Control Board
F1A,B	Fuses, Control Circuit Transformer (T1), Primary
F1C,D	Fuses, Control Circuit Transformer (T1), Secondary
F4A,B,C	Fuse, 460V 3-Phase Transformer (T4), Primary
F5C	Fuse, Powered GFCI Transformer (T6), Secondary
HEAT1	Heater Modules
HS	Heater Safety, Gas Heat
HP1,3	Hi-Pressure Switch, Refrigeration Circuits 1, 3
IFB	Interface Board
IFBF	Interface Board Electrical Noise Filter
IOT	Indoor Refrigerant Temperature Sensor
LCT	Temperature Sensor, Leaving Coil
LR1	Compressor Line Reactor
M1F	Compressor 1 Electrical Noise Filter
M3	Contactor, Compressor 3
MCB	Motor Circuit Breaker
M1	Mechanical Jumper
MMP1	Manual Motor Protector, A4P Board
MMP10	Manual Motor Protector, Supply Fan
MMP3	Manual Motor Protector, Compressor 3
MMP51	Manual Motor Protector, Exhaust Fan
MMP60	Manual Motor Protector, Energy Recovery Wheel

ID:	Description:
OAE	Enthalpy Sensor, Outside Air
OAER	Relay, Outside Air Enthalpy
OAT1	Temperature Sensor, Outside Air
OF1F	Outdoor Fan Electrical Noise Filter 1
OF2F	Outdoor Fan Electrical Noise Filter 2
ORT	Outdoor Refrigerant Temperature Sensor
PB1	Power Block, Power Distribution
PB1F	Power Block Electrical Noise Filter
PCS	Pressure Control, Dirty Filter Switch
PC7	Pressure Control, Proof Airflow Switch
PTD	Discharge Refrigerant Pressure Sensor
PTS	Suction Refrigerant Pressure Sensor
PVM1	Phase Voltage Monitor
R60	Energy Recovery Face and Bypass Damper Relay
R63	Relay, Duct High Limit Switch
RAE	Enthalpy Sensor, Return Air
RAT	Temperature Sensor, Return Air
R-CCH1	Crankcase Heater Relay
REC1	Receptacle, GFCI
RES3,4	Resistor
RHB1	Reheat Board, Hot Gas
R-HP1	High Pressure Compressor 1 Relay
RHV1	Valve, Reheat Coil
SD1/SD2	Smoke Detector, Supply Air/Return Air
SHS1	Space Humidity Sensor
SPS1	Static Pressure Sensor, Duct
SPS2	Static Pressure Sensor, Building
SRT	Suction Refrigerant Temperature Sensor
SVB	Refrigerant Bypass Solenoid Valve
SVBR	Refrigerant Reheat Solenoid Valve
T1	Transformer, Main Control
T12	575/460V Primary Power Transformer
T1F	Main Transformer Electrical Noise Filter
T2A,B	Transformer, 460V Primary (575V/460V)
T4	Transformer, 230V Single-Phase (460/230V/AC)
T6	Transformer, Powered GFCI Receptacle (Line/115VAC)
T7	Transformer, Reheat Control Board (115/24VAC)
TB1	Terminal Block, Internal Power Distribution
TB2	Terminal Block, Field Wiring
TB8	Terminal Block, Internal Signal Distribution
VFD60	Variable Frequency Drive, Energy Recovery Wheel

Figure 84: Typical CAV_VAV 460 VAC Wiring (1 of 4) — DPS 003–006 shown

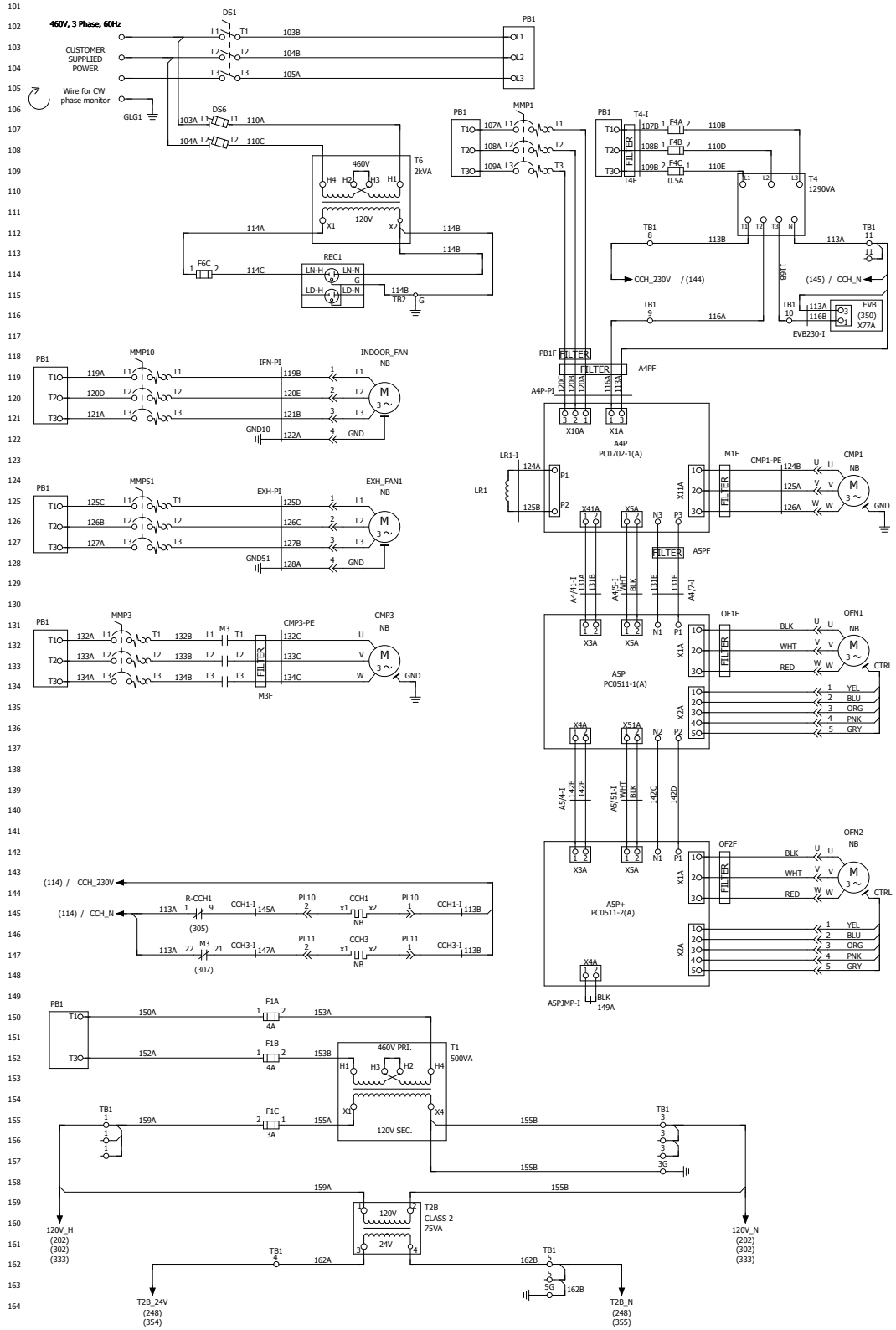


Figure 84 continued: Typical CAV_VAV 460 VAC Wiring (2 of 4) — DPS 003–006 shown

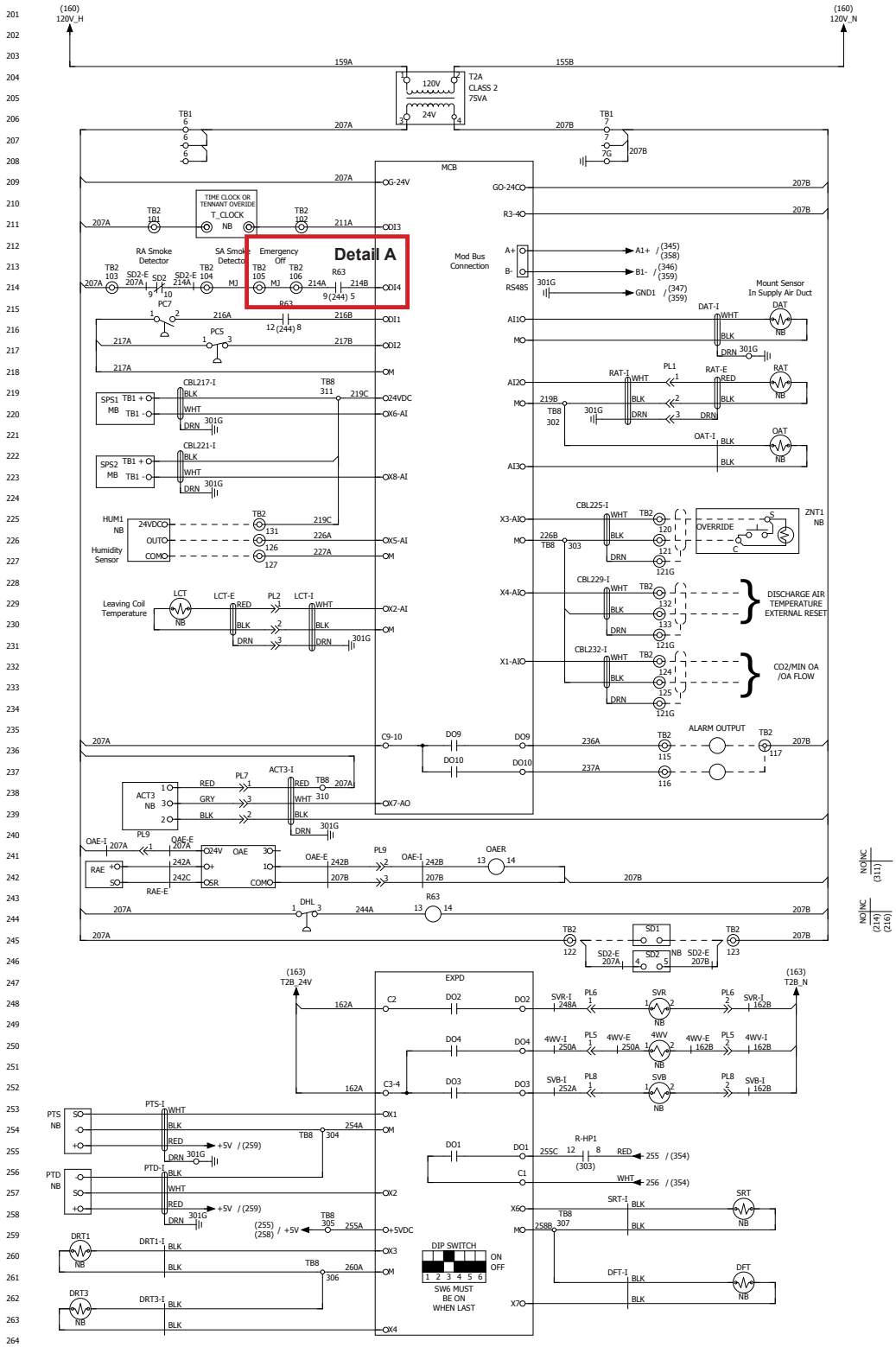


Figure 84 continued: Typical CAV_VAV 460 VAC Wiring (3 of 4) — DPS 003–006 shown

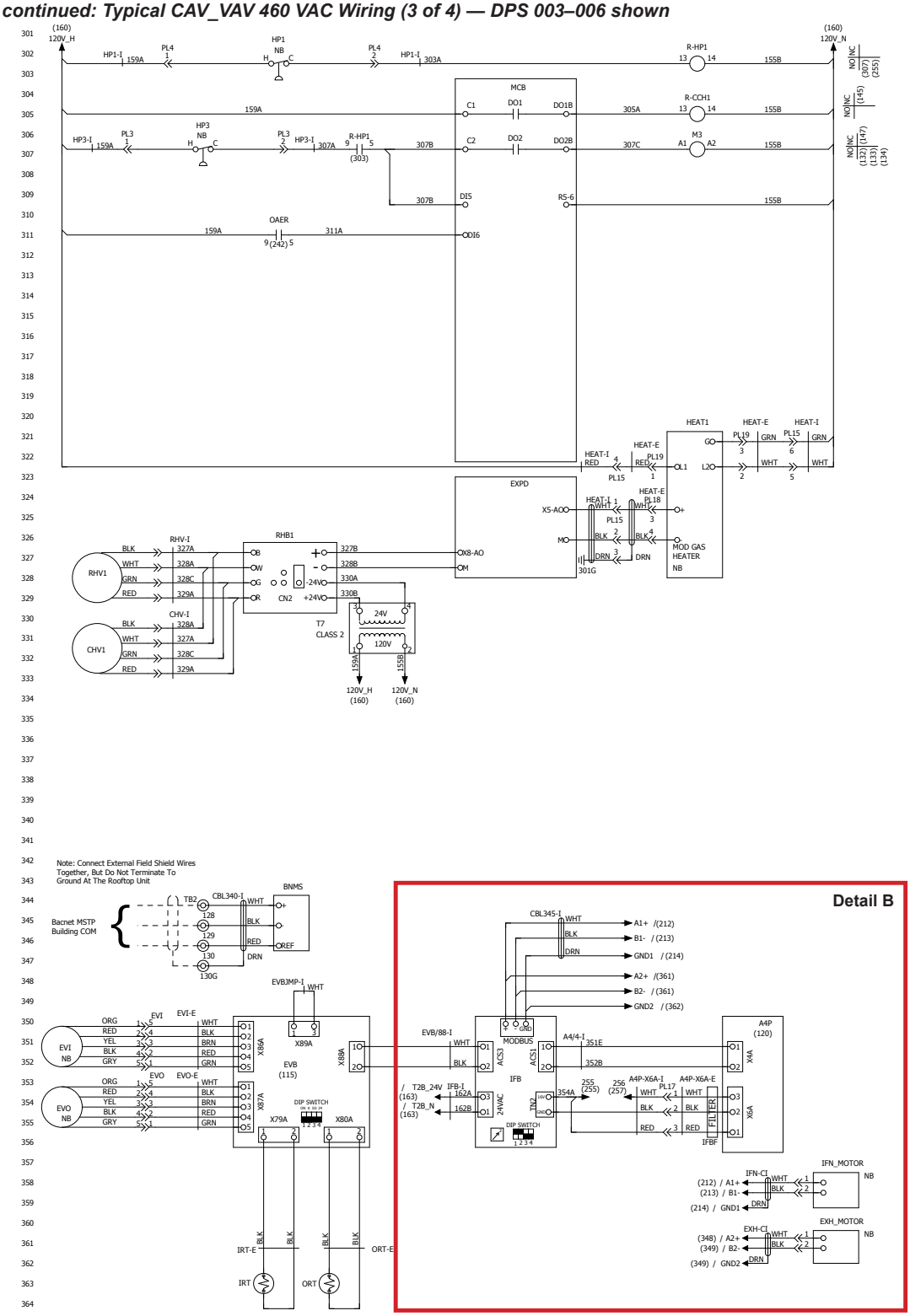


Figure 84 continued: Typical CAV_VAV 460 VAC Wiring (4 of 4) — DPS 003–006 shown

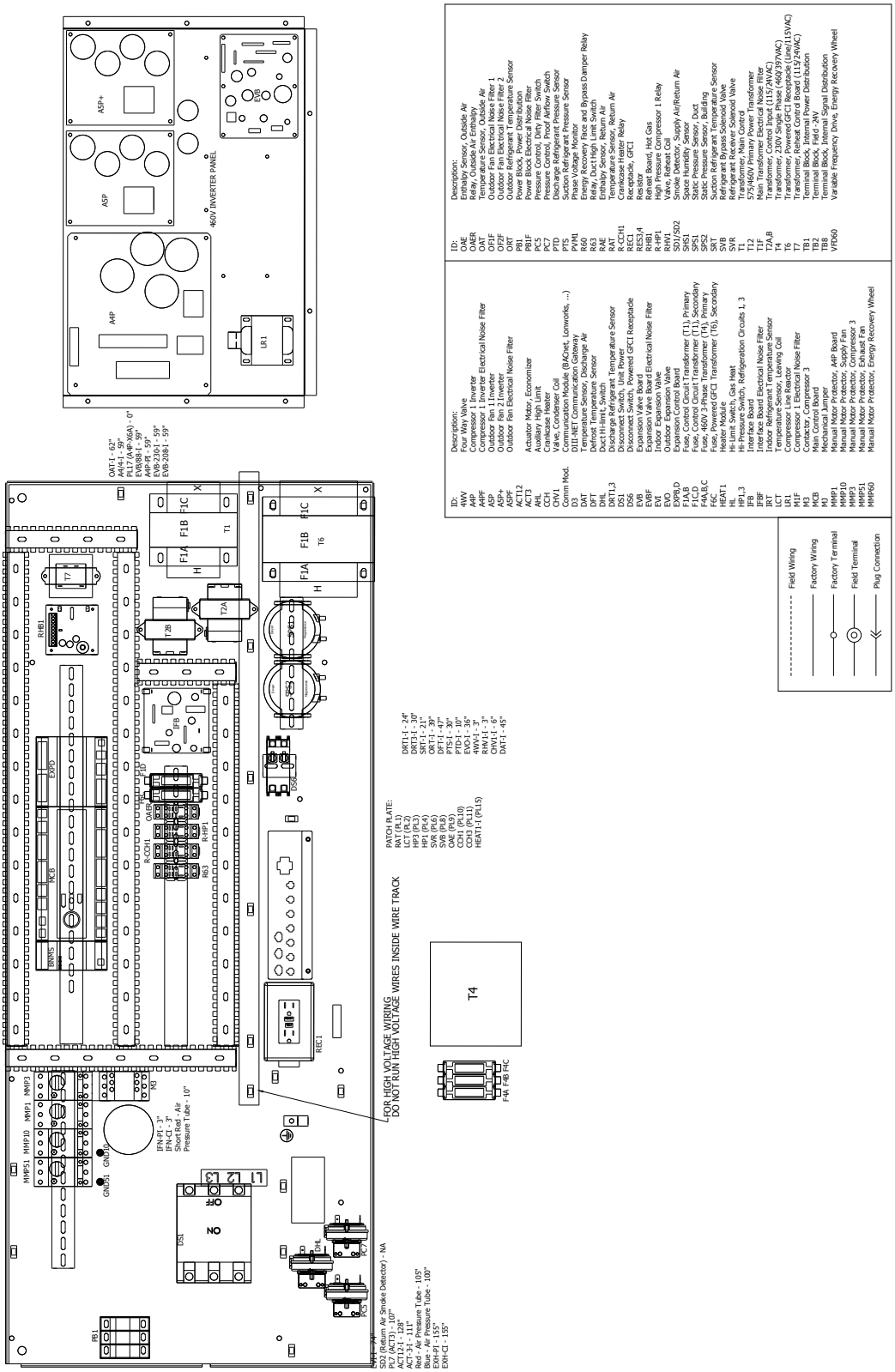


Figure 85: Typical 575 Volt Wiring (1 of 4) — DPS 007–015 shown with 460 to 575 Transformer

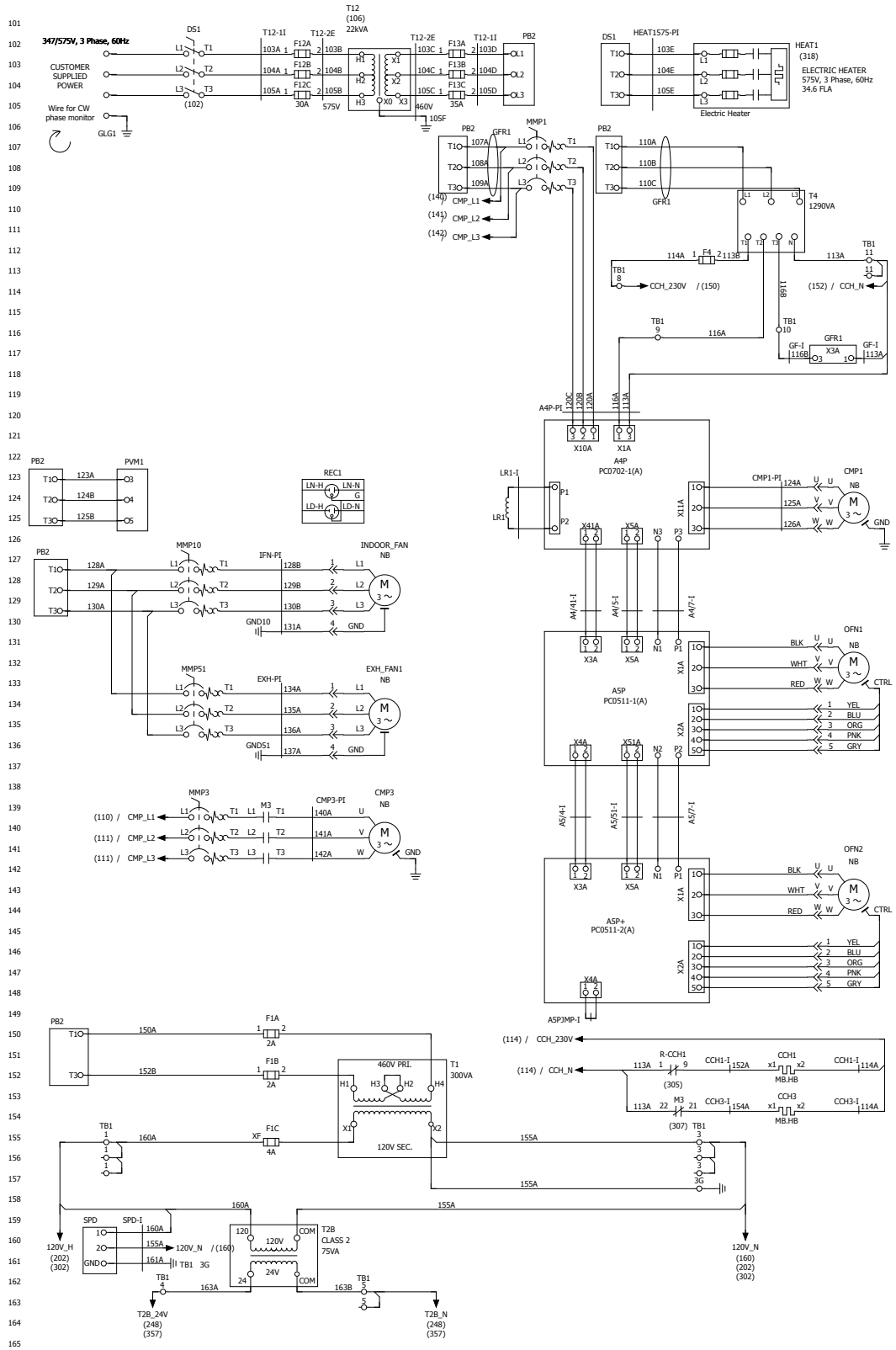


Figure 85 continued: Typical 575 Volt Wiring (2 of 4) — DPS 007–015 shown with 460 to 575 Transformer

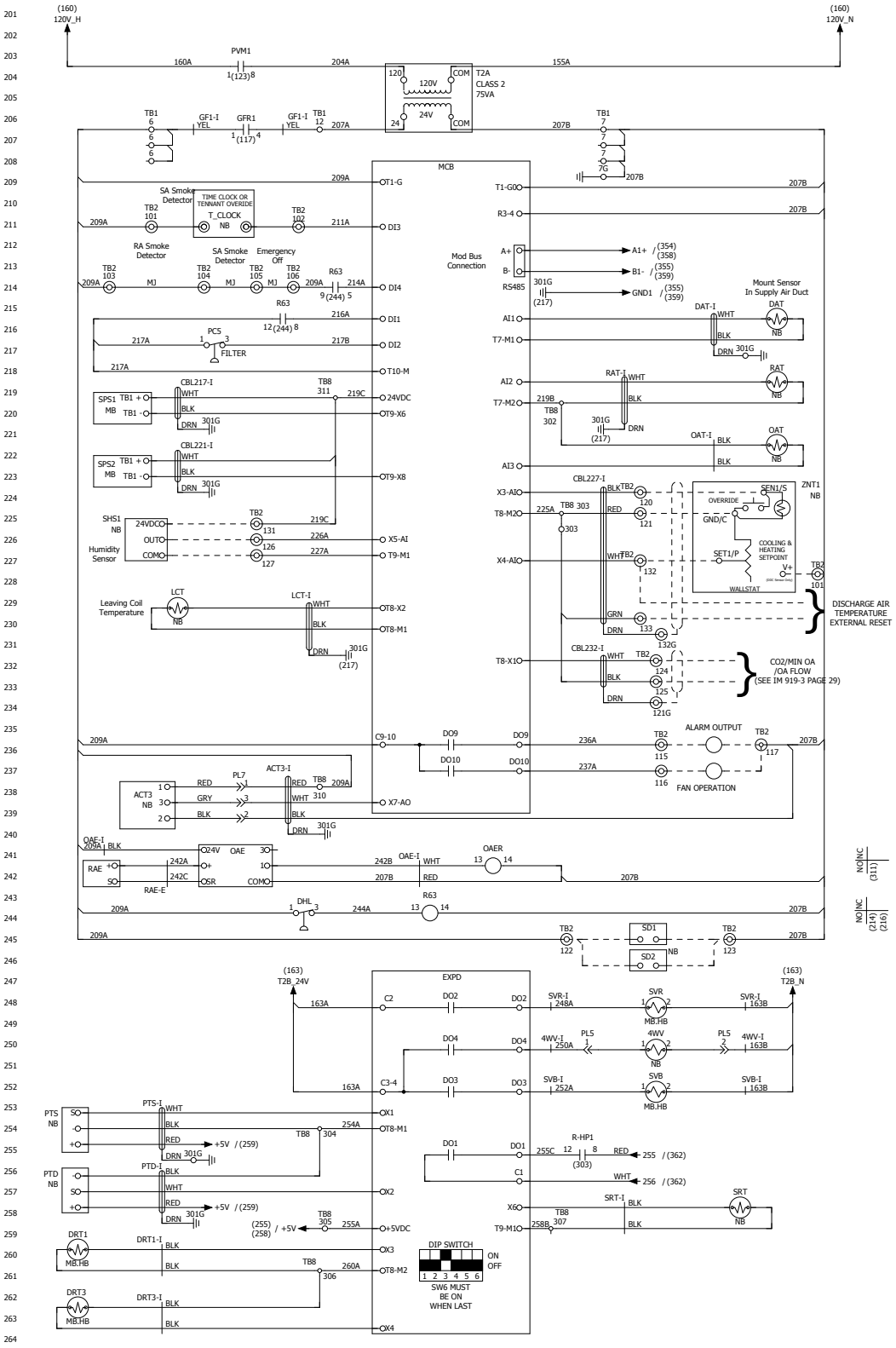


Figure 85 continued: Typical 575 Volt Wiring (3 of 4) — DPS 007–015 shown with 460 to 575 Transformer

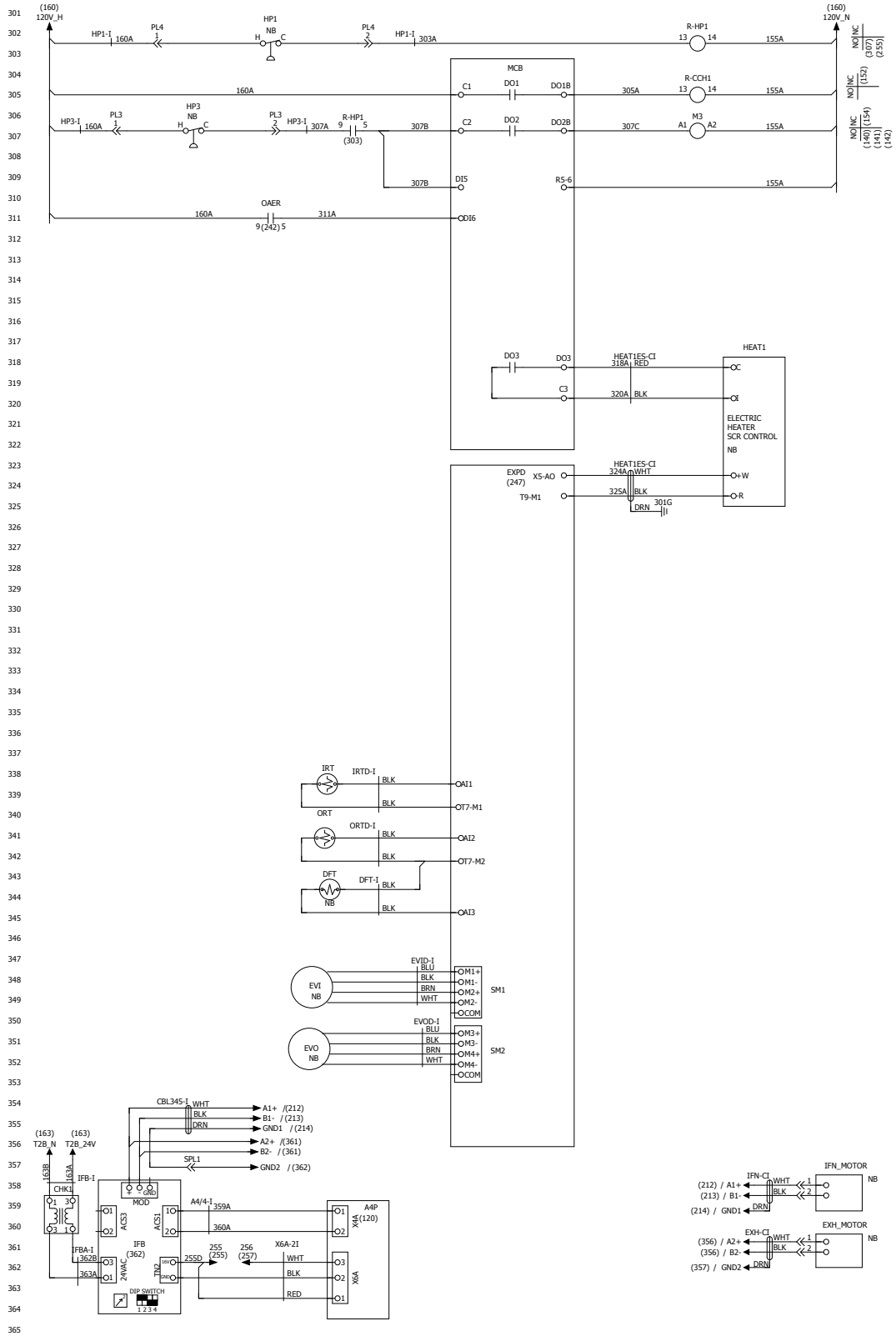


Figure 85 continued: Typical 575 Volt Wiring (4 of 4) — DPS 007–015 shown with 460 to 575 Transformer

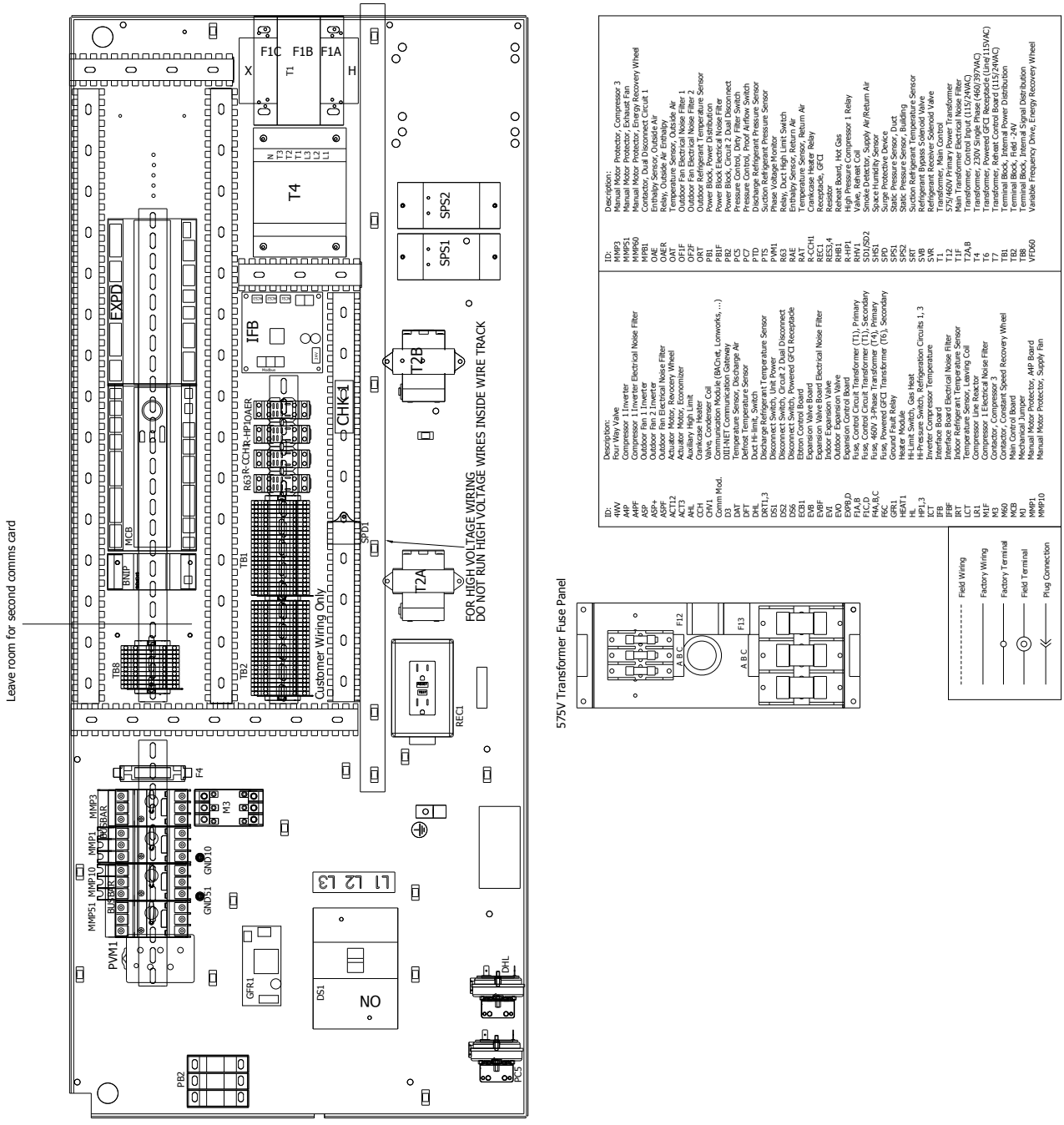


Figure 86: Typical 460V DPS 016–028 with Gas Heat

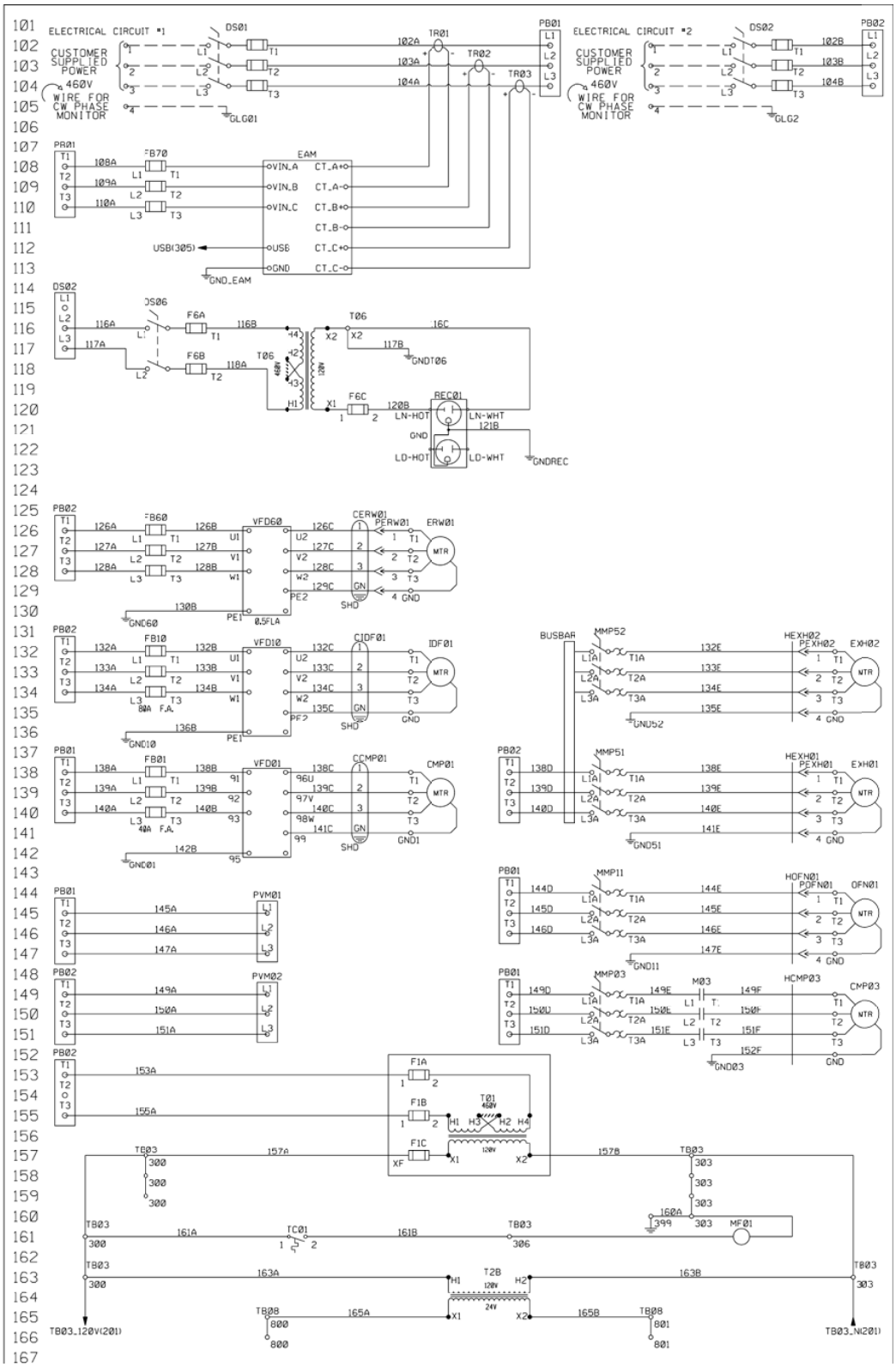


Figure 86 continued: Typical 460V DPS 016–028 with Gas Heat

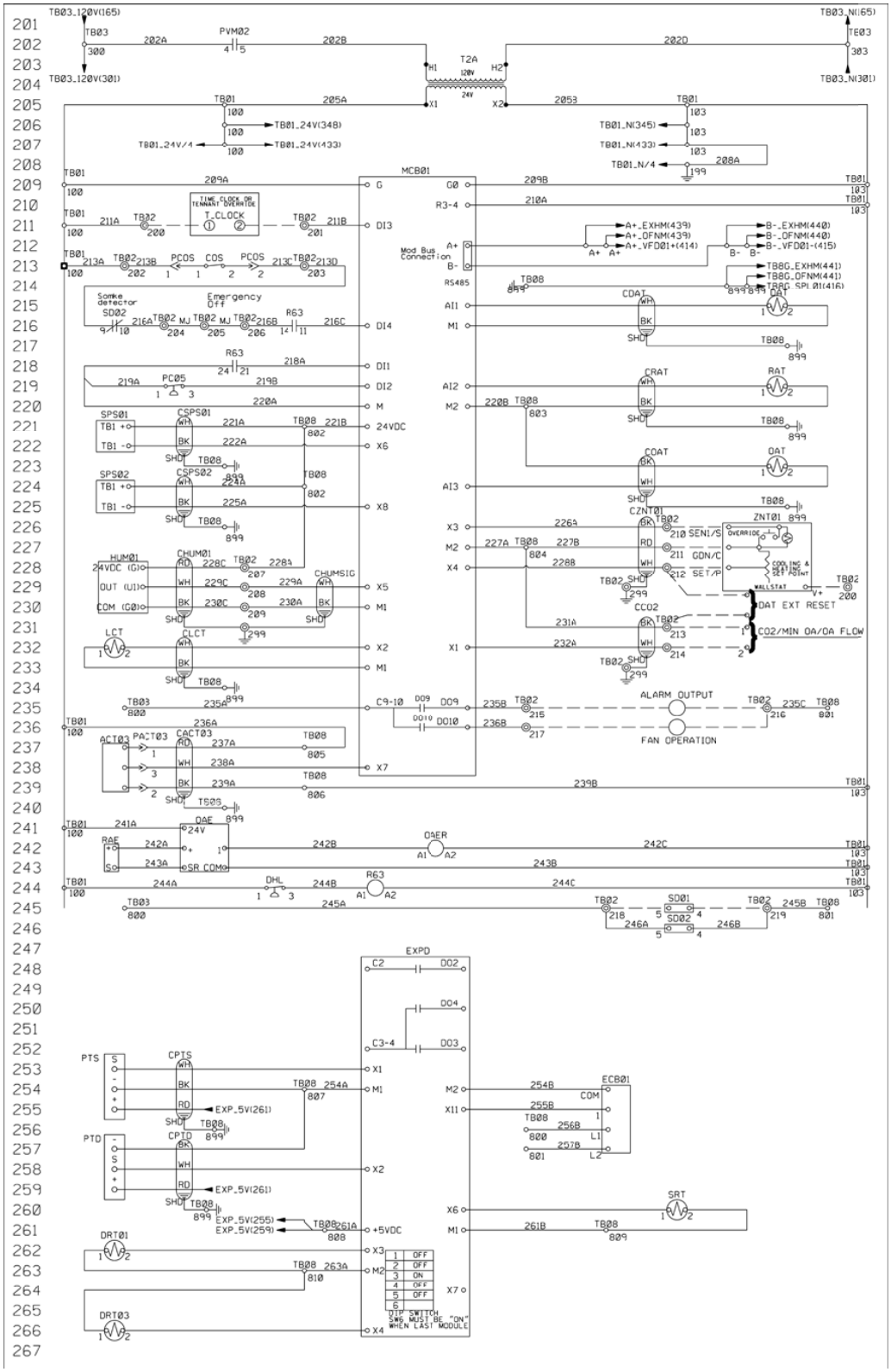


Figure 86 continued: Typical 460V DPS 016–028 with Gas Heat

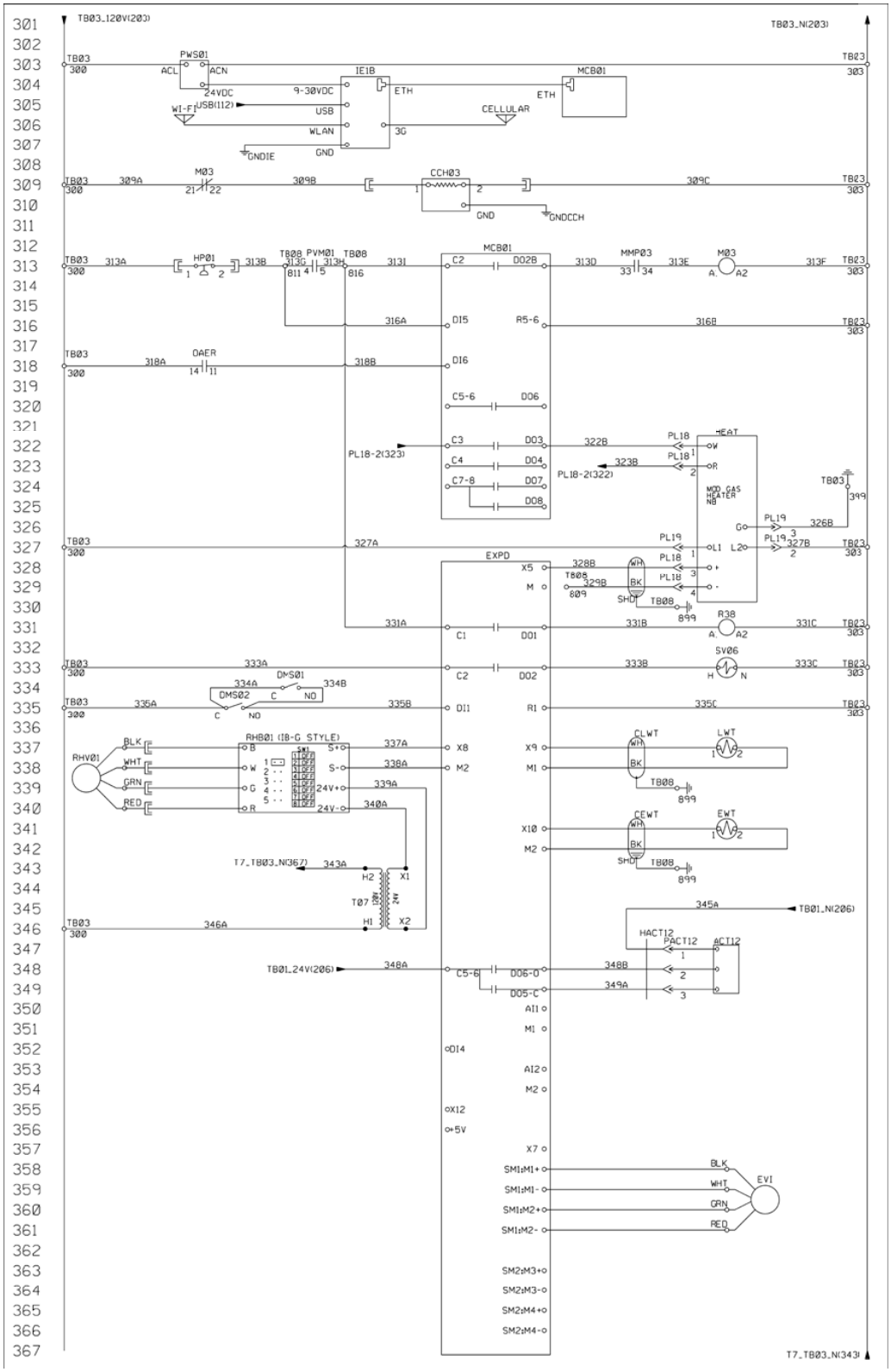


Figure 86 continued: Typical 460V DPS 016–028 with Gas Heat

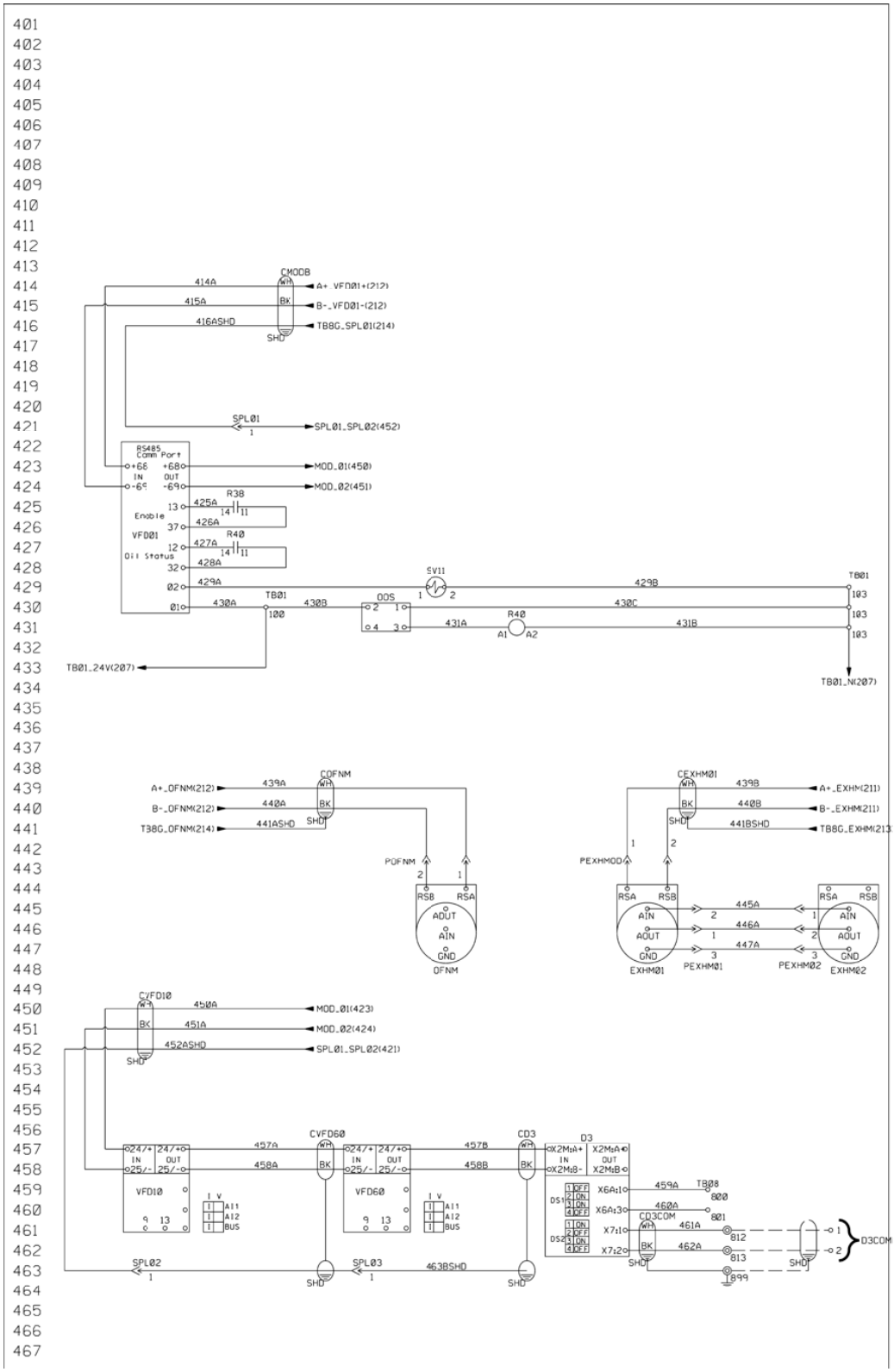


Figure 86 continued: Typical 460V DPS 016–028 with Gas Heat

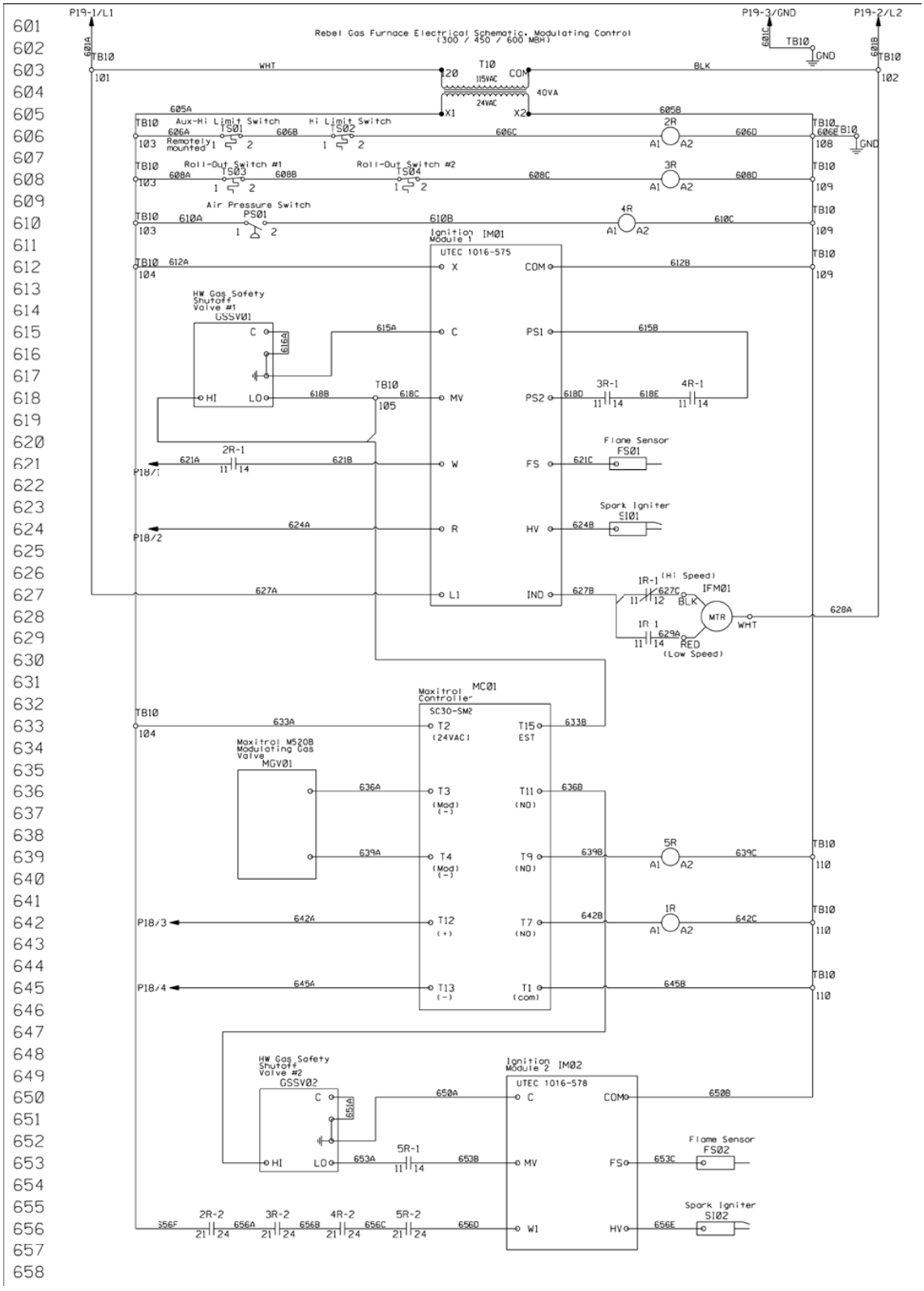


Figure 87: Typical 575V DPS 016–028 with Electric Heat, Dual Power, and Energy Recovery Wheel

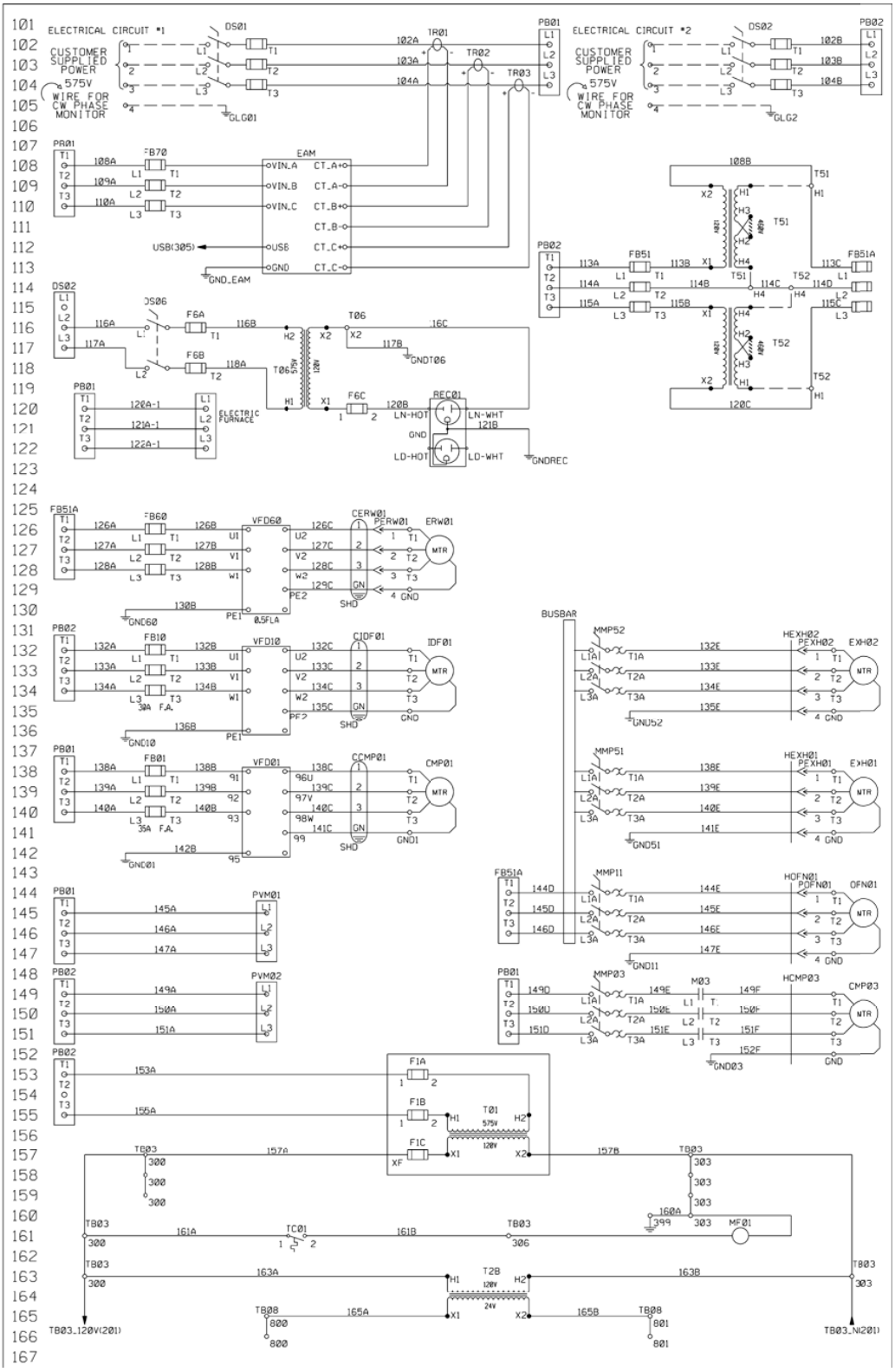


Figure 87 continued: Typical 575V DPS 016–028 with Electric Heat, Dual Power, and Energy Recovery Wheel (

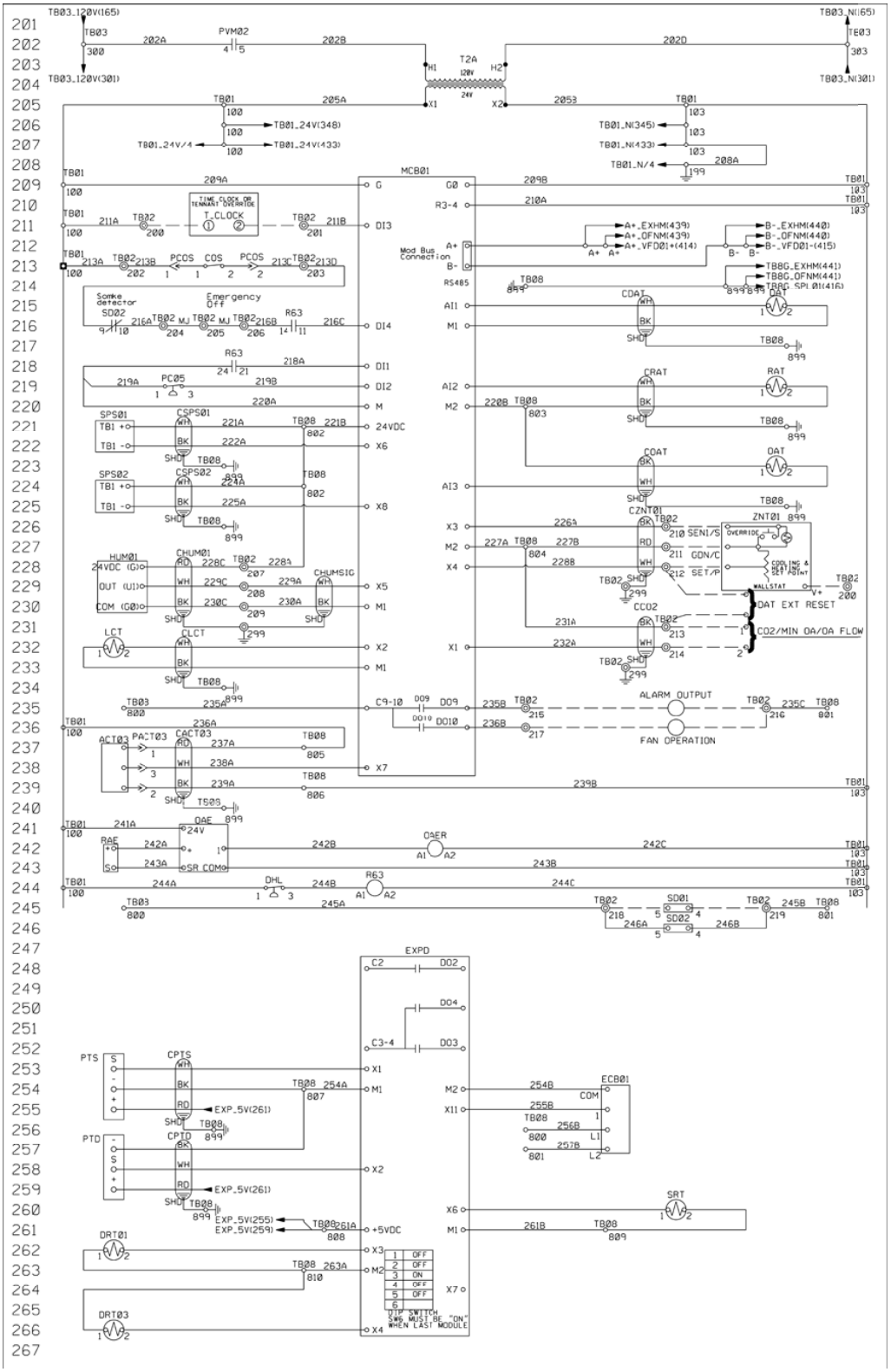


Figure 87 continued: Typical 575V DPS 016–028 with Electric Heat, Dual Power, and Energy Recovery Wheel

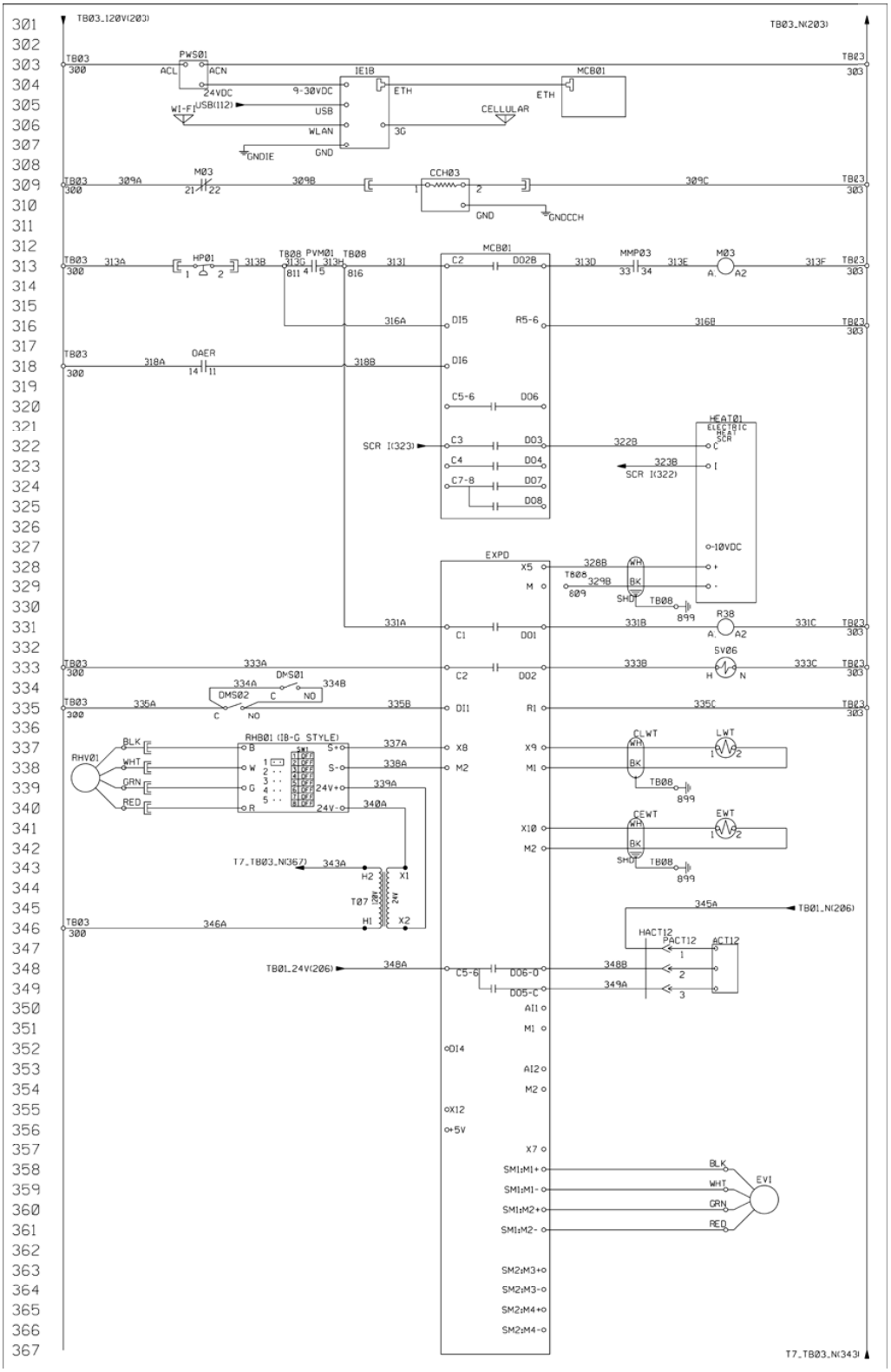


Figure 87 continued: Typical 575V DPS 016–028 with Electric Heat, Dual Power, and Energy Recovery Wheel

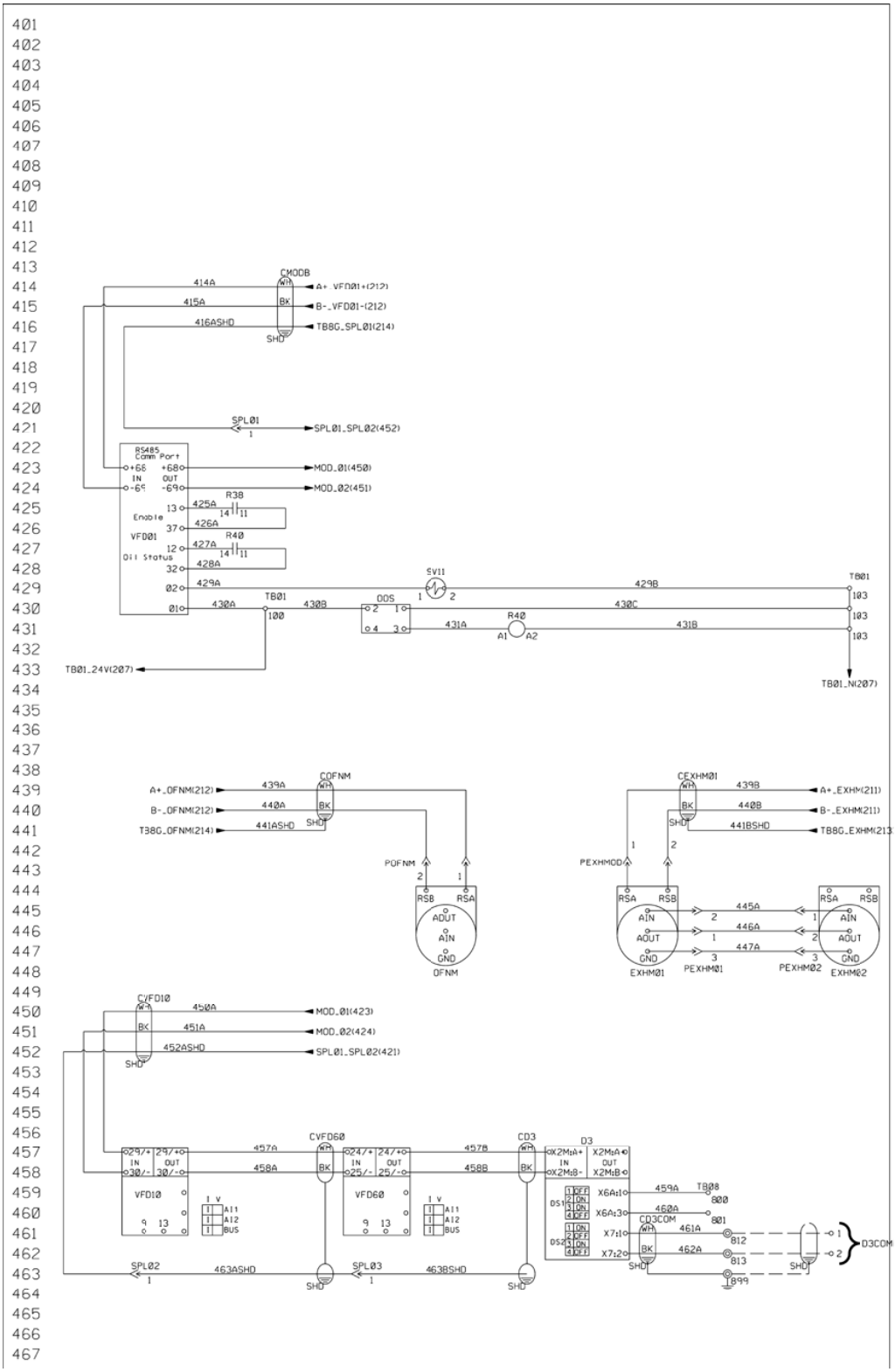


Figure 88: Typical 575V DPS 016–028 with Gas Heat

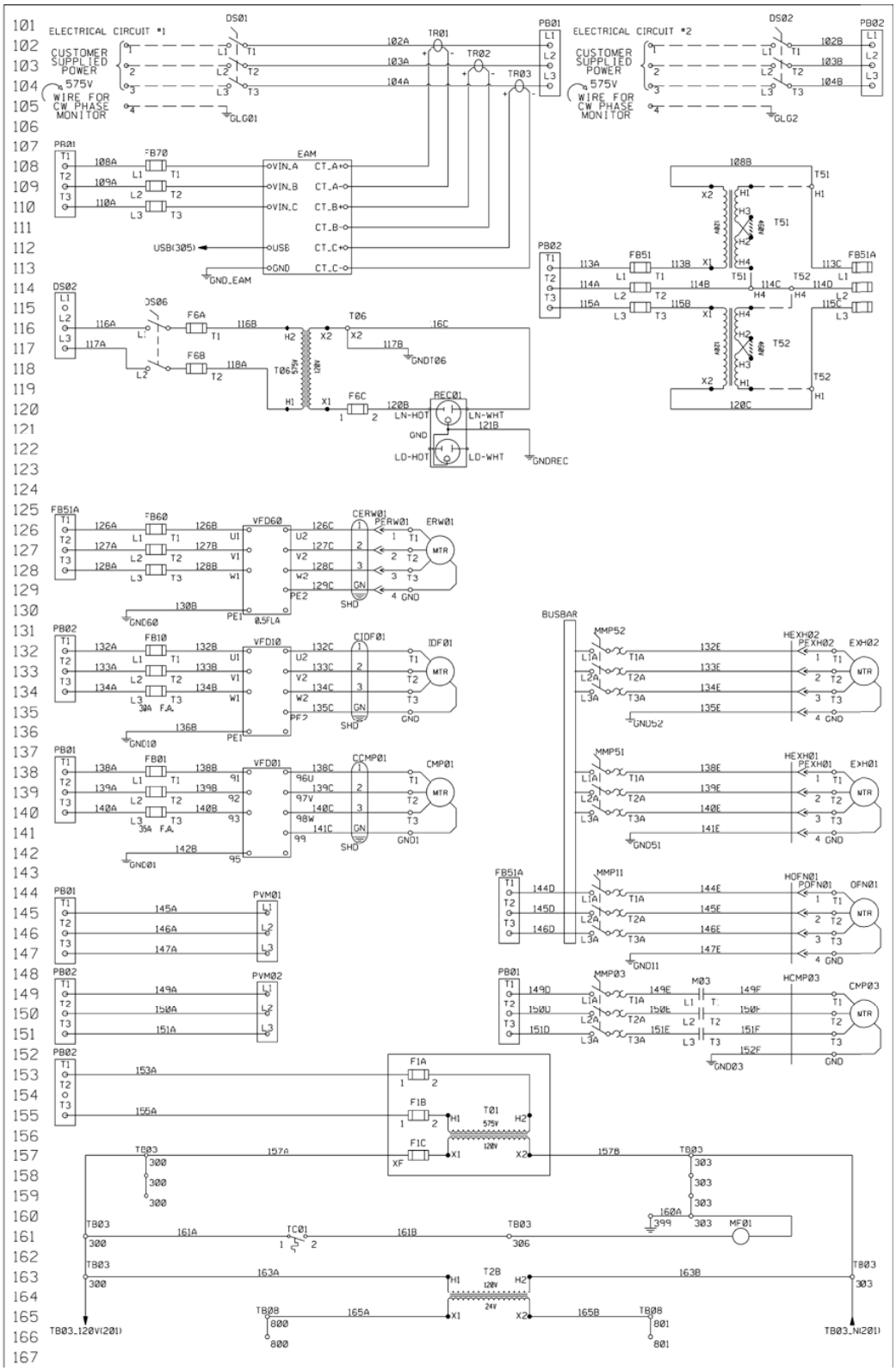


Figure 88 continued: Typical 575V DPS 016–028 with Gas Heat

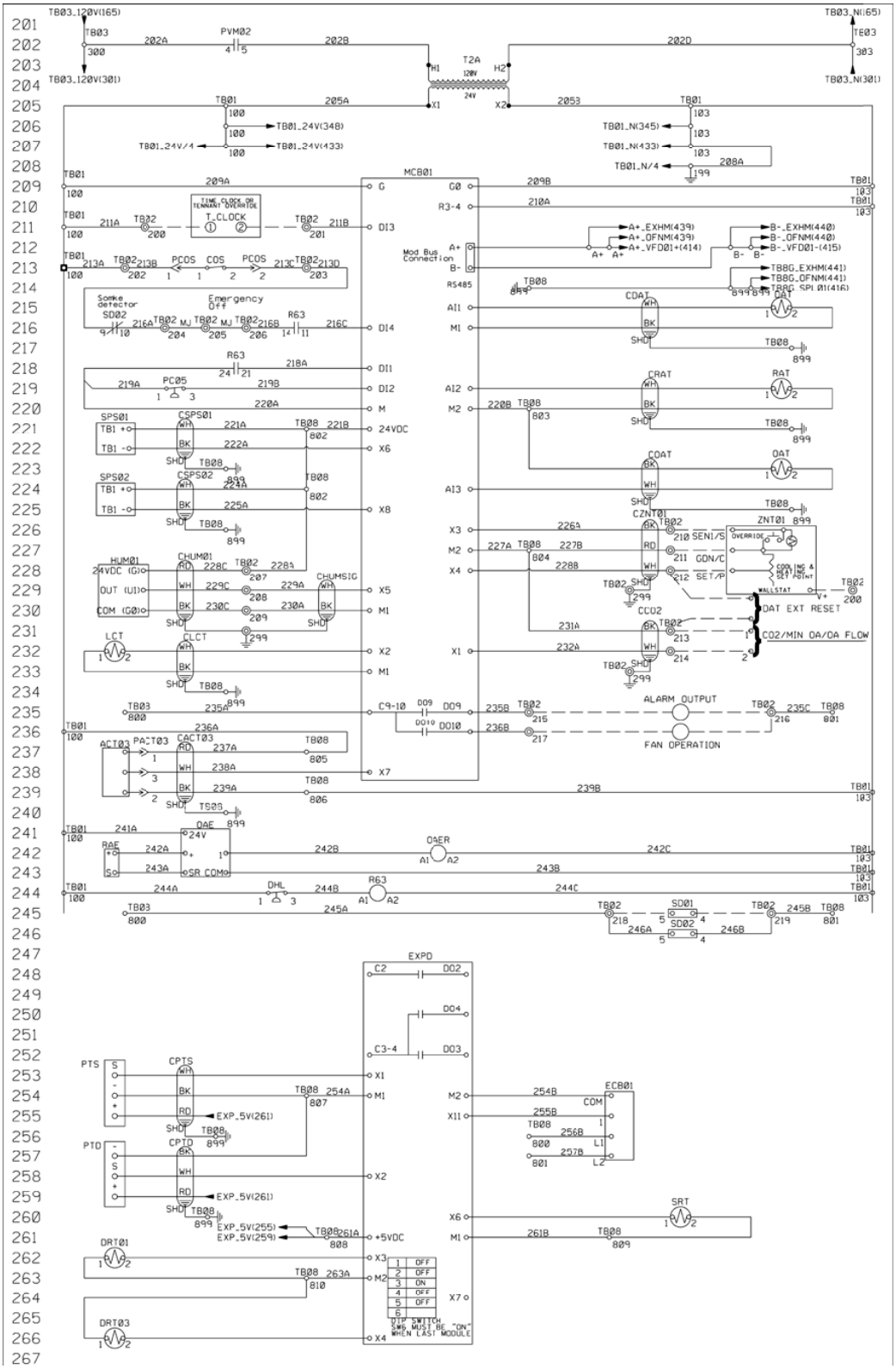


Figure 88 continued: Typical 575V DPS 016–028 with Gas Heat

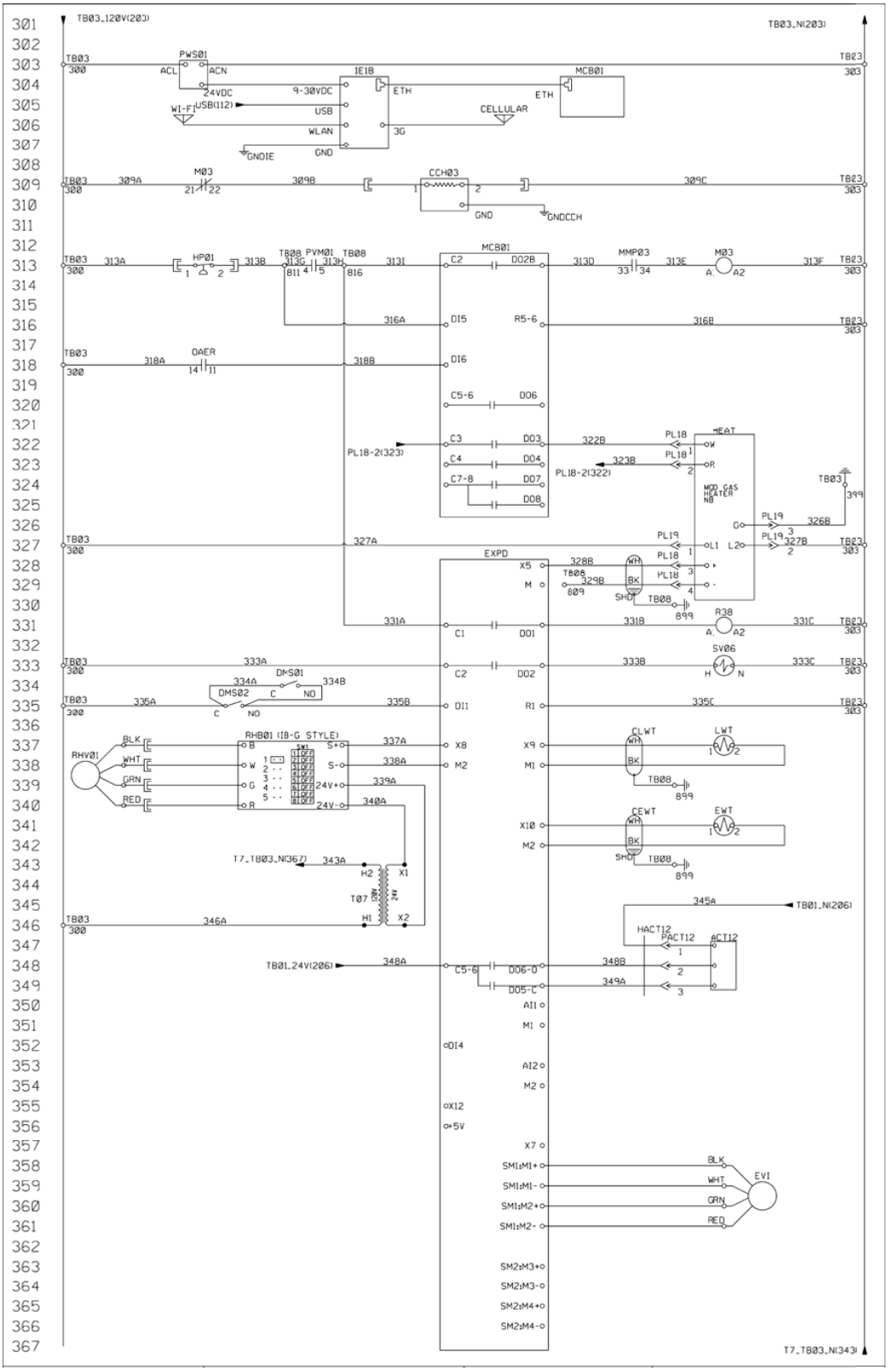


Figure 88 continued: Typical 575V DPS 016–028 with Gas Heat

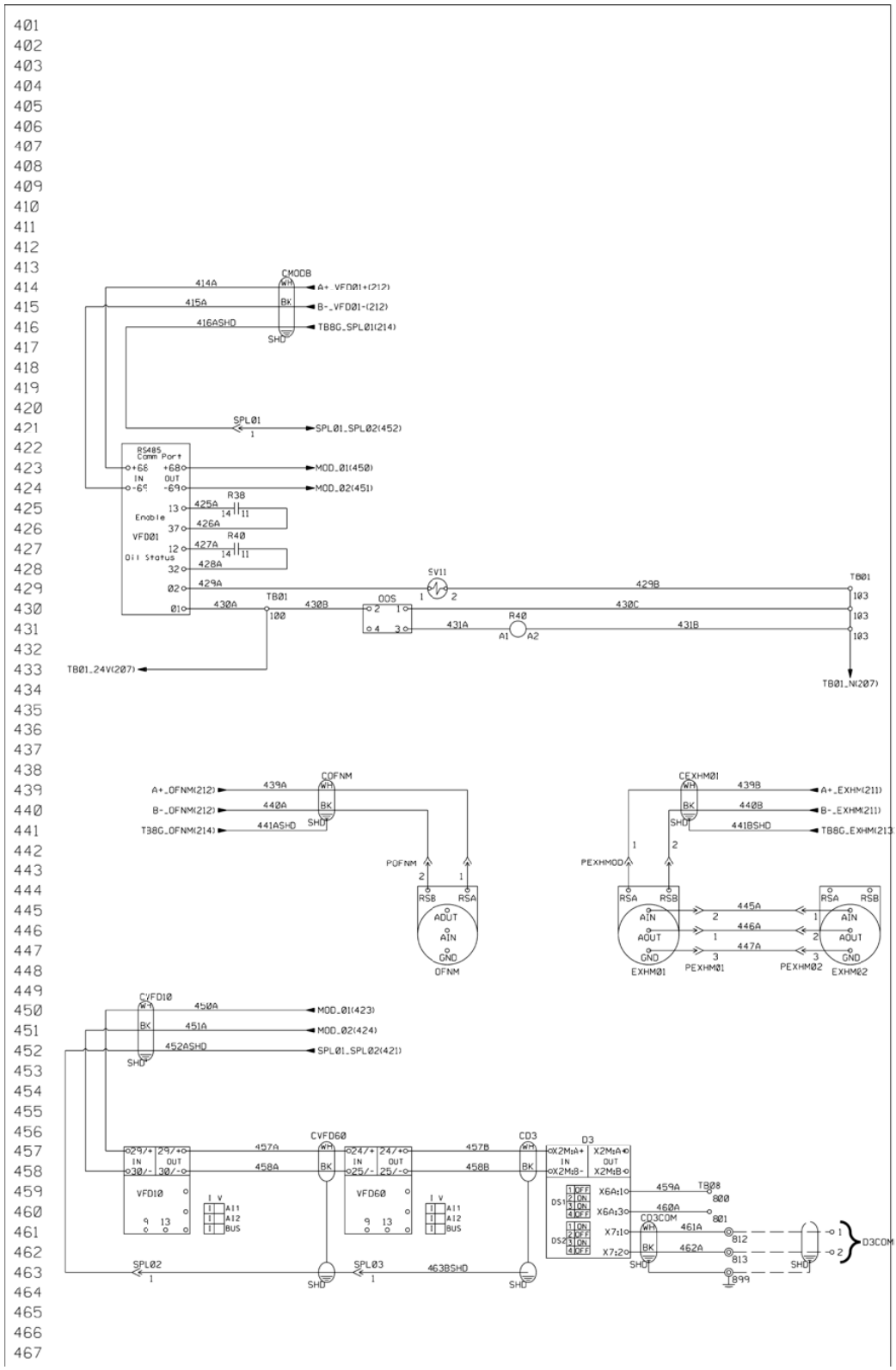


Figure 88 continued: Typical 575V DPS 016–028 with Gas Heat

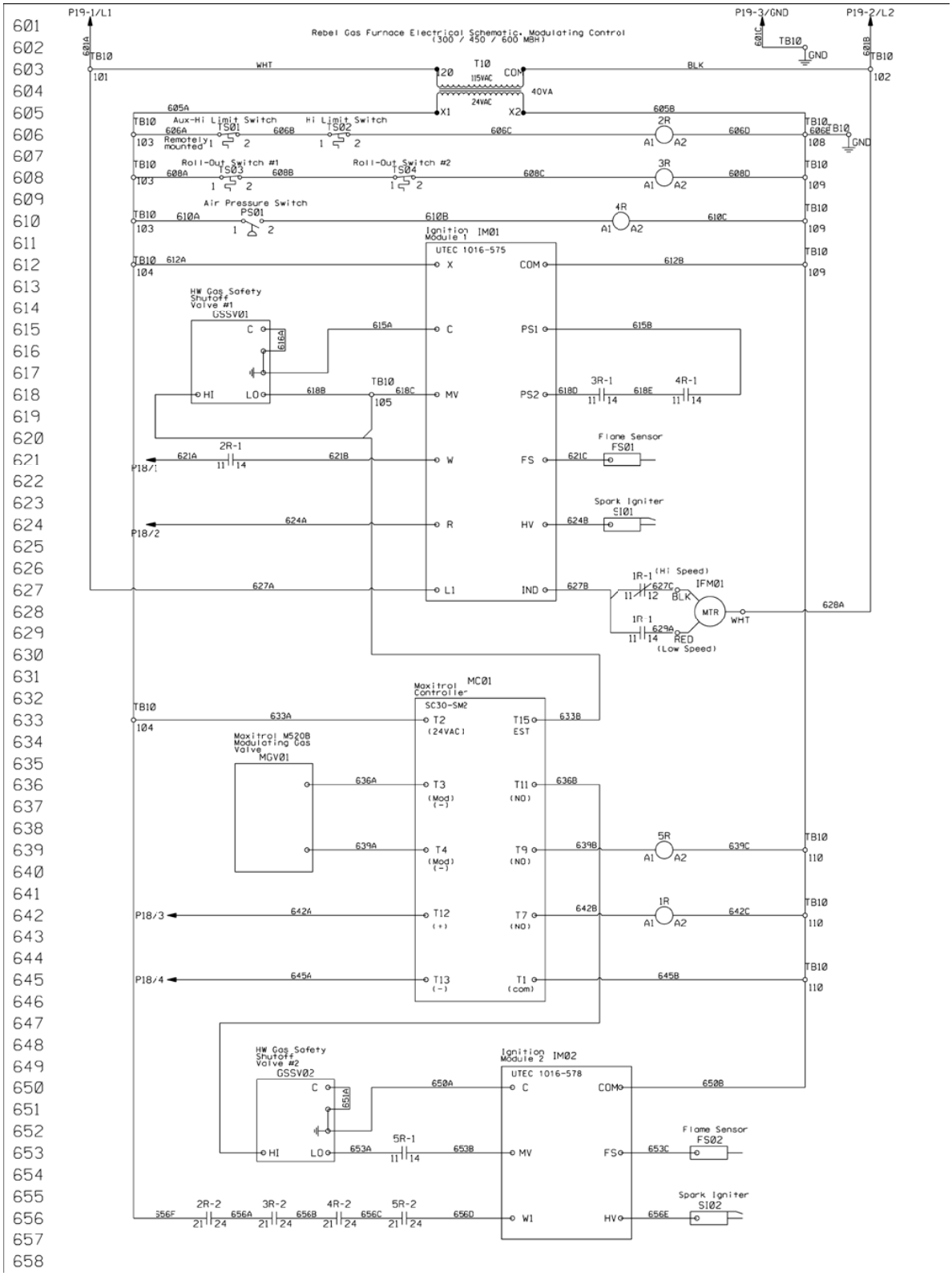
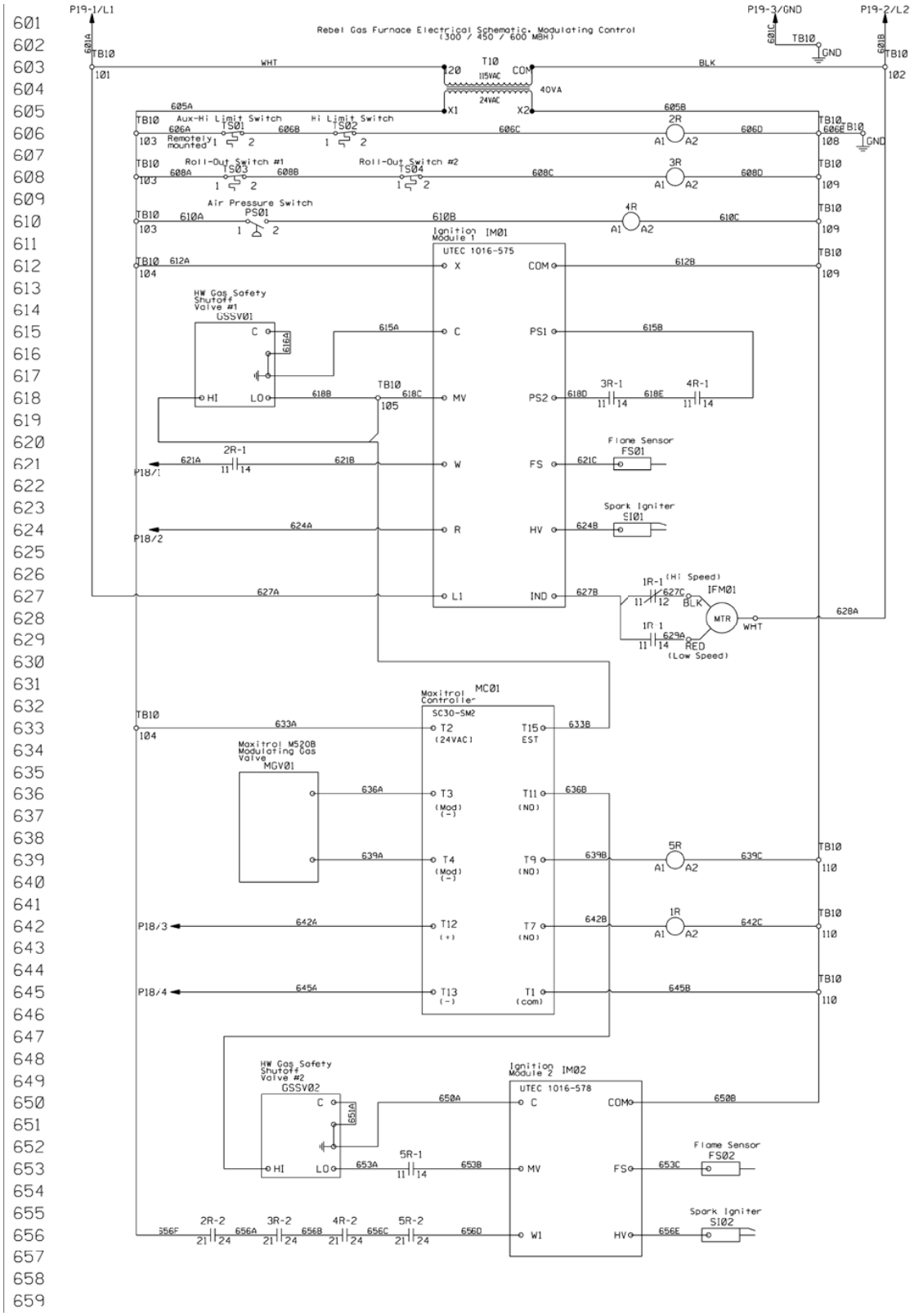


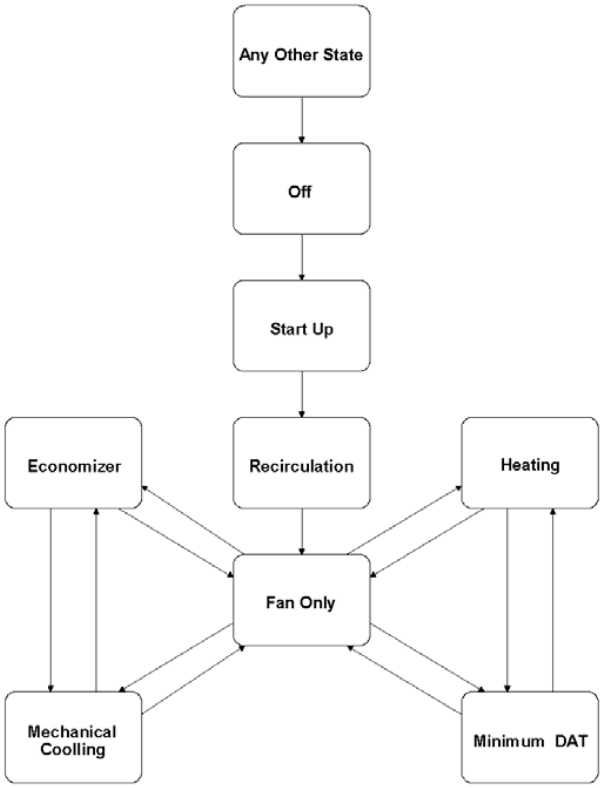
Figure 88 continued: Typical 575V DPS 016–028 with Gas Heat



Operating States

The transition from any operating state to another is graphically represented in Figure 89.

Figure 89: Operating State Diagram



Start Up

With a “start up” command from the “OFF” State the unit will default into the “Start Up” state of operation for 3 minutes. During this time, the fan is OFF.

Recirculation

Next, the unit will transition into the “Recirculation” state of operation for another 3 minutes. During this time, the outside air damper will close and the fan will turn ON, thereby mixing the air in the ductwork and the space.

Fan Only

The outside air damper will modulate to the minimum position and based upon the sensor inputs, the unit will go into one of the four running states - “Heating,” “Cooling,” “Economizing,” or “Minimum DAT.” If the control temperature is between its setpoint and its dead band, the unit will remain in the “Fan Only” state.

Heating (Electric Resistance, Gas Furnace, or Hot Water Heat)

The unit’s heating mode of operation is controlled by the control temperature and the heating setpoint temperature. The unit goes into the heating mode of operation by analyzing the control temperature.

The control temperature can be either the return temperature or the space temperature.

The return temperature is typically used for VAV units and the space temperature is typically used for CAV units.

The unit goes into the heating mode of operation when the control temperature (return or space temperature) is below the heating setpoint by more than ½ the deadband.

Example - If the heating setpoint is 68.0°F and the deadband is 1.0°F, the unit will not go into the heating mode of operation until the control temperature reaches 67.4°F.

When this takes place, the heating mode of operation will begin and the 1st stage of heating operation will start.

The next stage, up or down, will take place after 4 minutes. This “4 minutes” is called the stage timer. The gas or electric heat module will continue to stage up as long as the control temperature is below the heating setpoint by more than ½ the heating setpoint deadband. The unit will stage down if the maximum discharge air temperature of 120°F is reached. Gas units with one gas valve have 2 stages of heating and units with two gas valves have 4 stages of heating.

Auxiliary heating will be used with mechanical (heat pump) heating to maintain set point.

Minimum DAT

This control mode is designed to temper the air in the ductwork when in heating mode. When the unit is in the “Fan Only” state and the Discharge Air Temperature is less than the minimum discharge air temperature limit, “Minimum DAT” control is initiated. The unit will turn on minimum heat until the discharge air temperature exceeds the limit.

Mechanical Cooling

Constant Volume (Space Comfort Controller)

The control temperature for a CAV unit is typically the space temperature. A space temperature sensor must be field installed into the occupied space and connected to the unit controller.

The unit goes into the cooling mode of operation when the control temperature (space temperature) is above the cooling setpoint by more than ½ the deadband.

Example - the cooling setpoint is set to 70.0°F and the deadband is 1.0°F, the unit will not go into the cooling mode of operation until the space sensor reaches 70.6°F.

When this takes place, the cooling mode of operation will begin and the 1st stage of compressor operation will start.

The unit controller will turn ON the next stage of compressor operation, or turn off a stage of compressor operation, to maintain the cooling setpoint temperature within the deadband. When a compressor stage turns ON, the next compressor stage, up or down, will not take place for the next 4 minutes. This “4 minutes” is called the stage time. Reference the “Cooling Setup” menu for the adjustable stage time value.

When a cooling stage is initiated no further operation will take place within the stage timer limit. In the above example, the unit will stage down or turn OFF the cooling mode of operation when the cooling setpoint reaches 69.4°F.

Variable Air Volume (Discharge Air Controller)

The unit’s cooling mode of operation is controlled by the control temperature, the change-over temperature, and the discharge air temperature. The unit goes into the cooling mode of operation by analyzing the control temperature. The control temperature for a VAV system is the return temperature.

The unit goes into the cooling mode of operation when the control temperature (return temperature) is above the change-over setpoint by more than ½ the deadband.

Example - If the change over temperature is 70.0°F and the deadband is 1.0°F, the unit will not go into the cooling mode of operation until the return temperature reaches 70.6°F.

When this takes place, the cooling mode of operation will begin and the 1st stage of compressor operation will start.

The unit controller will turn ON the next stage of compressor operation, or turn off a stage of compressor operation, to maintain the discharge air temperature setpoint within the deadband. When a compressor stage turns ON, the next compressor stage up or down will not take place for the next 4 minutes. This “4 minutes” is called the stage timer.

When a cooling stage is initiated no further operation will take place within the stage timer limit. Reference the Cooling Setup menu for the adjustable stage time value. In the above example, the unit will stage down or turn OFF the cooling mode of operation when the return temperature reaches 69.4°F.

Economizer

When the economizer is enabled, the outside air temperature is below the changeover setpoint, and the differential enthalpy switch (if installed) is made, the economizer becomes the first stage of cooling. It will modulate to control to either the discharge air temperature (VAV) or space temperature (CV).

Every 4 minutes, the unit can then either add mechanical cooling if the economizer is at 100% open, continue economizing, or if the control temperature is satisfied, return to minimum position and transition back to “Fan Only” mode.

If the enthalpy switch breaks or the outside air warms, the unit will exit economizing and continue to mechanically cool while returning to the minimum position for ventilation.

Pre-Start of Unit

DANGER

Electric shock and moving machinery hazard. Can cause severe equipment damage, personal injury, or death.

Disconnect and tag out all electrical power before servicing this equipment.

All start-up and service work must be performed only by trained, experienced technicians familiar with the hazards of working on this type of equipment.

Read and follow this manual: "MicroTech III Unit Controller" (OM 1141) before operating or servicing.

Bond the equipment frame to the building electrical ground through grounding terminal or other approved means.

All units are completely run tested at the factory to promote proper operation in the field. However, to ensure proper operation once the unit is installed, the following check, test, and start procedures must be performed to properly start the unit. To obtain full warranty coverage, complete and sign the check, test, and start form supplied with the unit and return it to Daikin Applied.

A representative of the owner or the operator of the equipment should be present during start-up to receive instructions in the operation, care, and maintenance of the unit.

Spring Isolated Fans

DPS 016–028 Only

WARNING

Moving machinery hazard. Can cause severe injury ordeath. Before servicing equipment, disconnect power and lockoff. More than one disconnect may be required to de-energize unit. Prior to operating the fans for the first time, refer to Check, Test and Start Procedures on page 115.

Releasing Spring Mounts

The supply fan on DPS 016–028 units is spring isolated due to the relatively larger fan and increased applied energy.

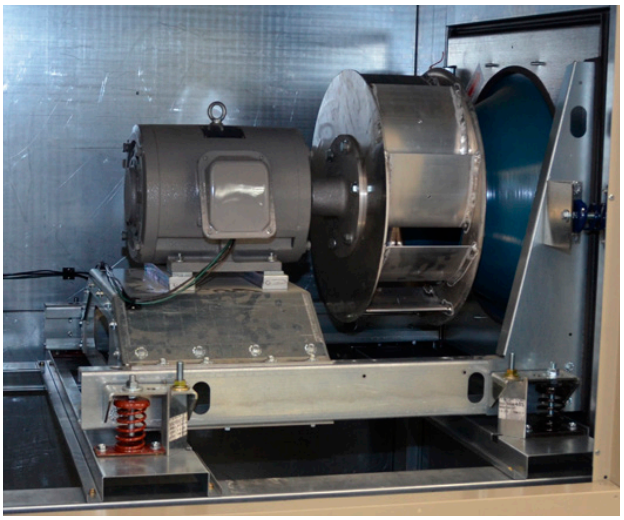
The spring-mounted supply fan is locked down with four shipping bolts for shipment. Remove each shipping bolt before operating the fans. Figure 90 shows a typical spring mount with a height adjustment nut and a shipping bolt.After removing the shipping bolts, rock the fan assembly by hand to check for freedom of movement.

Adjusting Spring Mounts

During operation all fans should ride level. Level the fan assembly by performing the following:

1. Loosen the 3/8" cap screw (do not remove).
2. Loosen the spring cap nut.
3. Rotate the 5/8" adjustment nut counter-clockwise to raise the fan assembly, or clockwise to lower the fan assembly.
4. Tighten the 3/8" cap screw.
5. Tighten the spring cap nut.

Figure 90: Spring Mounts



Servicing Control Panel Components

⚠ DANGER

Hazardous voltage. May cause severe injury or death.

Disconnect electric power before servicing equipment

Before Start-Up

1. Remove shipping bolts from compressor(s).
2. Verify that the unit is completely and properly installed with ductwork connected.
3. Verify that all construction debris is removed, and that the filters are clean.
4. Verify that all electrical work is complete and properly terminated.
5. Verify that all electrical connections in the unit control panel are tight, and that the proper voltage is connected.
6. Verify all nameplate electrical data is compatible with the power supply.
7. Verify the phase voltage imbalance is no greater than 2%.
8. Verify that gas piping is complete and leak tight.
9. Verify that the shutoff cock is installed ahead of the furnace, and that all air has been bled from the gas lines.
10. Verify installation of gas flue and outside air vents.
11. Manually rotate all fans and verify that they rotate freely.
12. Verify that the evaporator condensate drain is trapped and that the drain pan is level.
13. If unit is curb mounted, verify that the curb is properly flashed to prevent water leakage.
14. Review the equipment and service literature, the sequences of operation, and the wiring diagrams to become familiar with the functions and purposes of the controls and devices.
15. Determine which optional controls are included with the unit.
16. Inspect the outside and inside of the unit for any signs of damage or rough handling. Excessive air leakage would be one possible, unacceptable consequence. If any problems are found, contact the local Daikin representative for instructions.

Power-Up

1. Close the unit disconnect switch.
2. Power should now be supplied to the control panel.

Phasing the Rebel Unit

The supply and return fans, inverter compressor, and condenser fans are all inverter driven and are DC voltage motors. Care has to be taken to ensure proper phasing.

1. With a phase rotation indicating tool ensure phase rotation per the wiring diagrams on the inside door of the control panel.

Fan Start-Up

1. Verify all duct isolation dampers are open.
2. Place the unit into the “Fan Only” mode through the keypad.
3. The controller should enter the “Startup Initial” operating state. If the fan does not run, check the manual motor protectors or that the circuit breakers have not tripped.
4. Verify the rotation is correct.

Economizer Start-Up

1. Check whether the outdoor air is suitable for free cooling.
2. At the keypad, set the cooling setpoint low enough so the controller calls for cooling.
3. Place the unit into cooling mode through the keypad menu.
4. Observe the outdoor air dampers:
   a. If the outdoor enthalpy is low, the control algorithm should start to modulate the dampers open to maintain the discharge air setpoint.
   b. If the outdoor enthalpy is high, the dampers should maintain their minimum position.

NOTE: It may not be possible to check the economizer operation in both low and high enthalpy states on the same day. If this is the case, repeat this procedure on another day when the opposite outdoor air enthalpy conditions exist.

Compressor Start-Up

⚠ CAUTION

Low ambient temperature hazard. Can cause compressor damage. Do not attempt to start up and check out the refrigeration system when the outdoor air temperature is below 0°F.

1. Inspect all refrigerant piping and look for leaks by looking for refrigerant oil residue. If any problem is found, reclaim any remaining refrigerant, fix the problem and then add the circuit's nameplate charge by weight before proceeding.
2. With the supply fan operational, prepare for compressor operation. Verify that the crankcase heaters are operating. **These should operate for at least 24 hours before starting the compressors.**

Perform the Following Procedure:

NOTICE

Venting refrigerant to atmosphere is not allowed per most local laws and/or codes.

1. At the keypad, set the cooling setpoint low enough so that the controller will call for cooling.
2. Verify that compressor #1 starts. If the compressor motor hums but does not run, verify that it is phased correctly between the inverter board and compressor.
3. The compressor should operate continuously while there is a call for cooling. If the compressor cycles on and off on its low pressure switch, perform the following:
   a. Verify that the circuit is not short of refrigerant.
   b. Check for low airflow across the evaporator coil.
   c. Check for clogged filters.
   d. Check for restricted ductwork.
   e. Check for very low temperature return air entering the unit.
   f. Verify that the liquid line components, expansion valve, and distributor tubes are feeding the evaporator coil.
   g. Verify that all air handling section panels are closed.
4. Verify that the condenser fans are cycling and rotating properly (blowing air upward). When the compressor starts, at least one condenser fan should also start.

Checking Subcooling

Following are recommendations for checking subcooling:

1. Run unit until it reaches steady state. Close the unit section doors. Running the unit with its doors open will affect system operation.
2. Subcooling can be read from the MicroTech III unit controller.

Set Up for Optimum Control

The Outdoor air sensor must be calibrated.

- **Compare the MicroTech III OAT reading to an external temperature measuring device.** See Appendix, Figure 99 on page 138 go to the Quick Menu and OA Temp [pink path.]
- **If there is more than 1.0°F difference between the two readings [Note the OAT reading should be taken after the outdoor fans have been running for at least 1 minute.] then correct this difference on the keypad.** Go to Service Menus (Appendix, Figure 95 and then Figure 98 on page 136), Sensor Offsets [orange path,] find OA temp, and make the required adjustment. **The adjustment has a range setting of +/– 10.0°F.**

Proper discharge and suction super heat is critical

- **Suction super heat is monitored at the display screen.** Appendix, see Figure 95 and then Appendix, Figure 97 on page 134, go to commission unit, expansion valve set up, and super heat [yellow path.]
- **Discharge super heat is not shown directly but is the difference between discharge temperature and saturated discharge temperature and both can be monitored at the display screen.** See Figure 95 and Figure 97.
  - Go to commission unit (Figure 97), expansion valve set up, and disch sat tmp [yellow path.]
  - Go to view/set unit (Figure 95 and Figure 96), temperatures, DRT1 [inverter compressor] and DRT 2 [fixed speed compressor] [green path]
- **If, after all motor speeds are constant +/– 5 hz for 15 minutes for either compressor, suction superheat drops below 5°F, or discharge superheat drops below 18°F, or discharge superheat drops below 30°, then proceed as follows.**
  - **Set the SS Hi Base to 2°F.** See Figure 95 and Figure 97, go to commission unit, expansion valve set up, and SS Hi Base [yellow path.]
  - **Contact the factory to diagnose why super heat is too low.**
- **If super heats do not reach steady state [less than 10°F variation for 2 minutes] then**
  - **Set the SS Hi Base to 2°F.** See Figure 95 and Figure 97. Go to commission unit, expansion valve set up, and SS Hi Base [yellow path.]
  - **Contact the factory to diagnose why the unit is hunting.**

Air Balancing

⚠ WARNING

Moving machinery hazard. Can cause severe personal injury or death. Do not use a mechanically driven tachometer to measure the speed of return fans on this fan arrangement. Use a strobe tachometer.

The following should be performed by a qualified air balancing technician:

1. Check the operating balance with the economizer dampers positioned for both full outdoor air and minimum outdoor air.
2. Verify that the total airflow will never be less than that required for operation of the electric heaters or gas furnace.
3. When the final drive adjustments or changes are complete, check the current draw of the supply fan motors. The amperage must not exceed the service factor stamped on the motor nameplate

Minimum and maximum airflow/rpm settings can be adjusted using the MicroTech III controller. Refer to OM 1141 for details.

Energy Recovery Wheel

Prestartup Checks

1. By hand, turn wheel clockwise (as viewed from the pulley side) to verify wheel turns freely through 360° rotation.
2. During rotation confirm wheel segments are fully engaged in the wheel frame and segment retainers are completely fastened
3. With hands and objects away from moving parts, apply power and confirm wheel rotation. Wheel rotates clockwise as viewed from the pulley side.
4. If wheel has difficulty starting, disconnect power and inspect for excessive interference between the wheel surface and each of the (4) diameter seals.

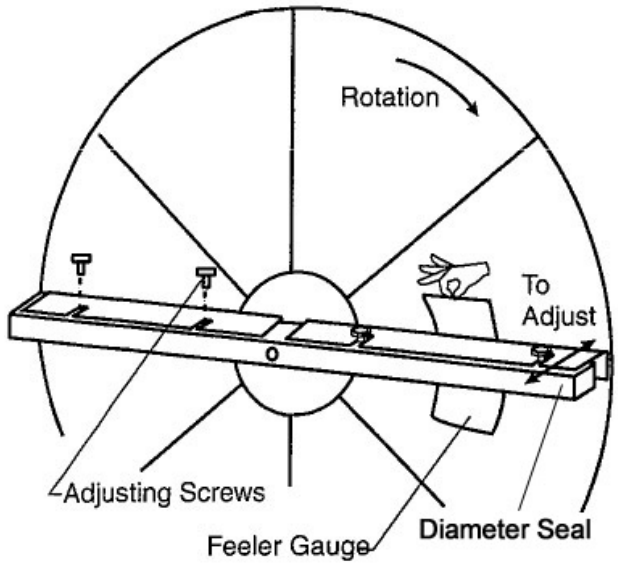
Diameter Seal Adjustment

⚠ WARNING

Keep hands away from rotating wheel! Contact with rotating wheel can cause physical injury.

1. Loosen diameter seal adjusting screws. See Figure 91.
2. Move adjustable diameter seals away from wheel.
3. Using a ¼ inch feeler gauge, adjust the diameter against the wheel. See Figure 91.
4. Tighten diameter seal adjusting screws.
5. Apply power per the start up procedure.

Figure 91: Energy Recovery Wheel Adjusting



CORE Set-Up

1. Attain outdoor air hoods.
2. Verify bypass damper moves freely.

Final Control Settings

Controller Settings for Normal Operation

When all start-up procedures are completed, set the controls and program the MicroTech III controller for normal operation. Use the following list as a guide; some items may not apply to your unit.

1. Set the heating and cooling parameters as required for normal unit operation:
   a. Temperature\Zone Cooling\
   b. Temperature\Zone Heating\
   c. Temperature\Discharge Cooling\
2. Set the low ambient compressor lockout setpoint as required. Do not set it below 20°F.
3. Set the high ambient heat lockout temperature setpoint.
4. Set the alarm limits as required.
5. Set the duct static pressure control parameters as required.
6. Set the building static pressure control parameters as required.
7. Set the economizer control parameters as required.
8. Set the date and time in keypad menu.
9. Set the operating schedule as required using keypad menus.

NOTE: Unit operation may also be controlled by the building automation system.

Maintaining Control Parameter Records

Daikin recommends that the MicroTech III controller's setpoints and parameters be recorded and saved for future reference. If the microprocessor control board requires replacement, this record facilitates entering the unit's proper data.

Performing Service Maintenance

Installation and maintenance must be performed only by qualified personnel who are experienced with this type of equipment and familiar with local codes and regulations.

IMPORTANT

Gas or Hot Water Piping: A qualified Architect or Systems HVAC Design Engineer familiar with piping design, local codes and regulations, must provide piping design. The following manufacturer recommendations serve as a general guide and should not replace a qualified professional's piping system design.

DANGER

Moving machinery and electrical power hazards. May cause severe personal injury or death. Disconnect and lock off all power before servicing equipment.

WARNING

Sharp edges are inherent to sheet metal parts, screws, clips, and similar items. May cause personal injury.

Exercise caution when servicing equipment.

Servicing Control Panel Components

Disconnect all electric power to the unit when servicing control panel components. Before servicing, always inspect units for multiple disconnects to ensure all power is removed from the control panel and its components.

DANGER

Hazardous voltage. May cause severe injury or death.

Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

Planned Maintenance

Preventive maintenance is the best way to avoid unnecessary expense and inconvenience. Have this system inspected at regular intervals by a qualified service technician. The required frequency of inspections depends upon the total operating time and the indoor and outdoor environmental conditions. Routine maintenance should cover the following items:

- All blowers, including furnace inducer, have sealed bearings. No lubrication is necessary.
- Tighten all wire connections.
- Clean the outside and inside coils mechanically or with cold water, if necessary. Usually any fouling is only matted on the entering air face of the coil and can be removed by brushing or vacuuming.
- Clean or replace the filters as required.
- Check for blockage of the condensate drain. Clean the condensate pan as needed.
- Check the power and control voltages.
- Check the running amperage of all motors.
- Check all operating temperatures and pressures.
- Check and adjust all temperature and pressure controls as needed.
- Check and adjust all damper linkages as needed.
- Check the operation of all safety controls.
- Check the condenser fans and tighten their setscrews.
- Periodic removal of snow drifts will be required in northern climates

Unit Storage

Location

The Rebel is an outdoor unit. However, the construction schedule may dictate storage either on the ground or in its final position at the site. If the unit is stored on the ground, additional precautions should be taken as follows:

- Make sure that the unit is well supported along the length of the base rail.
- Make sure that the unit is level (no twists or uneven ground surface).
- Provide proper drainage around the unit to prevent flooding of the equipment.
- Provide adequate protection from vandalism, mechanical contact, etc.
- Make sure all doors are securely closed and all latches closed.
- Units should be fitted with covers over the supply and return air openings.

Preparation for Storage

Supply Fans

1. Depending on local climate conditions, condensate may collect on components inside the units. To prevent surface rust and discoloration, spray all bare metal parts with a rust preventive compound.

Cabinet Sections

Once a month, open a door on each section and verify that no moisture or debris is accumulating in the unit.

Control Compartment

1. Daikin Applied recommends that the electronic control equipment in the unit be stored in a 5% to 95% RH (non-condensing) environment.
2. It may be necessary to put a heat source (light bulb) in the main control panel to prevent the accumulation of atmospheric condensate within the panel. The location and wattage of the heat source is dependent on local environmental conditions.
3. Check the control compartment every two weeks to confirm that the heat source is functional and is adequate for current conditions.

Filter Replacement

This unit is provided with filters are show in Table 37. These filters are disposable and should be replaced periodically. Unit is equipped with a filter pull to assist in this process. See Figure 92.

Table 37: Filter Sizes

Cabinet Size	Filter Size
003–006	4 – 16" × 16"
003–006 with ERW	6 – 16" × 16"
007–015	6 – 18" × 24"
007–015 with ERW	10 – 18" × 24"
007–015 with CORE	6 – 18" × 20" 6 – 18" × 24"
016–028	9 – 18" × 24"
016–028 with ERW	13 – 18" × 24"
016–028 with CORE	11 – 18" × 24" 6 – 24" × 24"

Restart

After extended storage, perform a complete start up. Inevitable accumulations of dirt, insect nests, etc. can contribute to problems if not cleaned out thoroughly prior to start up. In addition, thermal cycling tends to loosen mechanical and electrical connections. Following the startup procedure helps discover these and other issues that may have developed during the storage interval.

Figure 92: Rebel Filter Section

Fans

The supply, condenser and exhaust fan motors are permanently lubricated and require no periodic lubrication.

Vibration Levels

Each unit as shipped is trim balanced to operate smoothly. To provide satisfactory operation after shipping and installation, use accepted industry guidelines for field balancing fans.

NOTE: Excessive vibration from any cause contributes to premature fan and motor bearing failure. Monitor overall vibration levels every six months of operation. An increase in levels is an indication of potential trouble.

Vibration Causes

1. Wheel imbalance.
   a. Dirt or debris on wheel blades.
   b. Wheel distorted from overspeed.
2. Bent shaft.
3. Motor imbalance.
4. Fan section not supported evenly on foundation.

Periodic Service and Maintenance

- Check all moving parts for wear every six months.

  The Rebel unit is equipped with a direct drive,variable speed fan/motor combination. When equipped, the exhaust fan will be the same. There are no belts or pulleys to maintain. The bearing are permanently sealed and do not require periodic greasing.

Refrigerant Charge

The Rebel unit has many configurable options that can affect the refrigerant charge. Actual unit charge is given on the unit's data plate found on the inside of the control panel. The Rebel unit uses electronic expansion valves that maintain peak efficiency. Liquid sub-cooling and suction super heat float and should not be used as an indication that charge needs to be added or removed from the system. If a leak is suspected, the full charge should be removed and weighed. Weight should be compared against the unit nameplate data. Unit should be re-charged with the amount given on the unit nameplate.

POE and PVE oil is hygroscopic and does absorb moisture when exposed to atmosphere. Steps should be taken to minimize exposure time to atmosphere during any maintenance where the sealed system is to be opened.

Rebel 003–015 refrigerant systems use only Polyvinylether (PVE) oil. Rebel 016–028 refrigerant systems use only Polyester (POE) oil.

⚠ IMPORTANT

Do not use POE oil in DPS 003–015 refrigerant systems and do not use PVE oil in DPS 016–028 refrigerant systems.

Re-charging the unit

The entire system must be evacuated using a suitable vacuum pump. The quality of vacuum is measured using a suitable micron gauge that has been calibrated. The vacuum level reading should be taken directly from the sealed system, not at the vacuum pump. The minimum vacuum level is 300 microns Hg. The vacuum pump should be isolated from the system and the observed. Decay should not be greater than 500 microns after 15 minutes.

The crankcase heaters should be on during the evacuation procedure. This will help boil any dissolved refrigerant in the oil.

R410A is a zeotropic refrigerant that is made up of more than one compound. It must be charged as a liquid from the canister. Charging is to be done by weight and must match the unit nameplate found on the inside of the control panel door.

When re-charging the unit there might be alarms in the MT III controller and the Building Automation System that need to be cleared.

MicroTech III keypad instructions for charging and/or evacuation

Evacuating the charge:

- Navigate to the Exp Valve Set-Up Menu
- Set ManCtrl EV Op=Man
- Navigate to the Manual Control Menu
- Set Manual Ctrl=ManCtrl
- Set RcvSol Valve=Open (Heat Pump only)
- Set BP Sol Valve=Open
- Set EVO Cmd=100% (Heat Pump only)
- Set EVI Cmd=100%
- Reclaim refrigerant

Charging the system:

Static Charge (Step 1)

- Navigate to the Manual Control Menu
- Set RcvSol Valve=Close (Heat Pump only)
- Set Reheat Valve=50% (if present)
- Set EVO Cmd=30% (Heat Pump only)
- Set EVI Cmd=30%
- → When PTS>20psi: Navigate to Exp Valve Set-Up
- Set ManCtrl EV Op=Auto

Dynamic Charge (Step 2)

- Clear any active alarms (ex: Charge Loss: Problem generated while removing charge)
- Navigate to Manual Control
- Set BP Sol Valve=Close
- Set Supply Fan=On
- Set SAF Spd Cmd=50%
- Set INV/OF Ena=On
- Set INV=On
- → When Clg State=Normal:
- Navigate to Manual Control
- Set INV Cmp Cmd=50%
- Set BP Sol Valve=Open
- Set OA Fan=On
- Set OA Fan Cmd=50%

Vary INV Cmp Cmd to maintain Te (temperature evaporator) below 59°F. Keep an eye on Discharge Superheat to shoot for minimum of 18°F, adjust the refrigerant being entered into the system if Discharge Superheat begins to drop below 18°F.

See OM 1141-1 for more information on keypad operation.

Servicing Refrigerant Sensors or Switches

⚠ CAUTION

Severe loss of charge may occur if the high refrigerant pressure switch is replaced before reclaiming the refrigerant. Replace pressure switch after reclaiming refrigerant.

Servicing Optional Electric Heater

⚠ DANGER

Hazardous voltage. May cause severe injury or death.

Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

If the electric heater is not operating properly, a qualified electrician should perform the following to check if the heater is damaged:

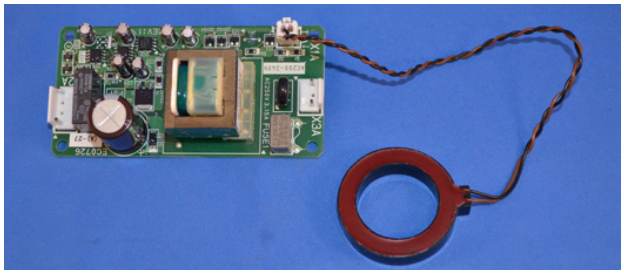
1. Measure continuity through all fuses.
2. Check that all electrical connections are tight. Look for signs of arcing.
3. Check the resistance to ground for each circuit. It should be infinite.
4. Check the resistance phase to phase for each circuit.
5. Check all contactors.

Servicing the Compressor Ground Fault Interrupter

The Rebel 003–015 units are equipped with a ground fault interrupter on the compressor(s). This is a two part device with a current sensing donut on the power wires to the compressor(s) and a PCB. The device is intended for personal safety by continuously monitoring the balance between the three phase power and the neutral conductor. It is not intended to provide overcurrent or short circuit protection to the equipment.

The device works by opening the 120V controls circuit in a fault condition. An open condition on the ground fault interrupter indicates the compressor has been grounded.

Figure 93: Ground Fault Interrupter



Phase Voltage Monitor (PVM)

The phase voltage monitor (Figure 94) is designed to protect three-phase loads from damaging power conditions. A microprocessor-based voltage and phase sensing circuit constantly monitors the three-phase voltages to detect harmful power line conditions. When a harmful condition is detected, its output relay is deactivated after a specified trip delay (Trip Delay). The output relay reactivates after power line conditions return to an acceptable level for a specified amount of time (Restart Delay). The trip and restart delays prevent nuisance tripping due to rapidly fluctuating power line conditions.

There are two LEDs on the face of the PVM (“1” in Figure 94) to indicate the following items in Table 38.

Factory defaults should be: Voltage (VAC) – Matching unit nameplate, Restart (sec) – 100, Unbalance trip (%) – 4%, Trip Delay (sec) – 5

Figure 94: Phase Voltage Monitor

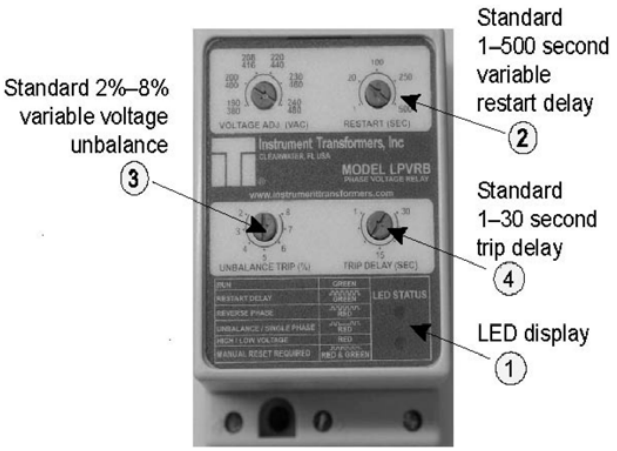


Table 38: LED Indication

Status	LED Indicator
Normal operation, no faults, relay energized	Green LED - steady on
Loss of input phase (relay deenergized)	Red LED - flash twice, off, flash twice, off, etc.
Voltage unbalance (relay deenergized)	Red LED - flash twice, off, flash twice, off, etc.
High or low voltage (relay de-energized)	Red LED - steady on
Phase reversal (relay deenergized)	Red LED - pulse on, off, on, off, etc.
Restart delay (fault cleared, PVM pending restart, relay de-energized)	Green LED - pulse on, off, on, off, etc.

Other features:

- Standard 2% to 8% variable voltage unbalance (“3” in Figure 94).
- Standard 1 to 500 second variable restart delay (“2”).
- Standard 1 to 30 second trip delay (“4”) (except loss of phase, which trips at 1 second non-adjustable).

Cleaning Option E Coated Coils

⚠ WARNING

Prior to cleaning the unit, turn off and lock out the main power switch to the unit and open all access panels.

The following cleaning procedures are recommended as part of the routine maintenance activities for Option E Coated Coils. Documented routine cleaning of Option E Coated Coils is required to maintain warranty coverage.

Remove Surface Loaded Fibers

Surface loaded fibers or dirt should be removed prior to water rinse to prevent further restriction of airflow. If unable to back wash the side of the coil opposite that of the coils entering air side, then surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft non-metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges bent over) if the tool is applied across the fins.

NOTE: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

Periodic Clean Water Rinse

A monthly clean water rinse is recommended for coils that are applied in coastal or industrial environments to help to remove chlorides, dirt and debris. An elevated water temperature (not to exceed 130ºF) will reduce surface tension, increasing the ability to remove chlorides and dirt. Pressure washer PSI must not exceed 900 psig and the nozzel should remain at leat 1 foot from the coil to avoid damaging fin edges.

Routine Quarterly Cleaning of Option E Coated Coil Surfaces

Quarterly cleaning is essential to extend the life of an Option E Coated Coil and is required to maintain warranty coverage. Coil cleaning shall be part of the unit's regularly scheduled maintenance procedures. Failure to clean an Option E Coated Coil will void the warranty and may result in reduced efficiency and durability in the environment.

For routine quarterly cleaning, first clean the coil with the below approved coil cleaner (see approved products list under Recommended Coil Cleaners section, Table 39). After cleaning the coils with the approved cleaning agent, use the approved chloride remover (under the Recommended Chloride Remover section) to remove soluble salts and revitalize the unit.

Table 39: Option E Coated Coil Recommended Cleaning Agents

Cleaning Agent	Reseller	Part Number
Enviro-Coil Concentrate	Hydro-Balance Corp P.O. Box 730 Prosper, TX 75078 800-527-5166	H-EC01
Enviro-Coil Concentrate	Home Depot	H-EC01
Chloride Remover	Chlor*Rid Int'l, Inc. P.O. Box 908 Chandler AZ 85244 800-422-3217	Chlor*Rid DTS

Replacement Parts

MicroTech III controllers are factory tested and documented prior to shipping. This is to assure the functionality of the controller and the unit and prevent dead on arrival controllers. Any miswiring of the MicroTech III controller that damages it in any way, such as blown internal fuse, will not be covered under warranty.

When contacting Daikin for service or replacement parts, provide the model number, serial number, and unit part number of the unit as stamped on the serial plate attached to the unit. For questions regarding wiring diagrams, provide the number on the specific diagram. If replacement parts are required, include the date of unit installation, the date of failure, an explanation of the malfunction, and a description of the replacement parts required.

Scroll Compressor

All Daikin Rooftop products include a first-year parts only warranty. The warranty period extends 12 months from startup or 18 months from date of shipment, whichever comes first. Labor to install these parts is not included with this warranty. Compressors are considered a part and are included in this standard warranty.

All Compressors

Replacement compressors for Daikin Rooftop Units can be obtained from the Daikin Service Parts department.

The decision to replace the failed portion of the compressor tandem, as opposed to replacing the entire tandem, must be decided based on the following.

1. **In warranty:** Warranty only covers replacement of the failed portion of the tandem.
2. **Out of warranty:** The customer decides whether to replace the entire tandem or just a portion.
3. Some equipment may include the extended 2nd - 5th year compressor warranty option.

Order the replacement compressor through the Daikin Parts Department (Minneapolis).

1. Contact the Daikin Parts Department for compressor availability.
2. Send a completed parts order form to the Daikin Parts Department.
3. The Parts Department processes the order and the compressors are shipped from our Dayton, OH warehouse via ground transportation. If next-day air is required, indicate this on the parts order form and a freight charge will be billed to your account. Air freight costs are not covered under the Daikin warranty.
4. After the failed compressor is replaced, return it to Daikin Parts Department with a Return Goods Tag attached, which you will receive in the mail. It must be attached to the compressor. The Return Goods Tag has instructions on where to send the compressor. If the compressor is not returned, you will be billed for the replacement compressor.
5. Consideration may be given at this time to a compressor teardown analysis, depending on the history of failures.

In-Warranty Return Material Procedure

Material other than compressors may not be returned except by permission of authorized personnel of McQuay International at Minneapolis, Minnesota.

A “return goods” tag will be sent to be included with the returned material. Enter the information as called for on the tag in order to expedite handling at out factories and issuance of credits. All parts shall be returned to the factory designated on the return goods tag, transportation charges prepaid.

The return of the part does not constitute an order for replacement. A purchase order for the replacement part must be entered through your nearest Daikin representative. The order should include the component’s part number and description and the model and serial numbers of the unit involved.

If it is determined that the failure of the returned part is due to faulty material or workmanship within the standard warranty period, credit will be issued on the customer’s purchase order.

NOTE:
1. Unit does not require high pressure switch testing
2. Refrigerant pressures can be checked from the MT III controller. Refrigerant gages are not needed.
3. Ensure proper unit phasing
4. Compressor 3 might not operate during startup due to ambient conditions and compressor operating envelope.

DAIKIN

Rebel
Equipment Warranty Registration Form

To comply with the terms of Daikin Applied Warranty, complete and return this form within 10 days to the Warranty Department of Daikin Applied.

Check, test, and start procedure for Rooftop roof mounted air conditioners with or without heat recovery and roof mounted air handlers.

GENERAL INFORMATION

Job Name: _____ **Unit No.:** _____

SOI No.: _____

Installation address: _____

City: _____ **State:** _____

Purchasing contractor: _____

City: _____ **State:** _____

Name of person doing start-up: _____

Company name: _____

Address: _____

City/State/Zip: _____

UNIT INFORMATION

Unit model number: _____

Unit serial number: _____

Compressor 1 model number: _____ **Serial number:** _____

Compressor 3 model number: _____ **Serial number:** _____

NOTE: 1. Unit does not require high pressure switch testing
2. Refrigerant pressures can be checked from the MT III controller. Refrigerant gages are not needed.
3. Ensure proper unit phasing.
4. Compressor 3 might not operate during startup due to ambient conditions and compressor operating envelope.

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DAIKIN **Rebel Equipment Warranty Registration Form (continued)**

Select Yes or No. If not applicable to the type of unit, select N/A.

I. INITIAL CHECK

A. Is any shipping damage visible? . . . . . ☐ Yes ☐ No ☐ N/A

B. Has the discharge static pressure reference been properly located in the building? . . . . . ☐ Yes ☐ No ☐ N/A

C. Do fans turn freely? . . . . . ☐ Yes ☐ No ☐ N/A

D. Electrical service corresponds to unit nameplate? . . . . . ☐ Yes ☐ No ☐ N/A

D1. Voltage at Terminal Block | Disconnect 1–2 _____ V 2–3 _____ V 1–3 _____ V

E. Unit phased correctly? . . . . . ☐ Yes ☐ No ☐ N/A

F. Is the main disconnect adequately fused and are fuses installed? . . . . . ☐ Yes ☐ No ☐ N/A

G. Are crankcase heaters operating, and have they been operating 24 hours prior to start-up? . . . . . ☐ Yes ☐ No ☐ N/A

H. Are all electrical power connections tight? . . . . . ☐ Yes ☐ No ☐ N/A

I. Is the condensate drain trapped? . . . . . ☐ Yes ☐ No ☐ N/A

II. FAN DATA

A. Check rotation of supply fan? . . . . . ☐ Yes ☐ No ☐ N/A

B. Voltage at supply fan motor: . . . . . 1–2 _____ V 2–3 _____ V 1–3 _____ V

C. Supply fan motor amp draw per phase: . . . . . 1–2 _____ A 2–3 _____ A 1–3 _____ A

D. What is the supply fan rpm? . . . . . _____

E. Record supply static pressure at unit in inches of H_20: . . . . . _____

F. Record return static pressure at unit (with outside air dampers closed) in inches of H_20: . . . . . _____

III. START-UP COMPRESSOR OPERATION

A. Do compressors have holding charge? . . . . . ☐ Yes ☐ No ☐ N/A

B. Are compressor shipping brackets removed? . . . . . ☐ Yes ☐ No ☐ N/A

C. Are compressors rotating in the right direction? . . . . . ☐ Yes ☐ No ☐ N/A

D. Do condenser fans rotate in the right direction? . . . . . ☐ Yes ☐ No ☐ N/A

E. Ambient temperature (°F): . . . . . _____

F. Compressor amperage:

Compressor #1: . . . . . Phase 1_____ Phase 2_____ Phase 3_____

Compressor #3: . . . . . Phase 1_____ Phase 2_____ Phase 3_____

DAIKIN

Rebel Equipment Warranty Registration Form (continued)

Select Yes or No. If not applicable to the type of unit, select N/A.

IV. PERFORMANCE DATA (Unit to run at steady state for 15 minutes)

A. Discharge pressure, one compressor: . . . . . Circuit #1 _____ psig

B. Suction pressure, one compressor: . . . . . Circuit #1 _____ psig

C. Liquid temperature (°F): . . . . . _____

D. Suction line temperature °F from unit controller: . . . . . _____

E. Discharge line temperature °F from unit controller: . . . . . _____

F. Superheat temperature °F from unit controller: . . . . . _____

G. Sub-cooling line temperature °F from unit controller: . . . . . _____

H. Record discharge air temperature at discharge of unit (°F): . . . . . _____

I. Are all control refrigerant lines secure to prevent excessive vibration and wear? . . . . . ☐ Yes ☐ No ☐ N/A

J. Are all valve caps and packing tight after start-up? . . . . . ☐ Yes ☐ No ☐ N/A

K. Did unit control DAT to DAT setpoint? . . . . . ☐ Yes ☐ No ☐ N/A

V. Hot Water Coil

A. Pressure test OK? . . . . . ☐ Yes ☐ No ☐ N/A

VI. Heat Recovery

A. Heat wheel rotates freely? . . . . . ☐ Yes ☐ No ☐ N/A

B. Heat wheel VFD operates properly? . . . . . ☐ Yes ☐ No ☐ N/A

C. Heat wheel VFD . . . . . Model No. _____ Serial No. _____

D. Check for air bypass around heat wheel . . . . . ☐ Yes ☐ No ☐ N/A

VII. ELECTRIC HEAT

A. Electrical heat service corresponds to unit nameplate? . . . . . ☐ Yes ☐ No ☐ N/A

Volts _____ Hertz _____ Phase _____

B. Are there any signs of physical damage to the electric heat coils? . . . . . ☐ Yes ☐ No ☐ N/A

C. Have all electrical terminals been tightened? . . . . . ☐ Yes ☐ No ☐ N/A

D. Does sequence controller stage contactors properly? . . . . . ☐ Yes ☐ No ☐ N/A

E. Electric heater voltage across each phase: . . . . . _____ L1 _____ L2 _____ L3

F. Amp draw across each phase at each heating stage:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Phase L1:						
Phase L2:						
Phase L3						

G. FLA: L1 _____ L2_____ L3 _____

H. Operate electric heat with fans off. Electric heat must cycle on high limit control . . . . . ☐ Yes ☐ No ☐ N/A

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DAIKIN

Rebel Equipment Warranty Registration Form (continued)

Select Yes or No. If not applicable to the type of unit, select N/A.

VIII. FURNACE CHECK, TEST, & START

A. Gas pressure at main (inches w.c.): _____

B. Gas pressure at manifold (inches w.c.): _____

C. High limit control OK? ☐ Yes ☐ No ☐ N/A

D. Flame failure shutoff (seconds): _____

E. Airswitch OK? ☐ Yes ☐ No ☐ N/A

F. Main Gas Valve Close-Off OK? ☐ Yes ☐ No ☐ N/A

G. Modulation Gas Heat Performance

Gas Pressure

Mod. Valve	**Reg. Valve**
25% _____ in Wc.	25% _____ in Wc.
50% _____ in Wc.	50% _____ in Wc.
75% _____ in Wc.	75% _____ in Wc.
100% _____ in Wc.	100% _____ in Wc.

IX. MAINTAINING MICROTECH CONTROL PARAMETER RECORDS

After the unit is checked, tested, and started and the final control parameters are set, record the final settings. Keep these records on file and update whenever changes to the control parameters are made. Keeping a record facilitates any required analysis and troubleshooting of the system operation and facilitates restoration after a controller replacement.

Thank you for completing this form. Please sign and date below.

Signature _____ **Startup date:** _____

Return completed form by mail to:

Daikin Warranty Department, 13600 Industrial Park Boulevard, Minneapolis, MN 55441

or by email to: AAH.Wty_WAR_forms@daikinapplied.com

Please fill out the Daikin Applied "Quality Assurance Survey Report" and list any additional comments that could affect the operation of this unit; e.g., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach it to the Survey Report and return it to the Warranty Department of Daikin Applied with the completed Equipment Warranty Registration form.

Submit Form

Clear Form

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DAIKIN

Quality Assurance Survey Report

To whom it may concern:
Please review the items below upon receiving and installing our product. Select N/A on any item that does not apply to the product.

Job Name: _____ **Daikin Applied S.O. No.** _____

Installation address: _____

City: _____ State: _____

Purchasing contractor: _____

City: _____ State: _____

Name of person doing start-up (print): _____

Company name: _____

Address: _____

City/State/Zip: _____

Unit model number: _____ **Unit serial number:** _____

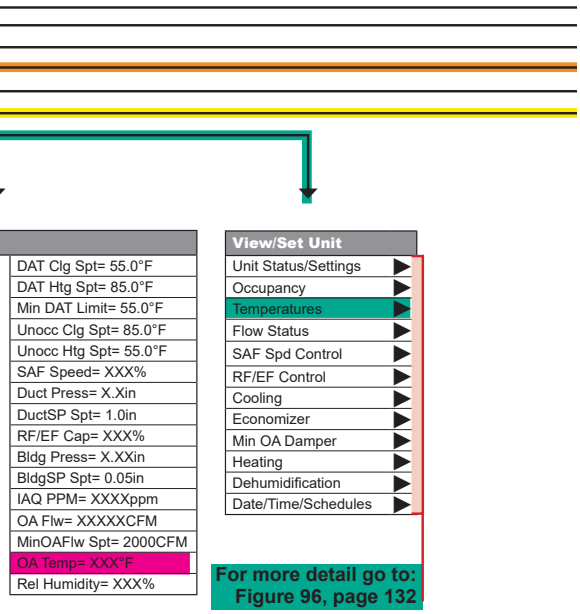
1. Is there any shipping damage visible? . . . . . Yes☐ No☐ N/A☐
   Location on unit _____
2. How would you rate the overall appearance of the product; i.e., paint, fin damage, etc.?
   Excellent☐ Good☐ Fair☐ Poor☐
3. Did all sections of the unit fit together properly? . . . . . Yes☐ No☐ N/A☐
4. Did the cabinet have any air leakage? . . . . . Yes☐ No☐ N/A☐
   Location on unit _____
5. Were there any refrigerant leaks? . . . . . Yes☐ No☐ N/A☐
   From where did it occur? . . . . . Shipping☐ Workmanship☐ Design☐
6. Does the refrigerant piping have excessive vibration? . . . . . Yes☐ No☐ N/A☐
   Location on unit _____
7. Did all of the electrical controls function at start-up? . . . . . Yes☐ No☐ N/A☐
   Comments _____
8. Did the labeling and schematics provide adequate information? . . . . . Yes☐ No☐ N/A☐
9. How would you rate the serviceability of the product?
   Excellent☐ Good☐ Fair☐ Poor☐
10. How would you rate the overall quality of the product?
    Excellent☐ Good☐ Fair☐ Poor☐
11. How does the quality of Daikin Applied products rank in relation to competitive products?
    Excellent☐ Good☐ Fair☐ Poor☐

    Comments _____

Please list any additional comments which could affect the operation of this unit; i.e., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach the sheet to this completed Quality Assurance Survey Report, and return it to the Warranty Department with the completed preceding "Equipment Warranty Registration Form".

x – Keypad/Display Menu Structure

d items can all be displayed with the keypad/



Unit
3456_12345
U123456789
2506018xxx
xxxxxxxxxxx
xxxxxxxxxxx
.XX
XX
= X.XX
= X.XX
.XX
x-xxxx-xxxx-
x-xxxx-xxxx-

Commission Unit
Unit Set-Up ▶
Timer Settings ▶
SAF Set-Up ▶
RF/EF Set-Up ▶
Htg/Clg ChgOvr Set-Up ▶
Cooling Set-Up ▶
INV Cmp Set-Up ▶
Econo Set-Up ▶
Min OA Set-Up ▶
Heating Set-Up ▶
OA Fan Set-Up ▶
Exp Valve Set-Up ▶
Defrost Set-Up ▶
Dehum Set-Up ▶
Energy Rec Set-Up ▶
D3 Set-Up ▶
Alarm Configuration ▶

For more detail go to:
Figure 97, page 134

Manual Control
Manual Control= Normal
Supply Fan= Off
SAF Spd Cmd= 0%
INV/OF Ena= Off
INV Comp= Off
INV Spd Cmd= 0%
Comp 3= Off
OA Fan= Off
OA Fan Cmd= 0%
4 Way Valve= Cool
RcvrSol Valve= Closed
BP Sol Valve= Closed
EVI Cmd= 0%
EVO Cmd= 0%
RF/EF VFD= Off
RF/EF Spd Cmd= 0%
Var Cmp=
Var Cmp Cmd=
VComp Emg Stop=
Htg Valve= 0%
SCR Out= 0%
Htg Stg 1= Off
SCR Ena 1= Off
Htg Stg 2= Off
Htg Stg 3= Off
Htg Stg 4= Off
Reheat Valve= 0%
RH Output=
ERec Wheel= Off
ER Whl Cmd= 0%
ER BP Dmpr Cl= Off
ER BP Dmpr Op= Off
Alm Output= Off
Fan Op Out= Off

Service Menus
Timer Settings ▶
Operating Hours ▶
Save/Restore Settings ▶
Active Alarms ▶
Alarm Log ▶
Event Log (65300)
Data Snapshots (65500)
Alarm/Event Config
Analog Input Status ▶
Universal I/O Status ▶
Digital Input Status ▶
Digital Output Status ▶
Network Input Status ▶
Modbus Status ▶
IP Set Up
D3 Status ▶
Sensor Offsets ▶
Reset Counte= XXXX
Last Reset Info

For more detail go to:
Figure 98, page 136

Trending
Trending Ena= No
Apply Chgs= No
Sample Time= 300s
TrendOnOff= Off
Auto Exp Time=
Export Data= No
Clear Trend= Done
Trend Full=
Points 1–8 (Fixed) ▶
Points 9–24 (from List) ▶
Points 25–27 (with IDs) ▶
Points 28–30 (with IDs) ▶

For more detail go to:
Figure 100, page 138

Unit Mai
Operating

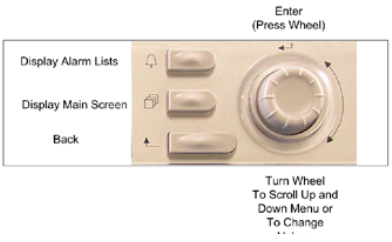
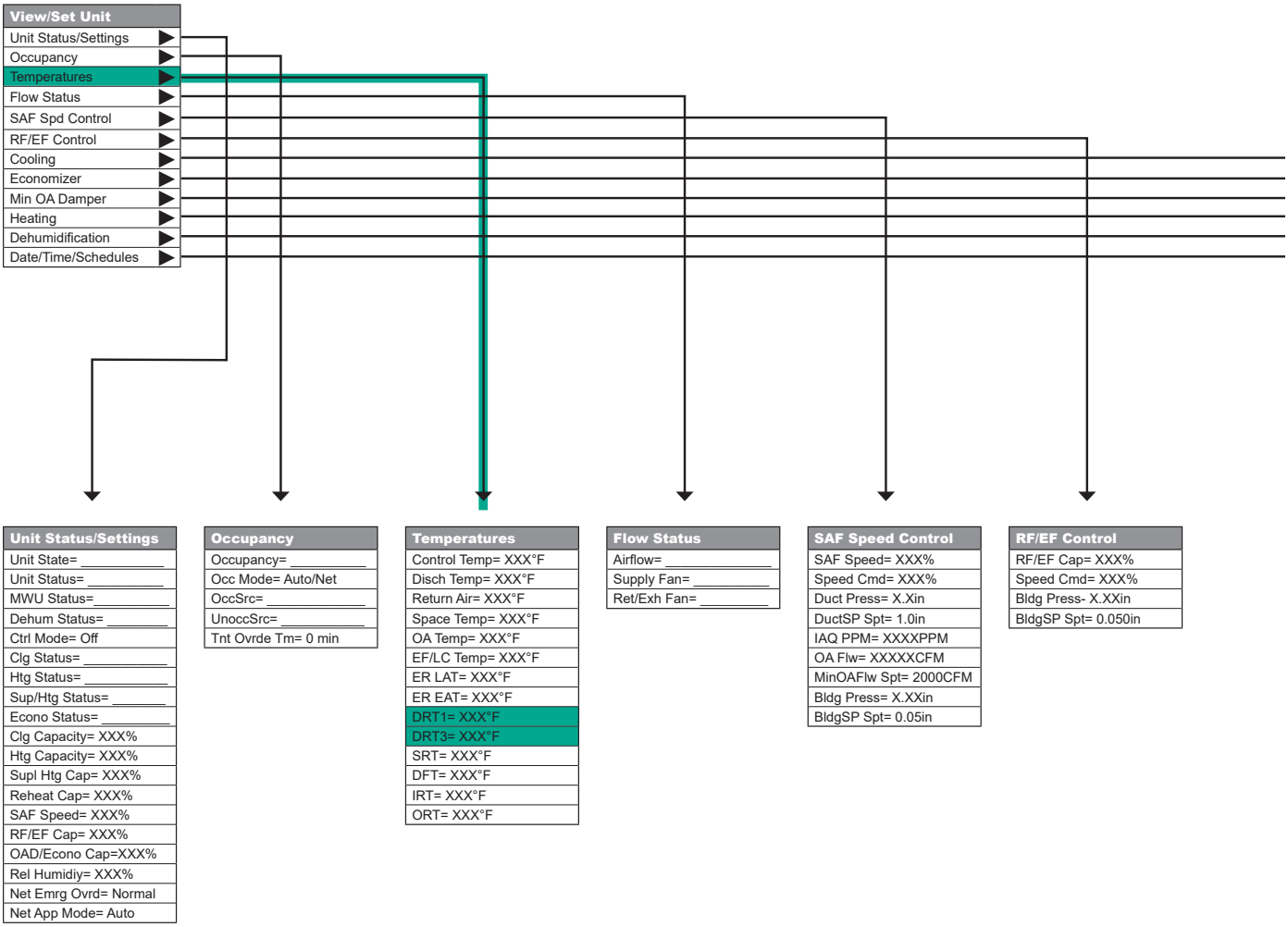


***Figure 96: View/Set Unit** – Keypad/Display Menu Structure*



Cooling
Occ Clg Spt= 72.0°F
Unocc Clg Spt= 85.0°F
DAT Clg Spt= 55.0°F

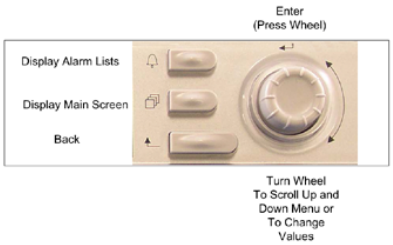
Economizer
OAD/Econo Pos= XXX%
DAT Clg Spt= 55.0°F
Min OA Pos= XXX%
Occ Clg Spt= 72.0°F
Unocc Clg Spt= 85.0°F

Min OA Damper
Min OA Pos= XXX%
Vent Limit= 20%
LoFlo V Lmt= 30%
DCV Limit= 10%
Min OA Src= _____

Heating
Occ Htg Spt= 68.0°F
Unocc Htg Spt= 55.0°F
MWU Spt= 70.0°F
DAT Htg Spt= 85.0°F

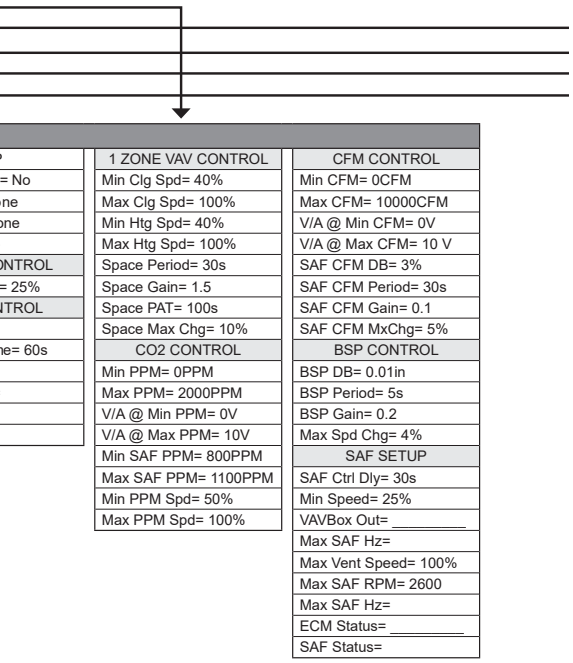
Dehumidification
Dehum Status= _____
Rel Humidity= XXX%
Dewpoint= XXX°F
Dehum Method= None
RH Setpoint= 50%
Dewpoint Spt= 50°F
Reheat Spt= XXX°F
Reheat Cap= XXX%

Date/Time/Schedules
Time= hh:mm:ss
Date= MM/DD/YY
UTC Diff= -60min
DAILY SCHEDULE
Mon= HH:MM-HH:MM
Tue= HH:MM-HH:MM
Wed= HH:MM-HH:MM
Thu= HH:MM-HH:MM
Fri= HH:MM-HH:MM
Sat= HH:MM-HH:MM
Sun= HH:MM-HH:MM
Hol= HH:MM-HH:MM
HOLIDAY DATES
Hol 1=MMMDD/YY-MMMDD/YY
Hol 2=MMMDD/YY-MMMDD/YY
Hol 3=MMMDD/YY-MMMDD/YY
Hol 4=MMMDD/YY-MMMDD/YY
Hol 5=MMMDD/YY-MMMDD/YY
Hol 6=MMMDD/YY-MMMDD/YY
Hol 7=MMMDD/YY-MMMDD/YY
Hol 8=MMMDD/YY-MMMDD/YY
Hol 9=MMMDD/YY-MMMDD/YY
Hol 10=MMMDD/YY-MMMDD/YY
ONE EVENT SCHEDULE
Beg= MMMDD/YY@HH:MM
End= MMMDD/YY@HH:MM
OPTIMAL START
Enable= No
Htg Range= 0.4 °F/min
Htg OAT= 35 °F
Des Htg OAT= 0 °F
Clg Rate= 0.4 °F/min
Clg OAT= 85 °F
Des Clg OAT= 95 °F
DAYLIGHT SAVINGS
DLS Strt Mon= Mar
DLS Strt Wk= 2nd Week
DLS End Mon= Nov
DLS End Wk= 1st Week
DLS Active= Yes

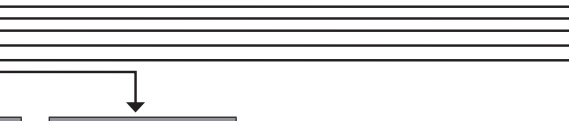


This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

– KEYPAD/DISPLAY MENU STRUCTURE



	1 ZONE VAV CONTROL	CFM CONTROL
= No	Min Clg Spd= 40%	Min CFM= 0CFM
ne	Max Clg Spd= 100%	Max CFM= 10000CFM
ne	Min Htg Spd= 40%	V/A @ Min CFM= 0V
	Max Htg Spd= 100%	V/A @ Max CFM= 10 V
NTROL	Space Period= 30s	SAF CFM DB= 3%
= 25%	Space Gain= 1.5	SAF CFM Period= 30s
NTROL	Space PAT= 100s	SAF CFM Gain= 0.1
	Space Max Chg= 10%	SAF CFM MxChg= 5%
e= 60s	CO2 CONTROL	BSP CONTROL
	Min PPM= 0PPM	BSP DB= 0.01in
	Max PPM= 2000PPM	BSP Period= 5s
	V/A @ Min PPM= 0V	BSP Gain= 0.2
	V/A @ Max PPM= 10V	Max Spd Chg= 4%
	Min SAF PPM= 800PPM	SAF SETUP
	Max SAF PPM= 1100PPM	SAF Ctrl Dly= 30s
	Min PPM Spd= 50%	Min Speed= 25%
	Max PPM Spd= 100%	VAVBox Out= _____
		Max SAF Hz=
		Max Vent Speed= 100%
		Max SAF RPM= 2600
		Max SAF Hz=
		ECM Status= _____
		SAF Status=



	OA Fan Set-Up	
	OA FAN STATUS	
	OA Fan1 Spd= XXX%	
	OA Fan1 Cmd= XXX%	
	OA Fan1Amps= XX.XA	
	Fault Code Details ▶	1
	OA Fan2 Spd= XXX%	
	OA Fan2 Cmd= XXX%	
	OA Fan2Amps= XX.XA	
	Fault Code Details ▶	1
F	REFRIG CIRCUIT STATUS	
	PTS= XXX.Xpsi	
	PTD= XXX.Xpsi	
	Disch Sat Tmp= XXX.X°F	
	EffDshSatTSpt= XXX.X°F	
	OA Temp= XXX°F	
	INV Fin Temp= XXX°F	
	OA FAN SET UP	
	DischSatTDiff=	
	DischSatTDB=	
	OA Fan Period=	
	OA Fan Gain=	
	OA Fan PAT=	
	OA Fan Max=	
	ECM Status=	
	IFB COMM STATUS ▶	2

[1], [2] See Figure 98, page 136 for the expansion information

RF/EF Set-Up
RF/EF Ctrl= None
SPEED CONTROL
Rem ExhF Cap= 5%
Rem RAF Cap
BSP CONTROL
BSP DB= 0.010in
BSP Period=
BSP Gain=
Max Spd Chg=
RF/EF SET UP
RFEF Ctrl Dly=
Min Speed=
MinExStrtTm=
MinExStopTm=
MinExOAPos=
MinExSAFCap=
ExhOnOAPos= 40%
ExhMxOAPos= 100%
Max Vent Spd= 100%
Max RFEF RPM= 2600
ECM Status= _____

Htg/Clg ChgOvr Set-Up
Ctlr Temp Src= RAT
Use Tstat Spt= No
Occ Clg DB= 2.0°F
Clg Period= 60s
Clg Gain= 0.1
Clg PAT= 600s
Max Clg Chg= 5.0°F
Occ Htg DB= 2.0°F
Htg Period= 60s
Htg Gain= 0.1
Htg PAT= 600s
Max Htg Chg= 5.0°F
Cal D Rem Spt @10°C=
Cal D Rem Spt @50°F=
Cal D Rem Spt @30°C=
Cal D Rem Spt @80°F=
Demand Shed=
Clg Demd Shed=
Htg Dmd Shed=
Clg Shed Rate=
Htg Shed Rate=

Cooling Set-Up
Clg Stage Time= 5min
Clg DB= 2.0°F
Clg Lo OAT Lk= 55ºF
OAT Diff= 2.0°F
Clg Reset= None
Min Clg Spt= 55.0°F
Min Clg Spt @= 0
Max Clg Spt= 65.0°F
Max Clg Spt@= 100
Unocc Diff= 3°F

INV Cmp Set-Up	
COMPRESSOR STATUS	COMPRESSOR SETUP
Clg State= _____	Clg Lo OAT Lk= 55°F
Htg State= _____	Htg Lo OAT Lk= 0.0ºF
INV Cmp Spd= XXX.X%	Htg Hi OAT Lk= 55.0ºF
INV Spd Cmd= XXX.X%	EffHtgOATLk= 55.0ºF
VCmp Oil Status=	OAT Diff= 2ºF
Comp 3=_____	INV Period= 20s
Fault Code Details ▶	INV Gain= 2.5
INV Port Temp= XXX.XºF [1]	INV PAT= 10s
INV Fin Temp= XXX.XºF	INV Max Chg= 15%
INV Amps= XX.XA	Oil Management=
REFRIG CIRCUIT STATUS	Low Oil Time=
PTS= XXX.Xpsi	Oil Boost Time=
PTD= XXX.Xpsi	Inv Man Dsbl=
4 Way Valve=_____	Comp 3 Man Dsbl=
RcvrSol Valve=_____	VFD Status=
BP Sol Valve=_____	VFD Alm/Wrn=
	IFB COMM STATUS ▶ [2]

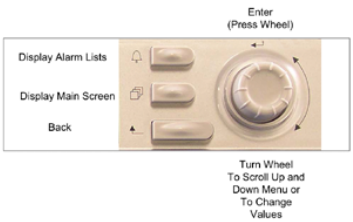
Exp Valve Set-Up	
EXP VALVE STATUS	EXP VALVE SETUP
EVI Pos= XXX%	SSH DB= 2.0ºF
EVO Pos= XXX%	SH Lo Base= 5.0ºF
EVStatus=_____	SH Hi Base= 9.0ºF
REFRIG CIRCUIT STATUS	Htg EVI Meth= SbC
PTS= XXX.Xpsi	IC SC Spt= 9.0ºF
PTD= XXX.Xpsi	IC SC DB= 2.0ºF
Suction SH= XX.XºF	HtgSC EVI Min= 0%
Discharge SH= XX.XºF	Clg EVO Meth= SbC
Subcooling= XX.X°F	OC SC Spt= 9.0ºF
Eff SSH Spt= XX.X°F	OC SC DB= 2.0ºF
EffSH Base= XX.X°F	ClgSC EVO Min= 0%
Eff SC Spt= XX.X°F	ManCtrl EV Op= Auto
Eff SC Lo Lmt= XXX%	
SRT= XXX°F	
Disch Sat Tmp= XXX.X°F	
Sucn Sat Tmp= XXX.X°F	
IRT= XXX°F	
ORT= XXX°F	

Defrost Set-Up
Defrost State= _____
Manual DF= No
MinCmpOpTm= 10min
MinAccCmpTm= 40min
MaxFrostTm= 120min
Defrost Temp= XXºF
Tdef Adj= 0.0ºF
CmpOpTime= XXXmin
AccCmpOpTm= XXXmin
LoFrstAccTm= XXXmin
HiFrstAccTm= XXXmin

Dehum Set-Up
Dehum Method= None
RH DB= 2%
Dewpoint DB= 2°F
RH Period= 30s
RH Gain= 1
LCS Lo Gain=
RH PAT= 30s
RH Max Chg= 10%
Dehum Ctrl= Occupied
Sensor Loc= Return
Mn Lvg Coil T= 45.0°F
Mx Lvg Coil T= 52.0°F
Min Rheat Spt= 55.0°F
Max Rheat Spt= 65.0°F
RH Sens Type= VDC
RH Min Sig= 0V
RH Max Sig= 10V
Min Dehum Spd= 33%
Max Dehum Spd= 100%
RH Min Pos= 15%
RH Dec Rate= 1.0%/s
RH OutMaxV=
BackUp RH Ena=

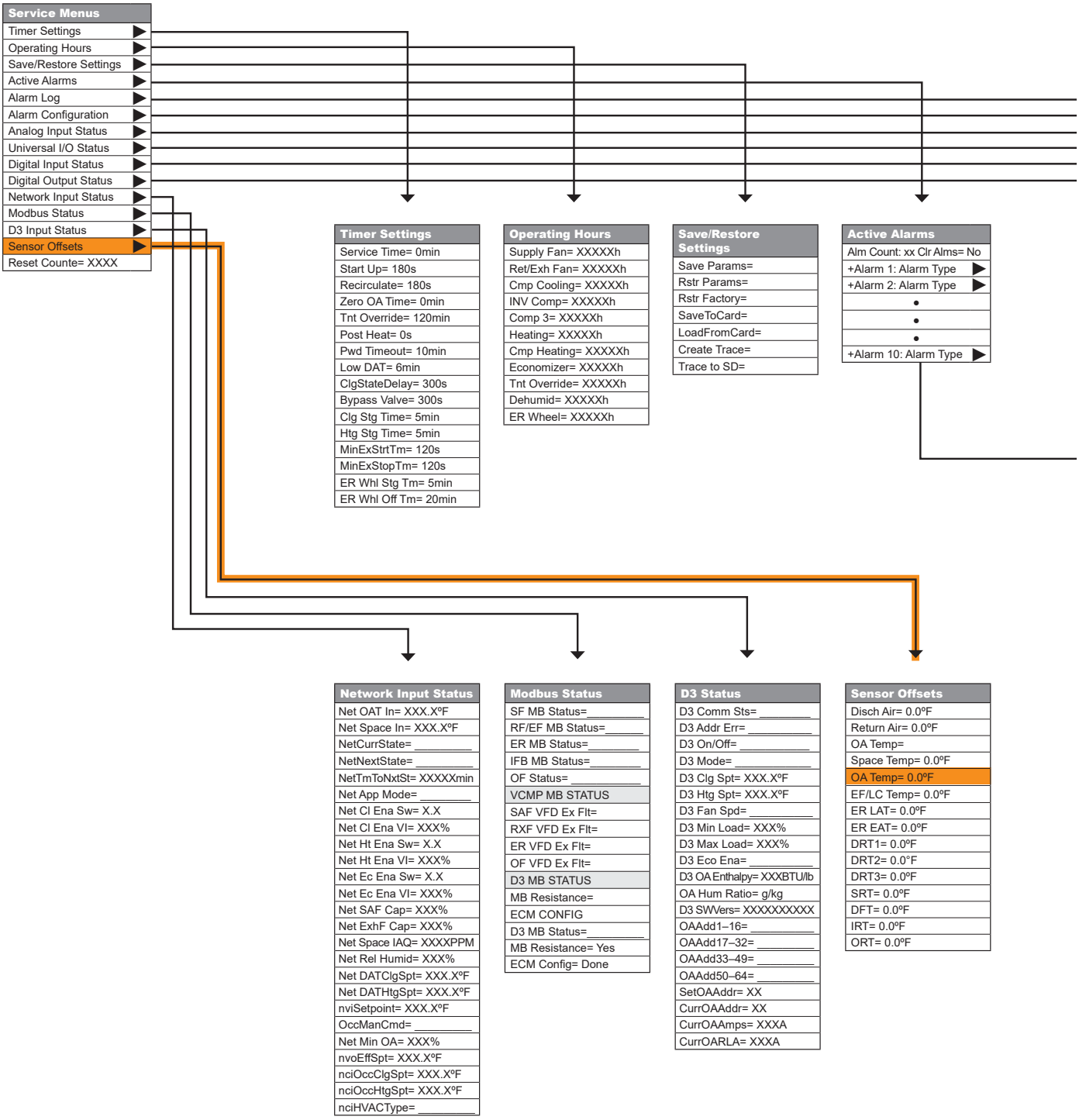
Energy Rec Set-Up
Energy Rcvy= Yes
ER Wheel=_____
Wheel Speed= XXX%
Whl Spd Cmd= XXX%
ER LAT= XXX°F
ER EAT= XXX°F
Min ExhT Diff= 2.0°F
Max ExhT Diff= 6.0°F
ER Whl Stg Tm= 5min
ER Whl Off Tm= 20min
Rel Humidity= XXX%
Min Whl Spd= 5%
Intersect Pt= XXX.XºF
Fst Mgnt Meth= Timed
OA Frst Temp= -5.0°F
Defrost Time= 5min
Defrost Period= 60min
Defrst On Tm= 1s
Defrst Off Tm= 24s
ER Whl Period= 30s
ER Whl Gain= 1.0
ER Whl PAT= 30s
ER Whl Chg= 10%
Lo ERLAT Cnplk=
Cap Limiting=

D3 Set-Up
Itouch Vers=_____
Unit D3 Addr= 1–00
Set D3 Addr= No
OA Unit Num= 0
OA Unit Amps= 0
OA Unit Addr= 0
Set OA Unit= No
Rst All OA= No
Min Load= 20%
Max Load= 50%
HiCapReset= No
DATLoDiff= 10.0ºF
Eco Method= None
DATHiDiff= 10.0ºF
OA Enth Max= 25.5 BTU/lb
OA Hum Max= 0.0107lb/lb
OAT Max= 84ºF
Temp Display= DAT
Low Speed= 33%
Med Speed= 66%
Hi Speed= 100%



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

Figure 98: Service Menu *– Keypad/Display Menu Structure*



Alarm Log
Log Count: xx Clr Log= No ▶
+/-Alarm 1: Alarm Type ▶
+/-Alarm 2: Alarm Type ▶
•
•
•
+/-Alarm 10: Alarm Type ▶

Alarm/Event Configuration
ALARM LIMITS
Hi Disch Temp= 170°F
Lo Disch Temp= 40°F
Hi Return Temp= 120°F
ALARM OUT CONFIG
Faults= Fast
Problems= Slow
Warnings= Off
ALARM DELAYS
Frz Delay Time= 30s
Air Flw Ing=120s
Sens Alm Dly= 30s
Temp AlmDly= 30s
ALARM CONFIG
Emerg Stop= ManClr
Alm Log to SD=
EVENT CONFIG
Show Events=
Event Log to SD=
SNAPSHOT CONFIG
Ena SnapShots=
Show SnapShots=
SnapShots to SD=

Analog Input Status
MCB AI1= XXXXXXXX
MCB AI2= XXXXXXXX
MCB AI3= XXXXXXXX
EMD AI1= XXXXXXXX
EMD AI2= XXXXXXXX
EMD AI3= XXXXXXXX

Universal I/O Status
MCB X1= XXXXXXXX
MCB X2= XXXXXXXX
MCB X3= XXXXXXXX
MCB X4= XXXXXXXX
MCB X5= XXXXXXXX
MCB X6= XXXXXXXX
MCB X7= XXXXXXXX
MCB X8= XXXXXXXX
EMB X1= XXXXXXXX
EMB X2= XXXXXXXX
EMB X3= XXXXXXXX
EMB X4= XXXXXXXX
EMB X5= XXXXXXXX
EMB X6= XXXXXXXX
EMB X7= XXXXXXXX
EMB X8= XXXXXXXX
EMD X1= XXXXXXXX
EMD X2= XXXXXXXX
EMD X3= XXXXXXXX
EMD X4= XXXXXXXX
EMD X5= XXXXXXXX
EMD X6= XXXXXXXX
EMD X7= XXXXXXXX
EMD X8= XXXXXXXX

Digital Input Status
MCB DI1= _____
MCB DI2= _____
MCB DI3= _____
MCB DI4= _____
MCB DI5= _____
MCB DI6= _____
EMA DI1= _____
EMB DI2= _____
EMD DI1= _____
EMD DI4= _____

Digital Output Status
MCB DO1= _____
MCB DO2= _____
MCB DO3= _____
MCB DO4= _____
MCB DO5= _____
MCB DO6= _____
MCB DO7= _____
MCB DO8= _____
MCB DO9= _____
MCB DO10= _____
EMB DO1= _____
EMB DO2= _____
EMB DO3= _____
EMB DO4= _____
EMB DO5= _____
EMB DO6= _____
EMD DO1= _____
EMD DO2= _____
EMD DO3= _____
EMD DO4= _____
EMD DO5= _____
EMD DO6= _____

Alarm Lists
Active Alarms ▶
Alarm Log ▶

Active Alarms
Alm Count: xx Clr Alms= No
+Alarm 1: Alarm Type ▶
+Alarm 2: Alarm Type ▶
•
•
•
+Alarm 10: Alarm Type ▶

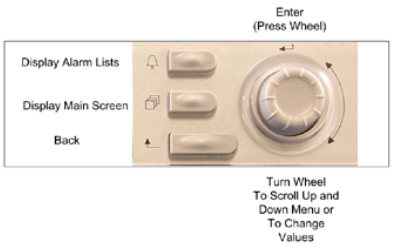
Alarm Log
Log Count: xx Clr Log= No ▶
+/-Alarm 1: Alarm Type ▶
+/-Alarm 2: Alarm Type ▶
•
•
•
+/-Alarm 50: Alarm Type ▶

Alarm Details
+/-Alarm 1: Alarm Type
MM/DD/YYYY HH:MM:SS
INV/OF Flt Code Details ▶
IFB Comm Status ▶

1
2

IFB Comm Status
IFB SW Vers= VP0329008
IFBCommStatus=____
PrvCommStatus=_____
MM/DD/YYYY HH:MM:SS
ACS1 DataRcvd=_____
ACS3 DataRcvd=_____

Fault Code Details
ACTIVE FAULT CODES
INVAlarmCode=_____
Code Text
OF1AlarmCode=_____
Code Text
OF2AlarmCode=_____
Code Text
PREVIOUS FAULT CODES
PrvINVAlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS
PrvOF1AlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS
PrvOF2AlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

Figure 99: BMS Communications *– Keypad/Display Menu Structure*

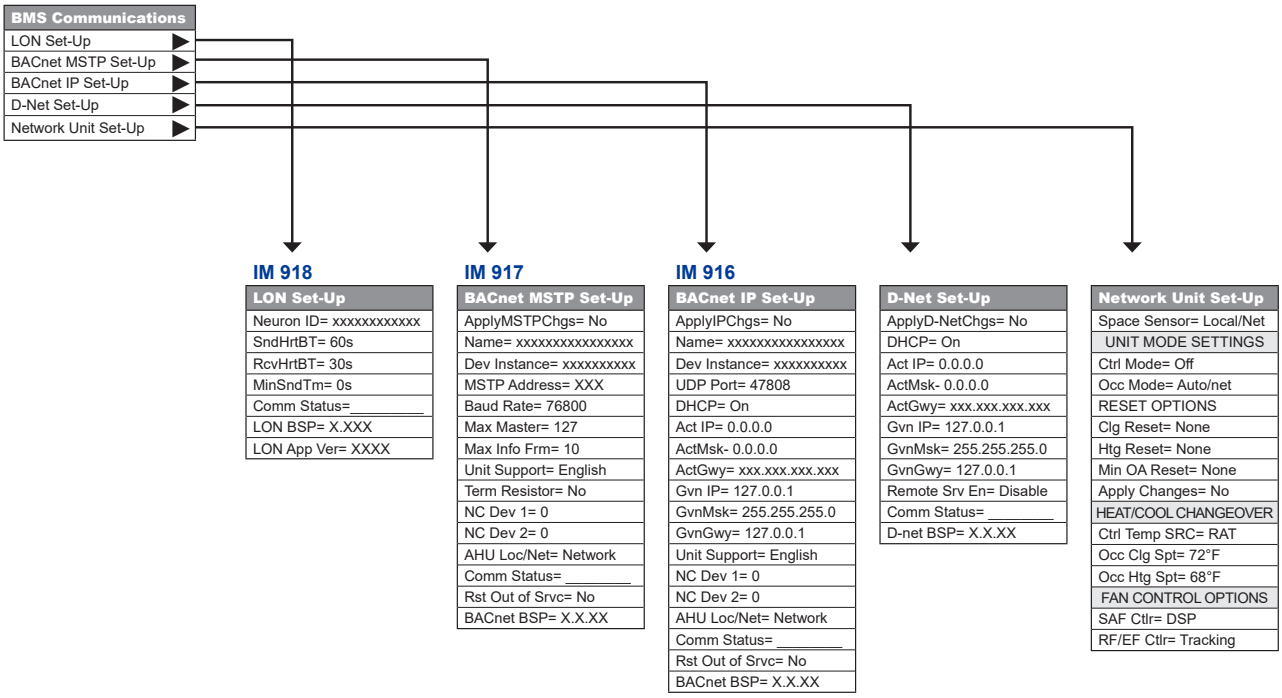


Figure 100: Trending *– Keypad/Display Menu Structure*

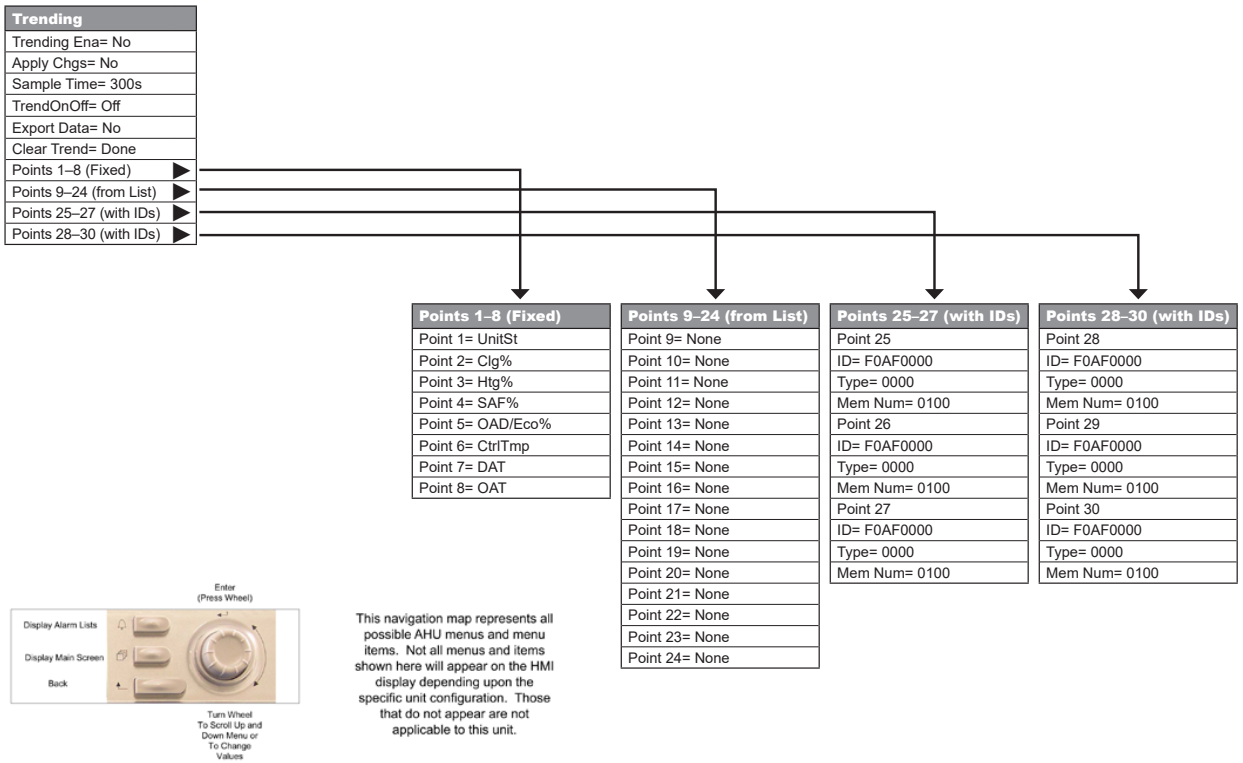
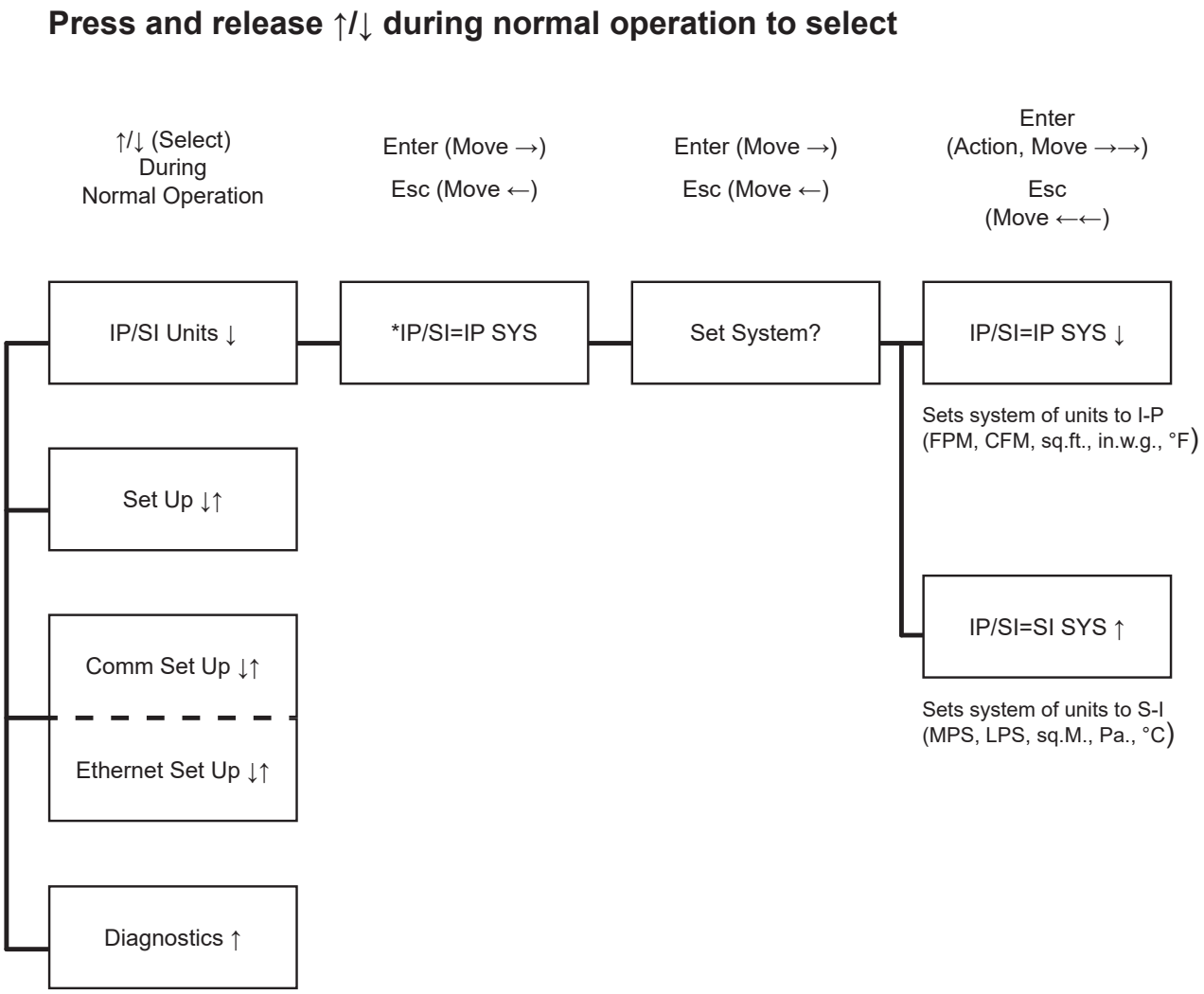


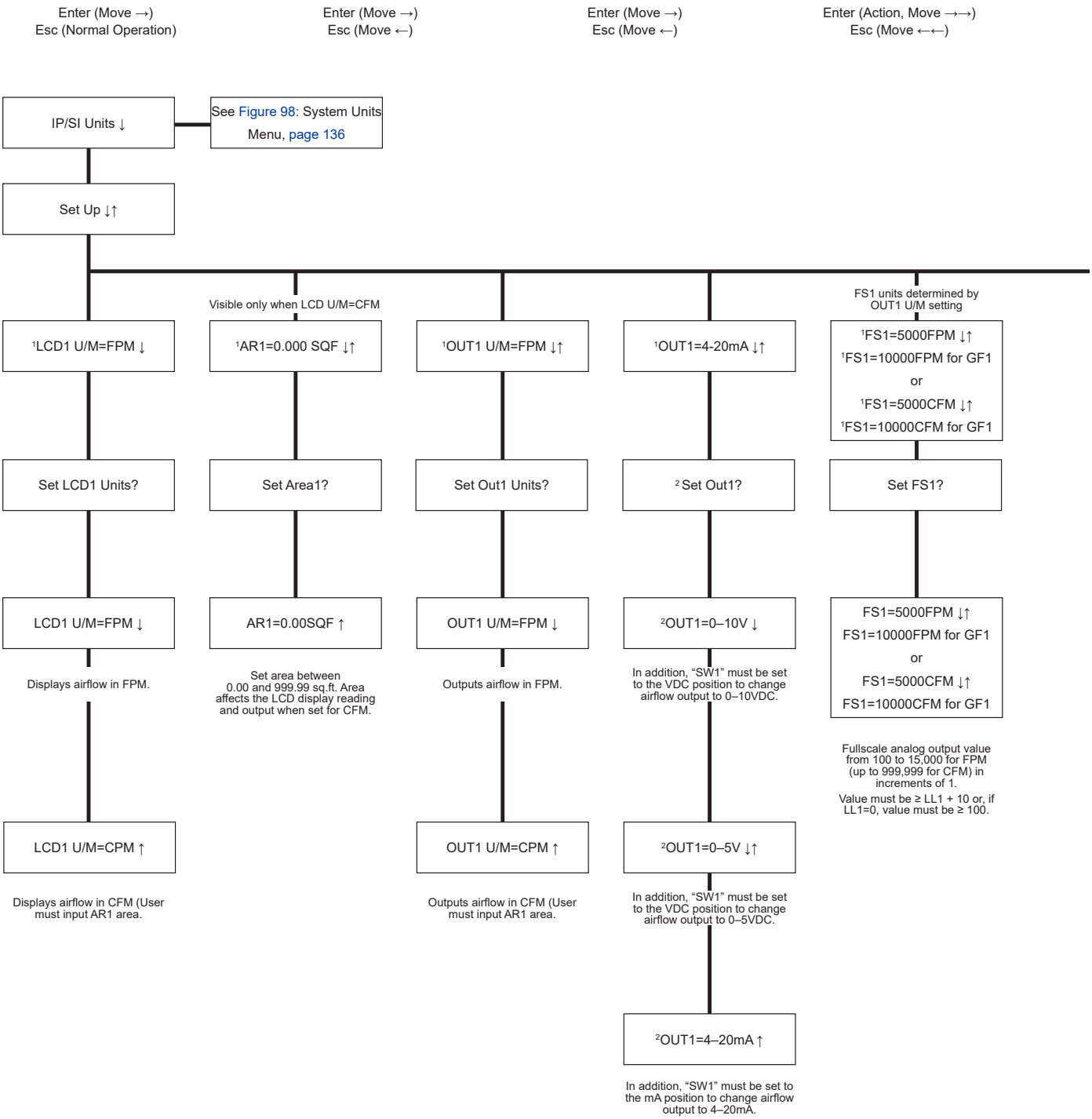
Figure 101: Optional Outdoor Air Monitor *– Changing the System of Units*

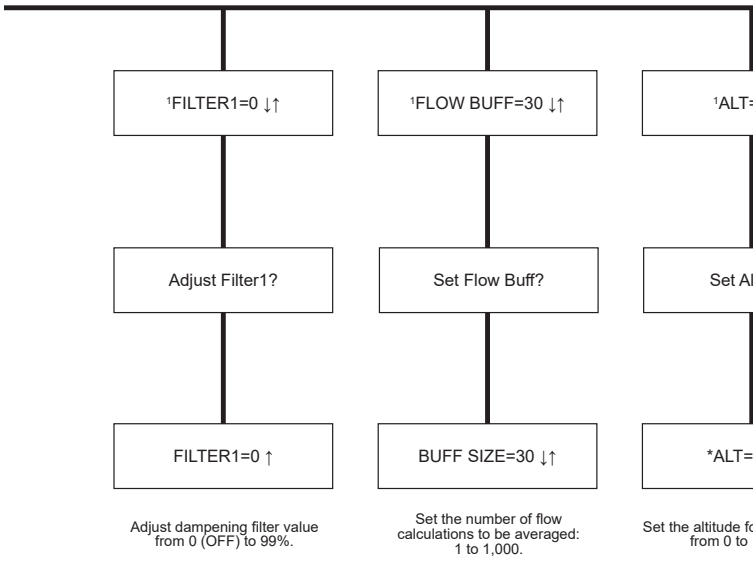


* Factory Default/Current Setting

***Figure 102: Optional Outdoor Air Monitor** – Set Up Menu*

Press and release ↑/↓ during normal operation to select




[1]FILTER1=0 ↓↑
[1]FLOW BUFF=30 ↓↑
[1]ALT=
Adjust Filter1?
Set Flow Buff?
Set Al
FILTER1=0 ↑
BUFF SIZE=30 ↓↑
*ALT=
Adjust dampening filter value from 0 (OFF) to 99%.
Set the number of flow calculations to be averaged: 1 to 1,000.
Set the altitude fo from 0 to

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This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.

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Installation and Maintenance Manual IM 1058-8

Group: **Applied Air Systems**
Part Number: **IM 1058**
Date: **July 2017**

Maverick® II
Commercial Packaged Rooftop Systems

Heating and Cooling
Models MPS015F – 0050F
15 to 50 Tons
R-410A Refrigerant
MicroTech® III Unit Controller
Energy Recovery Wheel

DAIKIN

Table of Contents

06/19/2020

This manual provides general information about the “F” vintage Daikin Commercial Packaged Rooftop Unit model MPS. In addition to an overall description of the unit, it includes mechanical and electrical installation procedures, commissioning procedures, sequence of operation information, and maintenance instructions.

The MicroTech® III rooftop unit controller is available on “F” vintage rooftop units. For a detailed description of the MicroTech III components, input/output configurations, field wiring options and requirements, and service procedures, see OM 920. For operation and information on using and programming the MicroTech III unit controller, refer to the appropriate operation manual (see Table 1).

For a description of operation and information on using the keypad to view data and set parameters, refer to the appropriate program-specific operation manual (see Table 1).

Table 1: Program Specific Unit Operation Literature

Rooftop unit control configuration	Manual bulletin number
VFDs	OM 844 - MD2 OM 895 - MD3 OM 1190 - MD4 OM 1191 - MD5 OM 847 - MD6
MPS Unit Controller Discharge Air Control (VAV or CAV) Space Comfort Control (SCC)	OM 920
LonWorks Integration	IM 918
BACnet Integration	IM 917
BACnet IP Comm Module	IM 916

Unit Nameplate

The unit nameplate is located on the outside of the main control box door. It includes the unit model number, serial number, electrical characteristics, and refrigerant charge.

Hazard Identification Information

⚠ DANGER

Dangers indicate a hazardous situation which will result in death or serious injury if not avoided.

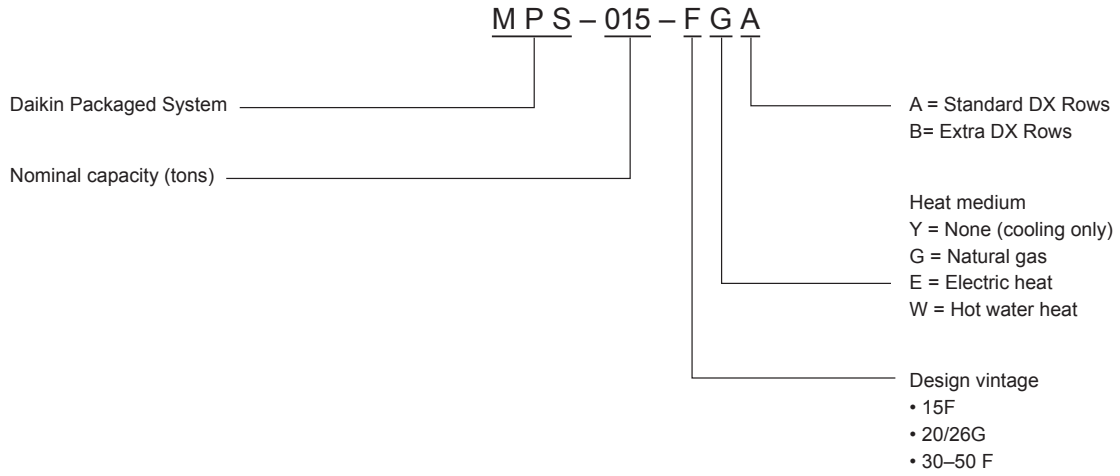
⚠ WARNING

Warnings indicate potentially hazardous situations, which can result in property damage, severe personal injury, or death if not avoided.

⚠ CAUTION

Cautions indicate potentially hazardous situations, which can result in personal injury or equipment damage if not avoided.

Nomenclature (MPS 015–050)



Installer Responsibilities

The installation of this equipment shall be in accordance with the regulations of authorities having jurisdiction and all applicable codes. It is the responsibility of the installer to determine and follow the applicable codes.

⚠ CAUTION

Sharp edges on sheet metal and fasteners can cause personal injury. This equipment must be installed, operated, and serviced only by an experienced installation company and fully trained personnel.

Receiving Inspection

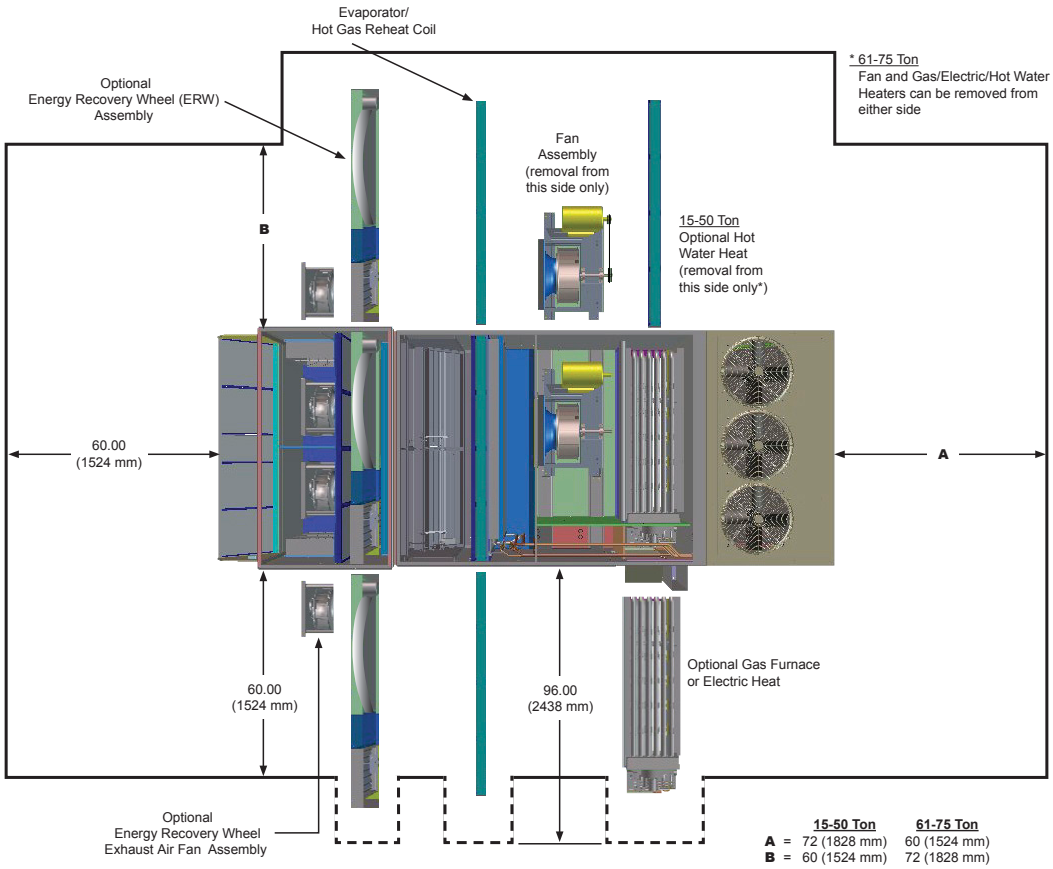
When the equipment is received, all items should be carefully checked against the bill of lading to be sure all crates and cartons have been received. **If the unit has become dirty during shipment (winter road chemicals are of particular concern), clean it when received.**

All units should be carefully inspected for damage when received. Report all shipping damage to the carrier and file a claim. In most cases, equipment is shipped F.O.B. factory and claims for freight damage should be filed by the consignee. Before unloading the unit, check the unit nameplate to make sure the voltage complies with the power supply available.

Service Clearance

Allow service clearances as approximately indicated in Figure 1. Also, Daikin recommends providing a roof walkway to the rooftop unit as well as along each side of the unit that provides access to most controls and serviceable components.

Figure 1: Service Clearances



Ventilation Clearance

Below are minimum ventilation clearance recommendations. The system designer must consider each application and provide adequate ventilation. If this is not done, the unit may not perform properly.

Unit(s) Surrounded by a Screen or a Fence:

1. The bottom of the screen or fence should be at least 1 ft. (305 mm) above the roof surface.
2. The distance between the unit and a screen or fence should be as described in Figure 1.
3. The distance between any two units within a screen or fence should be at least 120" (3048 mm).

Unit(s) Surrounded by Solid Walls:

1. If there are walls on one or two adjacent sides of the unit, the walls may be any height. If there are walls on more than two adjacent sides of the unit, the walls should not be higher than the unit.
2. The distance between the unit and the wall should be at least 96" (2438 mm) on all sides of the unit.
3. The distance between any two units within the walls should be at least 120" (3048 mm).

Do not locate outside air intakes near sources of contaminated air.

If the unit is installed where windy conditions are common, install wind screens around the unit, maintaining the clearances specified (see Figure 1). This is particularly important to maintain adequate head pressure control when mechanical cooling is required at low outdoor air temperatures.

NOTE: Low head pressure may lead to poor and erratic refrigerant feed control at the thermostatic expansion valve. The unit has automatic control of the condenser fans which should provide adequate head pressure control down to 20°F provided the unit is not exposed to windy conditions. The system designer is responsible for assuring the condensing section is not exposed to excessive wind or air recirculation.

Overhead Clearance

1. Unit(s) surrounded by screens or solid walls must have no overhead obstructions over any part of the unit.
2. The area above the condenser must be unobstructed in all installations to allow vertical air discharge.
3. The following restrictions must be observed for overhead obstructions above the air handler section:
   a. There must be no overhead obstructions above the furnace flue, or within 9" (229 mm) of the flue box.
   b. Overhead obstructions must be no less than 96" (2438 mm) above the top of the unit.
   c. There must be no overhead obstructions in the areas above the outside air and exhaust dampers that are farther than 24" (610 mm) from the side of the unit.

Roof Curb Assembly and Installation

Locate the roof curb and unit on a portion of the roof that can support the weight of the unit. The unit must be supported to prevent bending or twisting of the machine.

If building construction allows sound and vibration into the occupied space, locate the unit over a non-critical area. It is the responsibility of the system designer to make adequate provisions for noise and vibration in the occupied space.

⚠ WARNING

Mold can cause personal injury. Some materials such as gypsum wall board can promote mold growth when damp. Such materials must be protected from moisture that can enter units during maintenance or normal operation.

Install the curb and unit level to allow the condensate drain to flow properly and allow service access doors to open and close without binding.

The gasketed top surface of the curb seals against the unit when it is set on the curb. These flanges must not support the total weight of the duct work. See Installing Ductwork on page 16 for details on duct connections. It is critical that the condensate drain side of the unit be no higher than the opposite side.

Assembly Instructions

Assembly of a typical roof curb is shown in Figure 2.

1. Set curbing parts A thru G per dimensions shown over roof opening or on a level surface. Note location of supply air opening. Check alignment of all mating screw holes.
2. Screw curbing parts together using fasteners provided. Leave all screws loose until curb is checked to be square.
3. Square entire curbing assembly and securely tighten all screws.
4. Position curb assembly over roof openings. Curb must be level within 0.25 inches from side to side and 1.50 inches over its length. Check that top surface of curb is flat with no bowing or sagging.
5. Weld curb assembly in place. Caulk all seams watertight. Remove backing from 0.25 × 1.50 wide gasket and apply to surfaces shown by crosshatching.
6. Check that electrical connections are coordinated.

Figure 2: Roof Curb Assembly (MPS 026G – 035F Example)

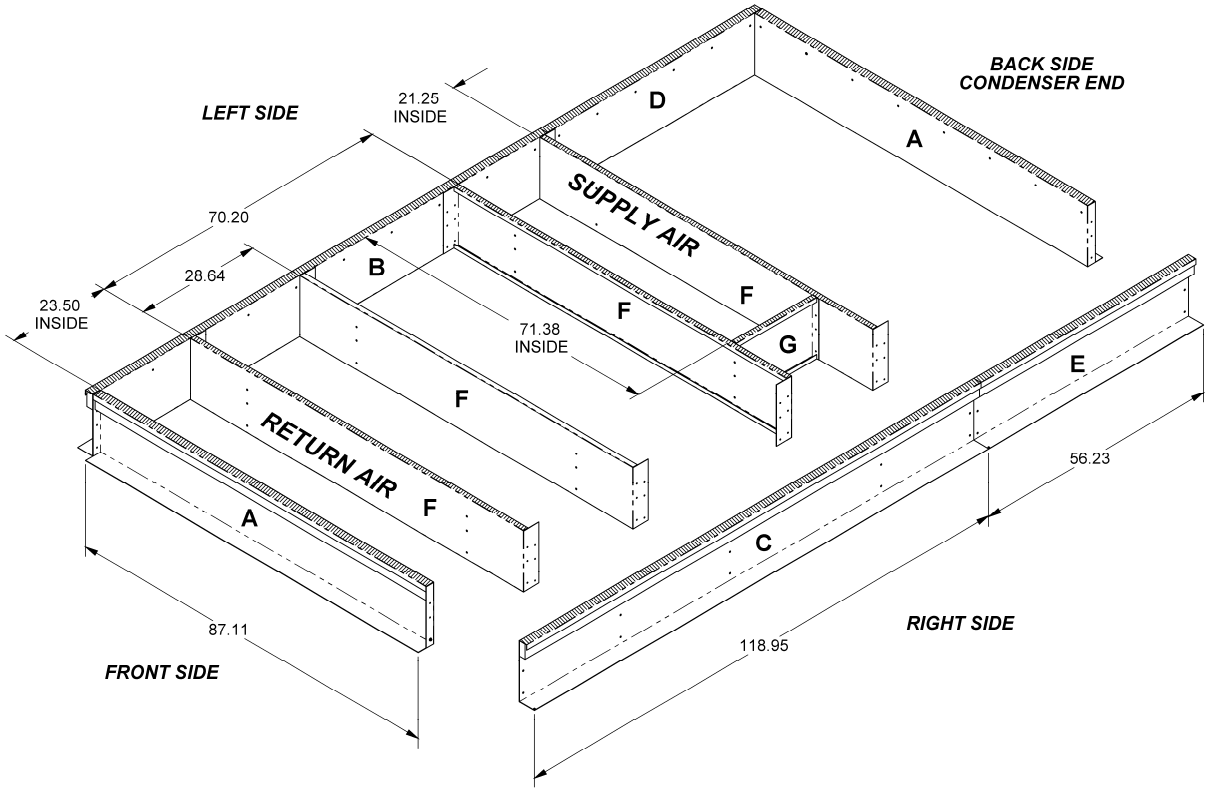
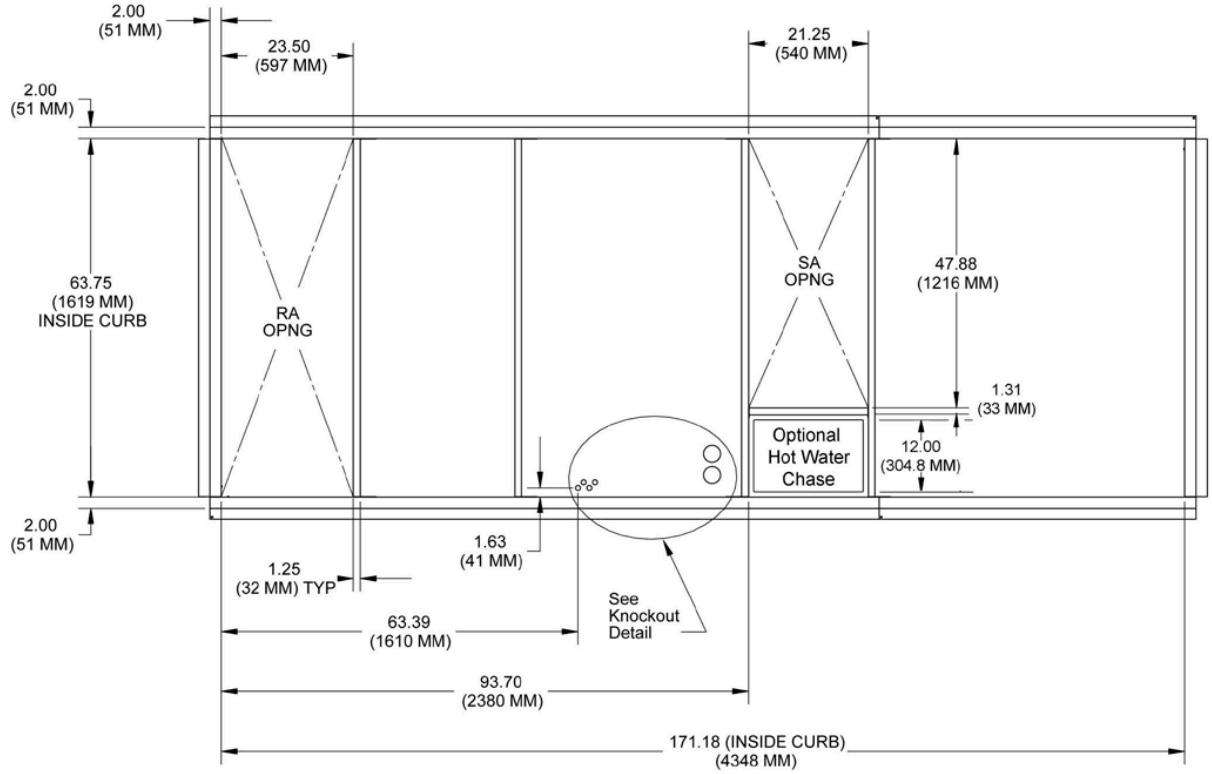
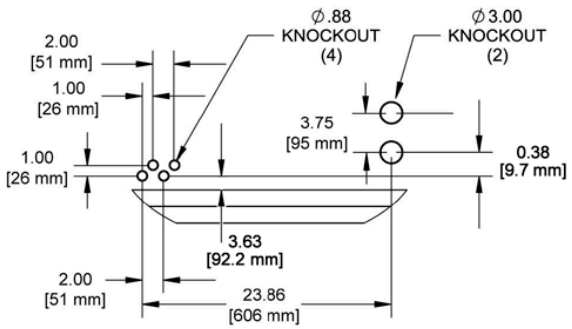


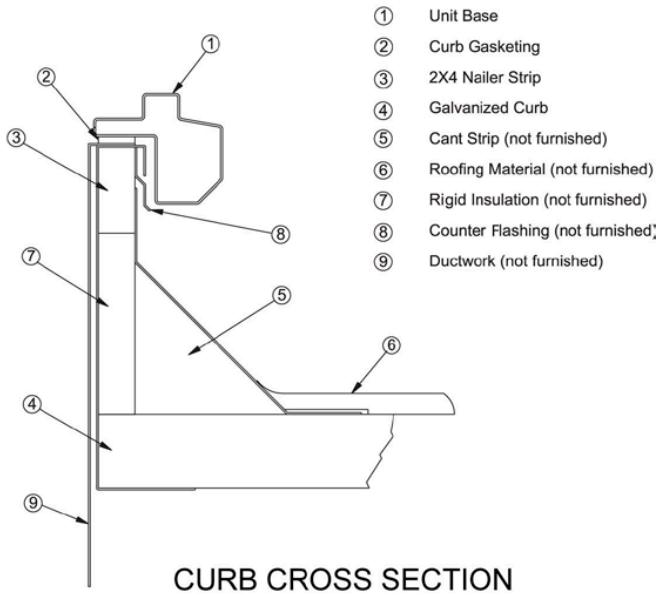
Figure 3: Roof Curb Layout—MPS 015F – 020G



PLAN VIEW

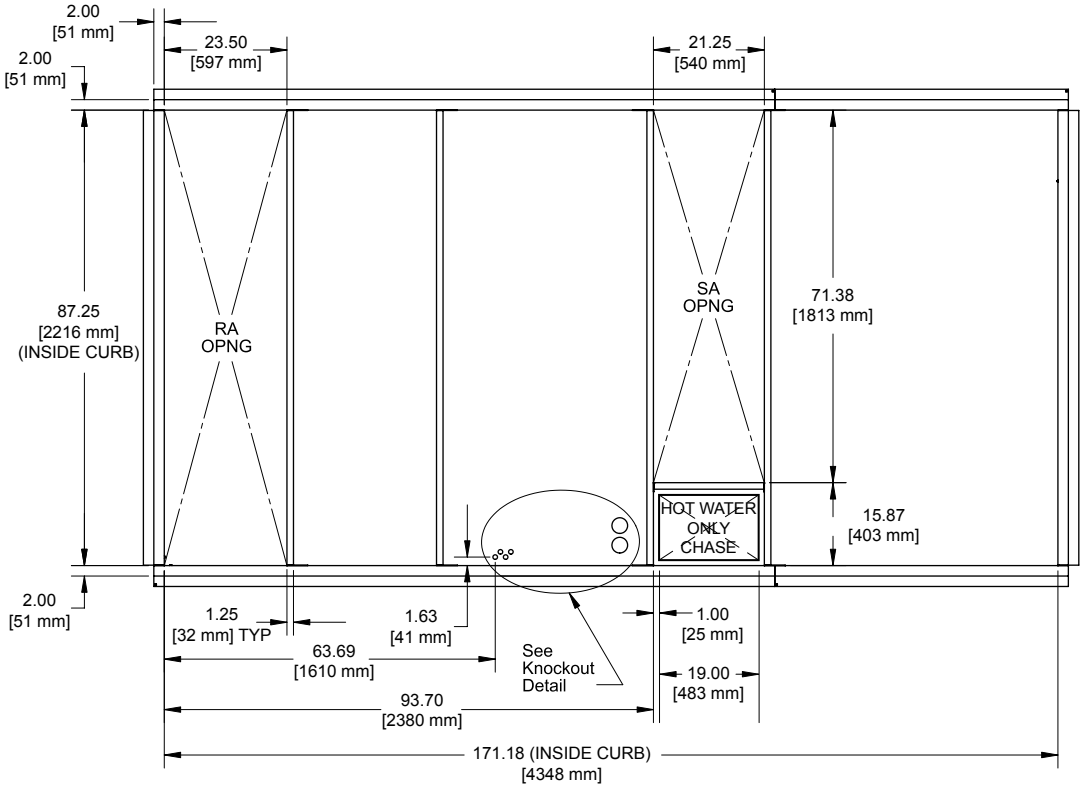


KNOCKOUT DETAIL

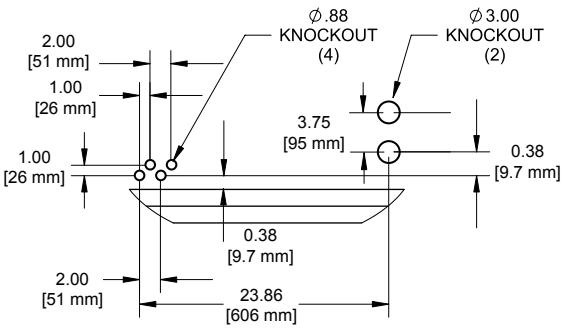


CURB CROSS SECTION

Figure 4: Roof Curb Layout—MPS 026G – 035F



PLAN VIEW



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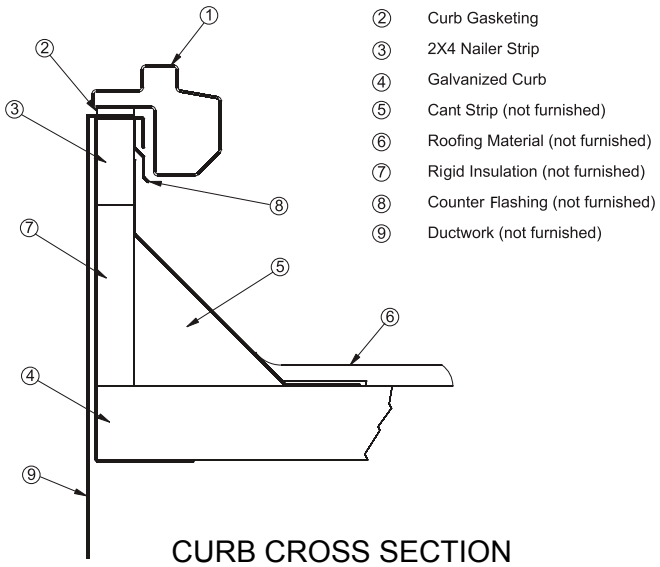
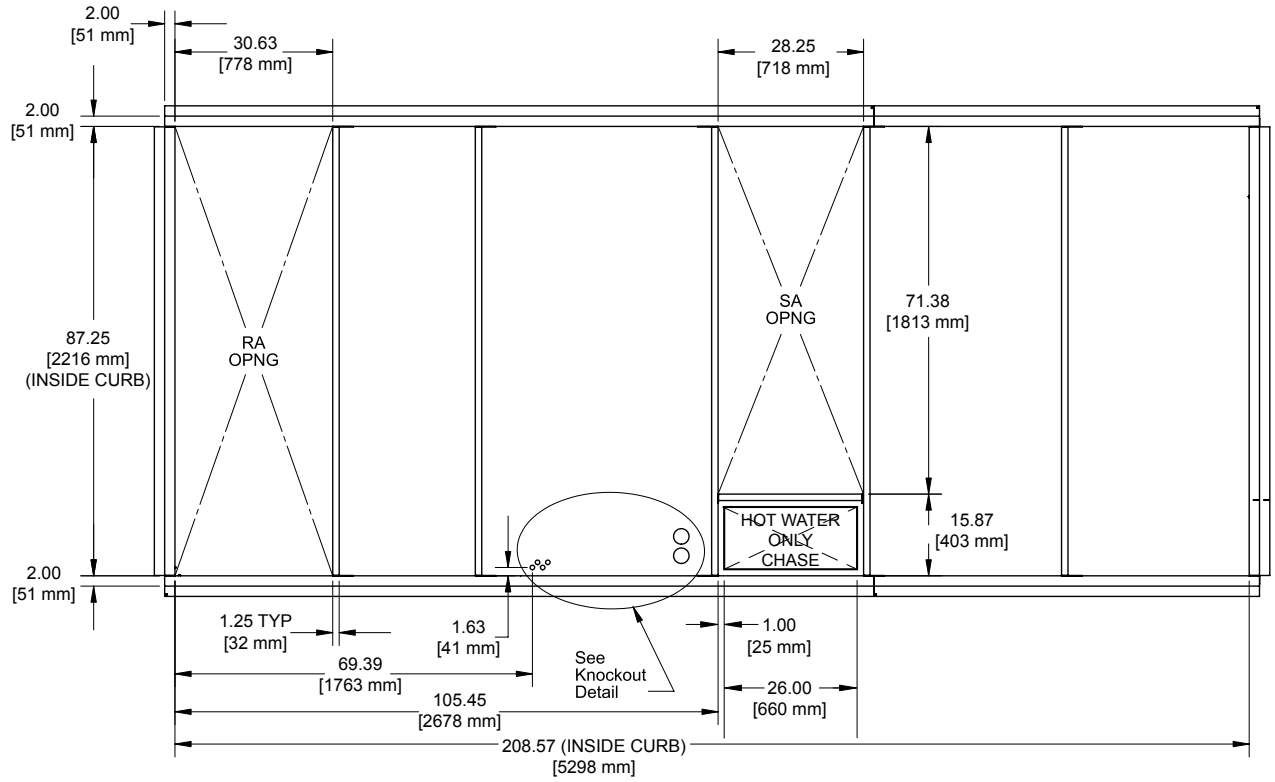
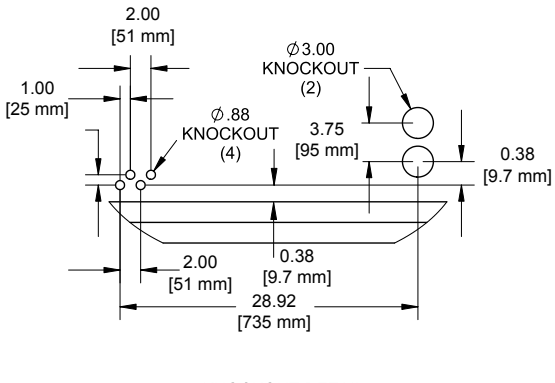


CURB CROSS SECTION

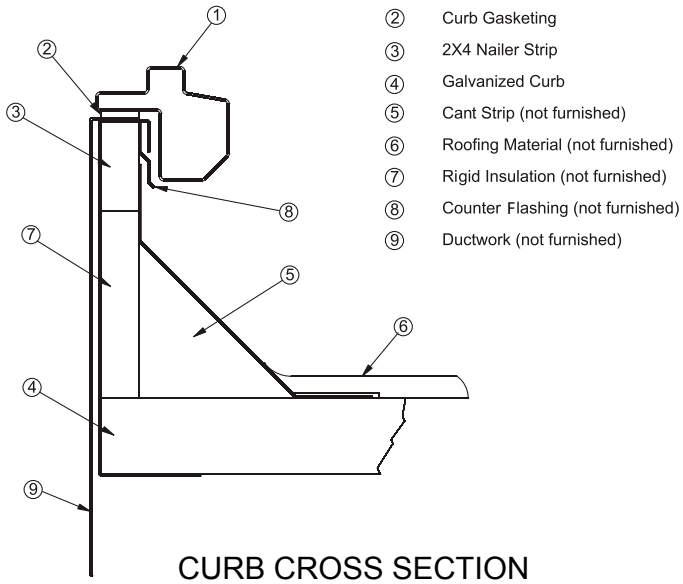
Figure 5: Roof Curb Layout—MPS 040F – 050F



PLAN VIEW

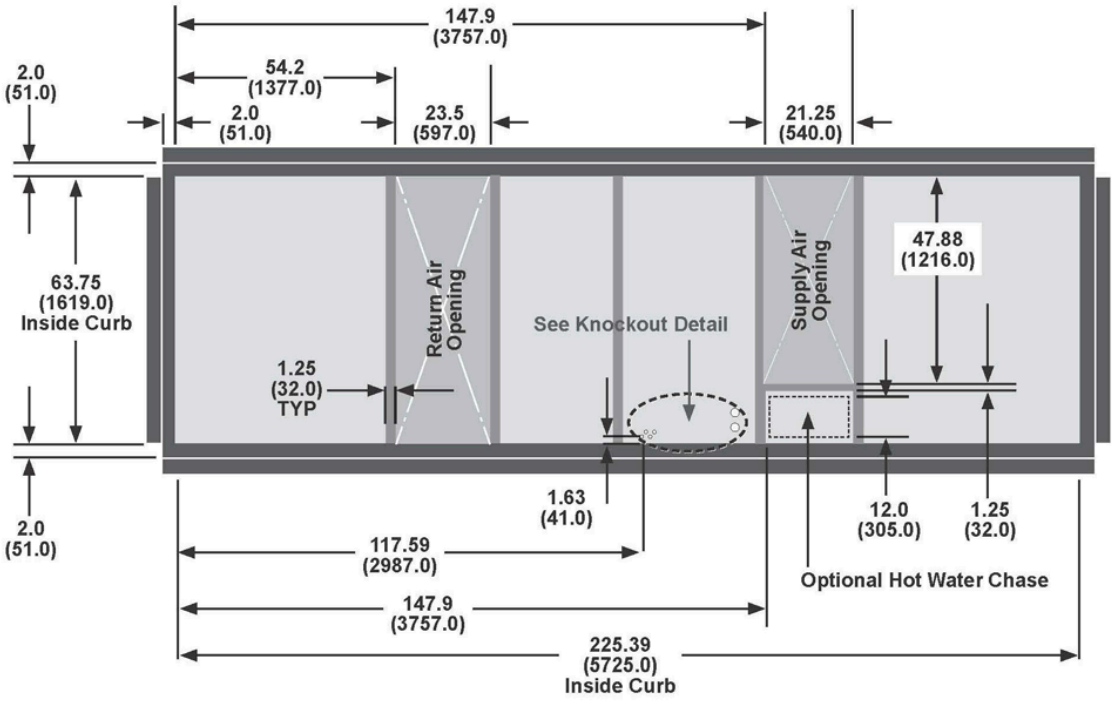


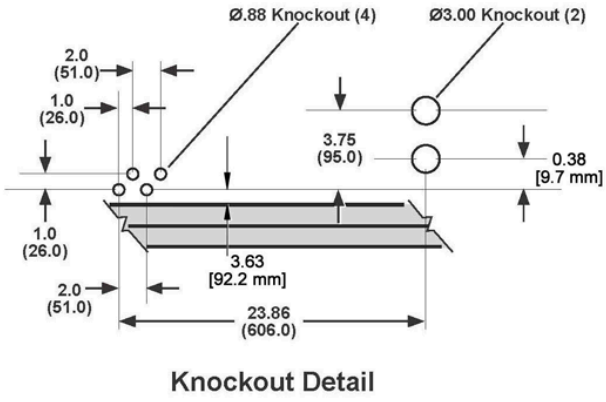
KNOCKOUT DETAIL



CURB CROSS SECTION

Figure 6: MPS 015–020 Roof Curb with Energy Recovery Wheel





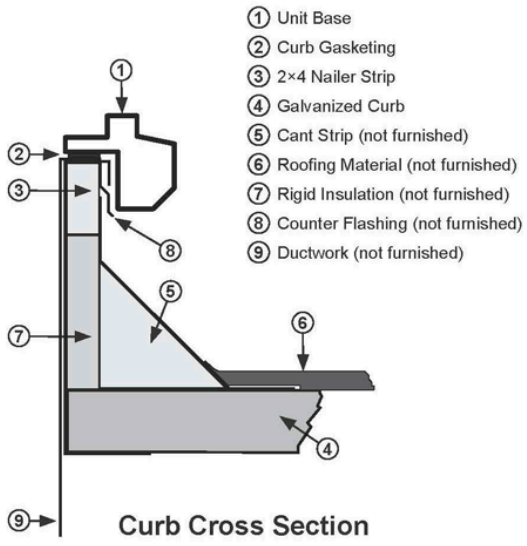


Figure 7: MPS 026–035 Roof Curb with Energy Recovery Wheel

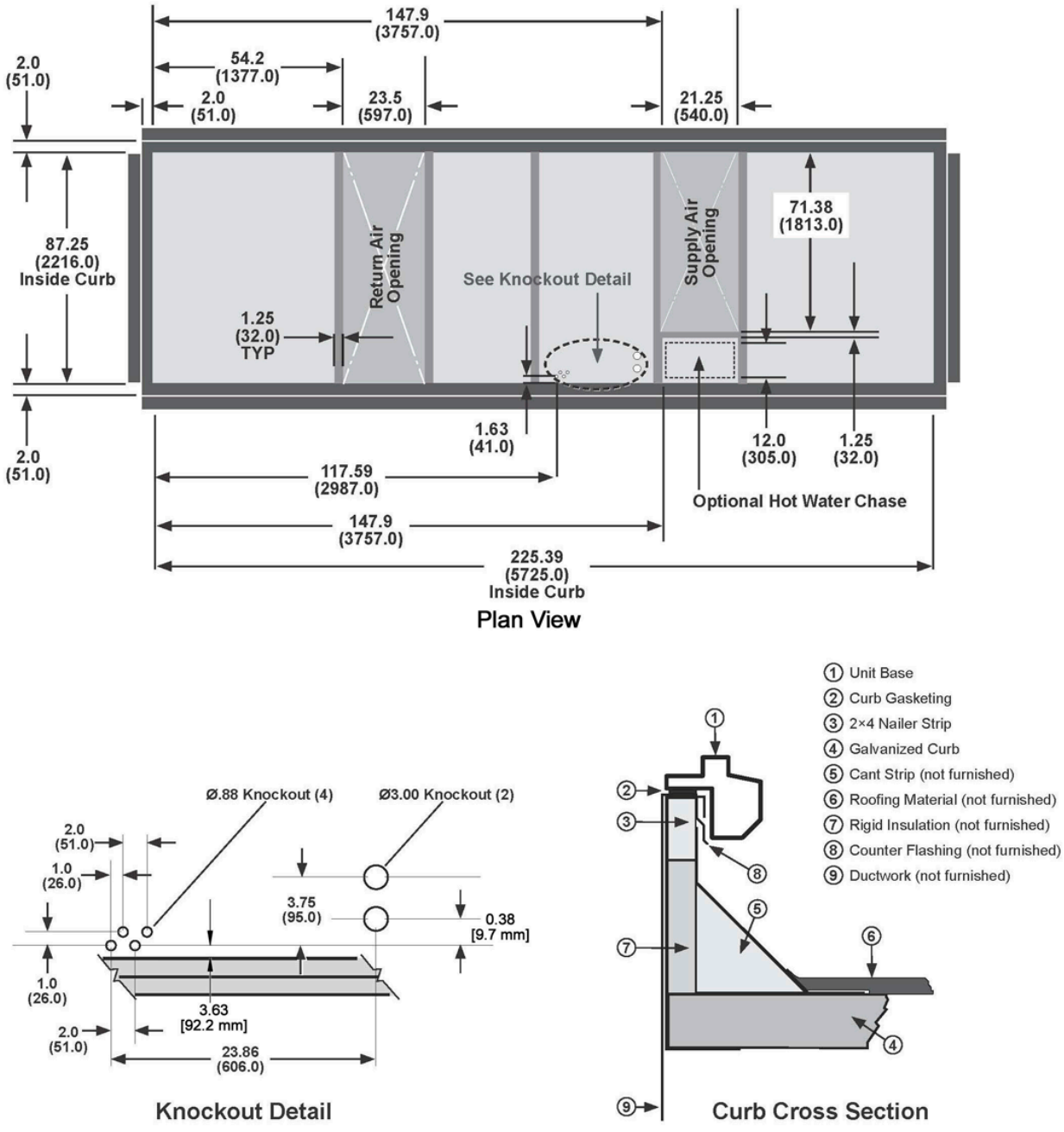
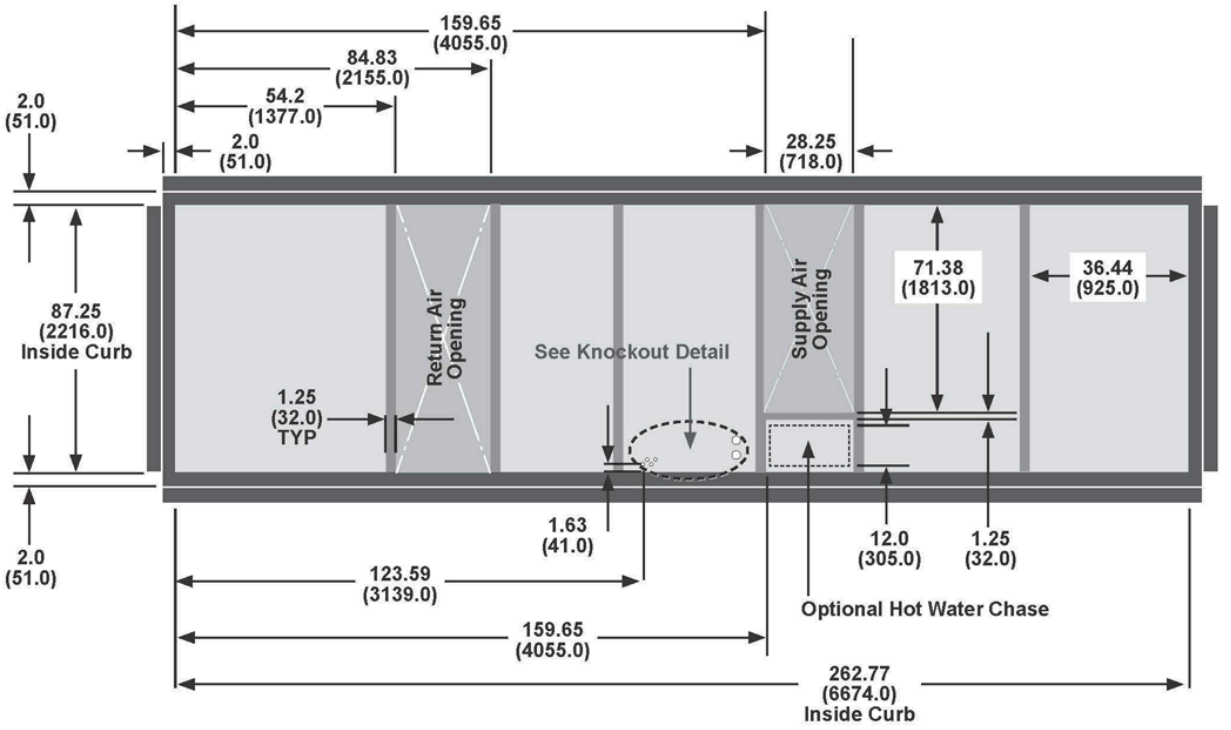
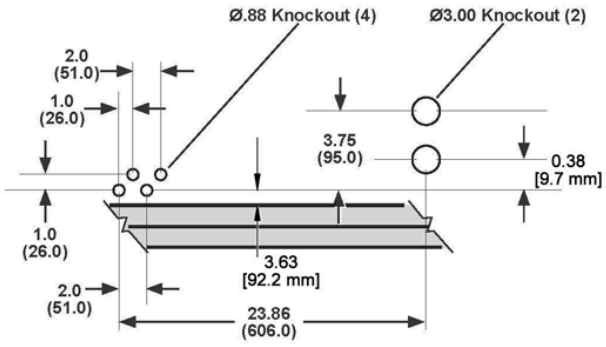


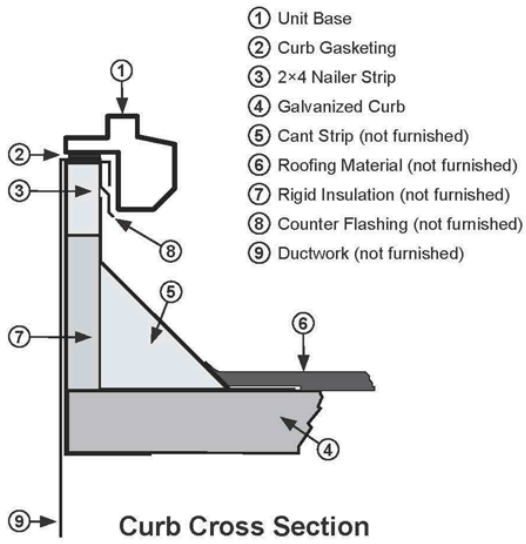
Figure 8: MPS 040–050 Roof Curb with Energy Recovery Wheel



Plan View



Knockout Detail



Curb Cross Section

Rigging and Handling

⚠ WARNING

Only trained and qualified personnel should be allowed to rig loads or operate load rated cranes and/or hoist assemblies. Do not use a forklift to lift or maneuver the unit. Failure to use a load rated crane or hoist assembly to lift or maneuver the unit can cause severe personal injury and property damage.

⚠ WARNING

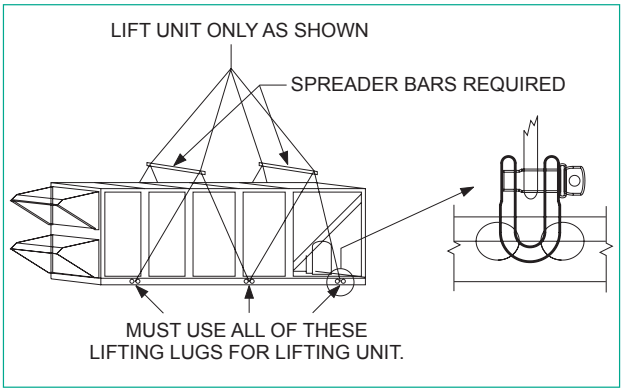
Use all lifting points. Improper lifting can cause property damage, severe pers al injury, or death.

⚠ CAUTION

Lifting points may not be symmetrical to the center of gravity of the unit. Ballast or unequal cable lengths may be required.

Rigging holes for shackles are integral on the unit base. **All six lifting points must be used for rigging the equipment. Use four independent lines, securing one end of a line to a unit base lifting point and the other end of the line to an associated spreader bar lifting point** (see Figure 10 and Figure 11). Figure 9 is an example of an instruction label shipped with each unit.

Figure 9: Rigging Label



Use spreader bars, 96" to 100" (2438 to 2540 mm) wide to prevent damage to the unit cabinet. Avoid twisting or uneven lifting of the unit. The cable length from the bracket to the hook should always be longer than the distance between the outer lifting points.

If the unit is stored at the construction site for an intermediate period, take these additional precautions:

1. Support the unit well along the length of the base rail.
2. Level the unit (no twists or uneven ground surface).
3. Provide proper drainage around the unit to prevent flooding of the equipment.
4. Provide adequate protection from vandalism, mechanical contact, etc.
5. Securely close the doors.
6. Cover the supply and return air openings.

Table 4 and Table 5 lists the weight distribution at each of the lifting points on the unit (refer to Figure 10 and Figure 11). Table 6 details lifting point locations. Table 7 through Table 12 lists the weights of unit curbs and other sections of the unit.

Table 2: Unit Base Weights

Unit (Tons)	Total Weight (lbs)
015	2655
017	2705
020	3610
026	3610
030	3610
035	3660
040	4685
050	4985

Table 3: Unit Curb Weights

Unit (tons)	Curb Height (inches)	Total Weight (lbs)
Standard Unit		
015–035	14	341
	24	504
040–050	14	461
	24	706
Unit with Energy Wheel		
015–035	14	458
	24	674
040–050	14	619
	24	908

Table 4: Weight Distribution Locations (see Figure 10)

Unit (tons)	Distance			
	L1	L2	L3	L4
040–050	42.2	66.6	58.3	60.9

Table 5: Weight Distribution Locations (see Figure 11)

Unit (tons)	Distance		
	L1	L2	L3
015–035	35.5	62.0	52.0
040–050	40.0	69.0	89.0

Table 6: Weight Distribution — Energy Wheel

Unit	Point							
	Percent of total							
	A	B	C	D	E	F	G	H
015–050 without Energy Wheel	11%	11%	20%	24%	16%	18%	N/A	N/A
015–035 with Energy Wheel	13%	12%	20%	21%	17%	17%	N/A	N/A
040–050 with Energy Wheel	12%	12%	13%	13%	12%	12%	13%	13%

Table 7: Heat Section Weights

Unit (tons)	Weights (lbs)			
	High Gas Heat	Low Gas Heat	Electric Heat	Hot Water Heat
015	200	100	120	195
017	200	100	120	195
020	200	100	120	195
026	270	135	270	291
030	270	135	270	291
035	270	135	270	291
040	350	175	350	307
050	350	175	350	307

Table 8: Curb Weights

Unit (tons)/ Curb Height (inches)	Weight (lbs)	
	without ERW	with ERW
015–035/14	341	458
015–035/24	501	674
040–050/14	481	619
040–050/24	708	908

Table 9: Energy Recovery Section Weights

Unit Size (tons)	Weight (lbs)
015–020	1200
026–035	1540
040–050	1000

Table 10: Additional Weights - Motors/Exhaust Fans (015–020)

HP	Additional Motor Weight (lbs)
1	0
1.5	9
2	9
3	32
5	43

Unit (tons)	Additional Exhaust Fan Weight (lbs)
15–20	150

Table 11: Additional Weights - Motors/Exhaust Fans (026–050)

HP	Additional Motor Weight (lbs)
7.5	0
10	25
15	125
20	175
25	225
30	275

Unit (tons)	Additional Exhaust Fan Weight (lbs)
26	150
30	150
35	150
40	200
50	200

Table 12: Additional Weights for 6-Row DX Coil and HGRH Coil

Unit Size (tons)	Weight (lbs)	
	6 Row DX	HGRH
15–20	118	70
26–35	164	82
40	187	92
50	231	92

Figure 10: Rigging the Unit (MPS 026– 035 Example)

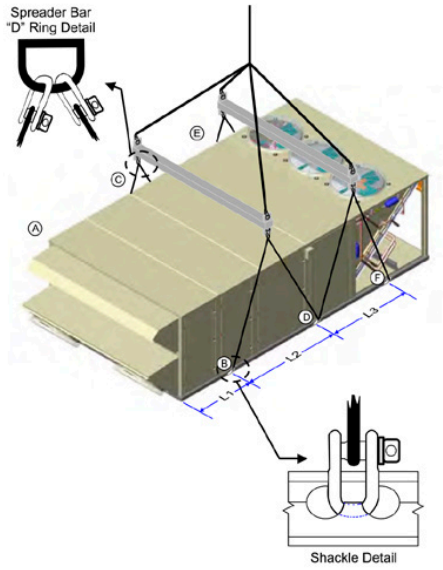
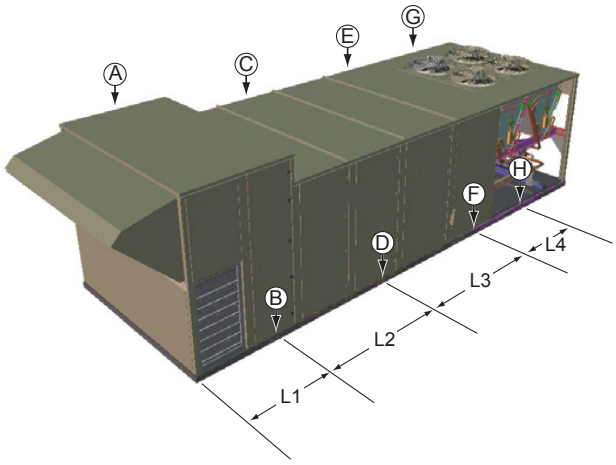


Figure 11: Rigging the Unit (MPS 040–050 Example)



Condensate Drain Pipe Connection

The unit is provided with a 1" male NPT condensate drain connection. For proper drainage, level the unit and drain pan side to side and install a P-trap.

Figure 12 shows the layout of the condensate drain connection. The distance from the drain pan outlet to the horizontal run of the P-trap should be a distance of twice the static pressure in the drain pan.

Example: If the static pressure as measured in the drain pan is 1.5", then the distance between the drain outlet and the horizontal run should be 3".

Draining condensate directly onto the roof may be acceptable; refer to local codes. Provide a small drip pad of stone, mortar, wood, or metal to protect the roof against possible damage.

If condensate is piped into the building drainage system, pitch the drain line away from the unit a minimum of 1/8" per foot. The drain line must penetrate the roof external to the unit. Refer to local codes for additional requirements. Sealed drain lines require venting to provide proper condensate flow.

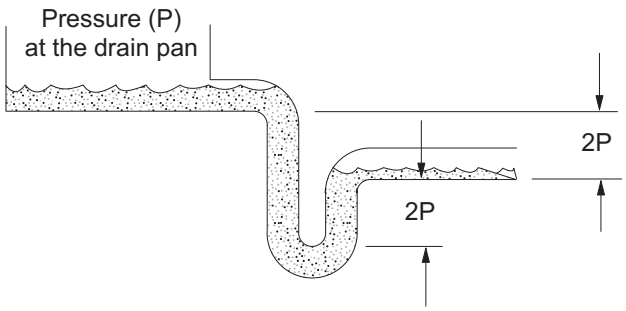
Where the cooling coils have intermediate condensate pans on the face of the evaporator coil, copper tubes near both ends of the coil supply drainage to the main drain pan. Verify the tubes are in place and open before putting the unit into operation.

Periodically clean to prevent microbial growth/algae buildup from plugging the drain and causing the drain pan to overflow. Clean drain pans to prevent the spread of disease. Cleaning should be performed by qualified personnel.

WARNING

Drain pans must be cleaned periodically. Material in uncleaned drain pans can cause disease. Cleaning should be performed by qualified personnel.

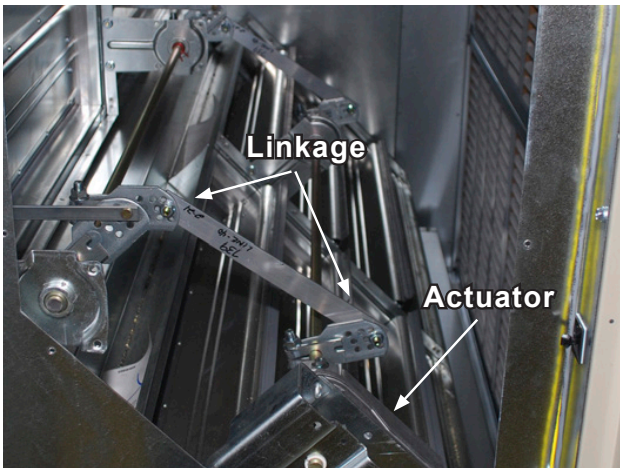
Figure 12: Condensate Drain Connection



Damper Assemblies

The optional damper assemblies described in this section are ordered with factory-installed actuators and linkages. The following sections describe the operation and linkage adjustment of the factory option.

Figure 13: Damper Assembly



Economizer Dampers

As the single actuator modulates, the outside air dampers open, the return air dampers close, and the exhaust air exits the unit through the gravity relief dampers.

The economizer comes with manually adjustable linkage (Figure 13). The damper is set so that the crankarm moves through a 90-degree angle to bring the economizer dampers from full open to full close. Mechanical stops are placed in the crankarm mounting bracket. Do not remove stops. Driving the crankarm past the stops results in damage to the linkage or damper.

Outdoor Air Dampers (0% to 30%)

These dampers are intended to remain at a fixed position during unit operation, providing fresh air quantities from 0 to 30% of the total system airflow, depending on the damper setting.

The damper position may be set at the unit controller keypad (refer to OM 920 for further detail). During unit operation, the damper is driven to the position set at the unit controller. During the off cycle, the damper is automatically closed.

Cabinet Weather Protection

This unit ships from the factory with fully gasketed access doors and cabinet caulking to provide weather resistant operation. After the unit is set in place, inspect all door gaskets for shipping damage and replace if necessary.

Protect the unit from overhead runoff from overhangs or other such structures.

⚠ CAUTION

Transportation, rigging, or maintenance can damage the unit's weather seal. Periodically inspect the unit for leakage. Standing moisture can promote microbial growth, disease, or damage to the equipment and building

Installing Ductwork

On vertical-supply/vertical-return units, if a Daikin roof curb is not used, the installing contractor should make an airtight connection by attaching field fabricated duct collars to the bottom surface of the unit's duct opening. Do not support the total weight of the duct work from the unit. See roof curb layouts in Figure 3 on page 7, Figure 4 on page 8 or Figure 5 on page 9.

Table 13: Rated Airflow

Unit Size (tons)	AHRI Rated Airflow
015	3750
017	4375
020	5000
026	6875
030	7500
035	8750
040	10000
050	12500

Use flexible connections between the unit and ductwork to avoid transmission of vibration from the unit to the structure.

To minimize losses and sound transmission, design duct work per ASHRAE and SMACNA recommendations.

Where return air ducts are not required, connect a sound absorbing T or L section to the unit return to reduce noise transmission to the occupied space.

Ductwork exposed to outdoor conditions must be built in accordance with ASHRAE and SMACNA recommendations and local building codes.

⚠ WARNING

Mold can cause personal injury. Materials such as gypsum wall board can promote mold growth when damp. Such materials must be protected from moisture that can enter units during maintenance or normal operation.

Installing Duct Static Pressure Sensor Taps

For all VAV units, duct static pressure taps must be field installed and connected to the static pressure sensor 1 (SPS1) in the unit. Sensor SPS1 is standard on VAV units and is located in the main control panel.

Carefully locate and install the duct static pressure sensing tap. Improperly locating or installing the sensing tap causes unsatisfactory operation of the entire variable air volume system. Below are pressure tap location and installation recommendations. The installation must comply with local code requirements.

1. Install a tee fitting with a leak-tight removable cap in each tube near the sensor fitting. This facilitates connecting a manometer or pressure gauge if testing is required.
2. Use different colored tubing for the duct pressure (HI) and reference pressure (LO) taps, or tag the tubes. Daikin recommends 3/16" ID tubing.
3. Locate the duct pressure (HI) tap near the end of a long duct to ensure that all terminal box take-offs along the run have adequate static pressure.
4. Locate the duct tap in a nonturbulent flow area of the duct. Keep it several duct diameters away from take-off points, bends, neckdowns, attenuators, vanes, or other irregularities.
5. Use a static pressure tip (Dwyer A302 or equivalent) or the bare end of the plastic tubing for the duct tap. (If the duct is lined inside, use a static pressure tip device.)
6. Install the duct tap so that it senses only static pressure (not velocity pressure). If a bare tube end is used, it must be smooth, square (not cut at an angle) and perpendicular to the airstream (see Figure 15).
7. Locate the reference pressure (LO) tap near the duct pressure tap within the building. If the tap is not connected to the sensor, unsatisfactory operation will result.
8. Route the tubes through the curb and feed them into the unit through the knockout in the bottom of the control panel (see Figure 14). Connect the tubes to appropriate barbed fittings (on SPS1) in the control panel. (Fittings are sized to accept 3/16" ID tubing.)

Figure 14: Static Pressure Tubing Knockout Location

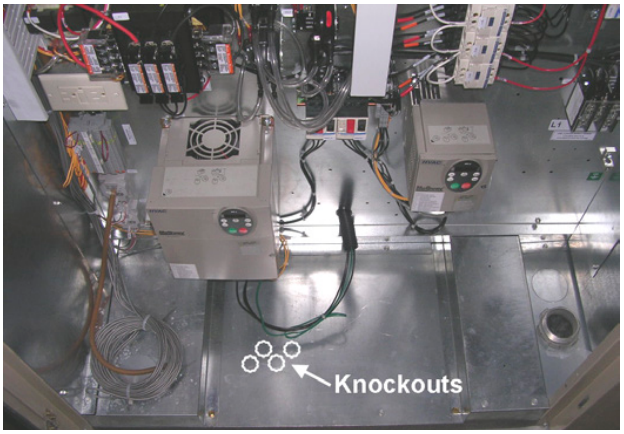
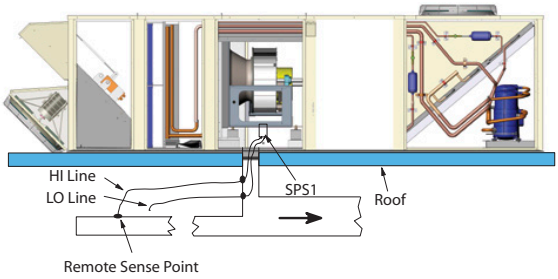
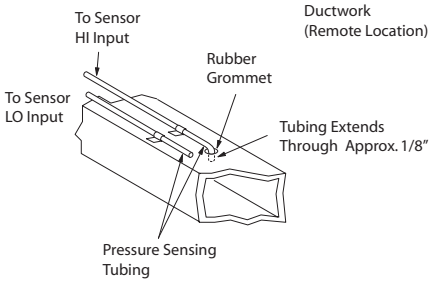


Figure 15: Duct Static Pressure Sensing Tubing Installation





Installing Building Static Pressure Sensor Taps

If a unit has building static pressure control capability, you must field install and connect static pressure taps to the static pressure sensor SPS2 in the unit. This sensor is located at the bottom of the main control panel next to SPS1.

Carefully locate and install the two static pressure sensing taps. Improper location or installation of the sensor taps causes unsatisfactory operation. Below are pressure tap location and installation recommendations for both building envelope and lab, or “space within a space” pressure control applications. The installation must comply with local code requirements.

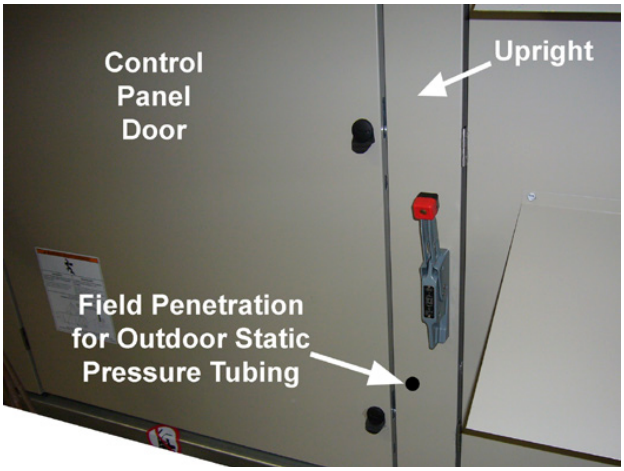
⚠ CAUTION

Fragile sensor fittings. If you must remove tubing from a pressure sensor fitting, use care. Do not use excessive force or wrench the tubing back and forth to remove or the fitting can break off and damage sensor.

Building Pressurization Applications

1. Install a tee fitting with a leak-tight removable cap in each tube near the sensor fitting. This facilitates connecting a manometer or pressure gauge if testing is required.
2. Locate the building pressure (high) tap in the area that requires the closest control. Typically, this is a ground level floor that has doors to the outside.
3. Locate the building tap so it is not influenced by any source of moving air (velocity pressure). These sources may include air diffusers or outside doors.
4. Route the building tap tube through the curb and feed it into the unit through the knockout in the bottom of the control panel (refer to Figure 14). Connect the 3/16" ID tube to the (high) fitting for sensor SPS2.
5. Locate the reference pressure (low) tap on the roof. Keep it away from the condenser fans, walls, or anything else that may cause air turbulence. Mount it high enough above the roof so it is not affected by snow. Not connecting the reference tap to the sensor results in unsatisfactory operation.
6. Use an outdoor static pressure tip (Dwyer A306 or equivalent) to minimize the adverse effects of wind. Place some type of screen over the sensor to keep out insects. Loosely packed cotton works well.
7. Route the outdoor tap tube out of the main control panel through a small field-cut opening in the upright. Seal the penetration to prevent water from entering. Connect the 3/16" ID tube to the (low) fitting for sensor SPS2.

Figure 16: Outdoor Static Pressure Tubing Installation



Lab Pressurization Applications

1. Install a “T” fitting with a leak-tight removable cap in each tube near the sensor fitting. This facilitates connecting a manometer or pressure gauge if testing is required.
2. Use different colored tubing for the controlled space pressure (high) and reference pressure (low) taps, or tag the tubes.
3. Regardless whether the controlled space is positive or negative with respect to its reference, locate the high pressure tap in the controlled space (the setpoint can be set between -0.2" and 0.2" wc).
4. Locate the reference pressure (low) tap in the area surrounding the controlled space. Not locating the reference tap to the sensor results in unsatisfactory operation.
5. Locate both taps so they are not influenced by any source of moving air (velocity pressure). These sources may include air diffusers or doors between the high and low pressure areas.
6. Route the building tap tube between the curb and the supply duct and feed it into the unit through the knockout in the bottom of the control panel.
7. Connect the tube to the (high) fitting for sensor SPS2.

Field Power Wiring

Wiring must comply with all applicable codes and ordinances. The warranty is voided if wiring is not in accordance with these specifications.

According to the National Electrical Code, a disconnecting means shall be located within sight of and readily accessible from the air conditioning equipment. The unit can be ordered with an optional factory mounted disconnect switch. This switch is not fused. Power leads must be over-current protected at the point of distribution. The maximum rated overcurrent protection device (MROPD) value appears on the unit nameplate.

All Units

All units are provided with internal power wiring for single point power connection. The power block or an optional disconnect switch is located within the main control panel. Field power leads are brought into the unit through knockouts in the bottom of the main control panel (see Figure 17 and also Table 14). Refer to the unit nameplate to determine the number of power connections.

NOTE: To wire entry points, refer to certified drawings for dimensions.

⚠ WARNING

Hazardous voltage. Can cause severe injury or death. Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

The preferred entrance for power cables is through the bottom knockouts provided on the unit. If a side entrance is the only option, a hole may be drilled in the stationary upright.

The minimum circuit ampacity (MCA) is shown on the unit nameplate. Refer to Table 14 for the recommended number of power wires.

Copper wire is required for all conductors. Size wires in accordance with the ampacity tables in Article 310 of the National Electrical Code. If long wires are required, it may be necessary to increase the wire size to prevent excessive voltage drop. Wires should be sized for a maximum of 3% voltage drop. Supply voltage must not vary by more than 10% of nameplate. Phase voltage imbalance must not exceed 2%. (Calculate the average voltage of the three legs. The leg with voltage deviating the farthest from the average value must not be more than 2% away.) Contact the local power company for correction of improper voltage or phase imbalance.

⚠ CAUTION

Provide proper line voltage and phase balance. Improper line voltage or excessive phase imbalance constitutes product abuse. It can cause severe damage to the unit's electrical components.

A ground lug is provided in the control panel. Size the grounding conductor in accordance with Table 250-95 of the National Electrical Code.

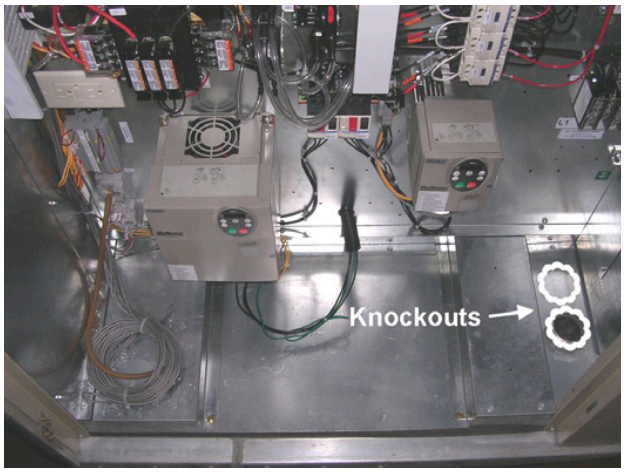
In compliance with the National Electrical Code, a 115 V factory mounted service receptacle outlet is provided. This outlet must be powered by a field connected 15 A, 115 V power supply. Leads are brought into the unit through a 7/8" knockout in the bottom of the main control panel.

Table 14: Recommended Field Power Wiring

Ampacity (MCA)	No. of Power Wires per Phase	Wire Gauge	Insulation Temperature Rating (°C)
20	1	14	75
25	1	12	75
35	1	10	75
50	1	8	75
65	1	6	75
85	1	4	75
100	1	3	75
115	1	2	75
130	1	1	75
150	1	1/0	75
175	1	2/0	75
200	1	3/0	75
230	1	4/0	75
255	1	250	75
300	2	1/0	75
350	2	2/0	75
400	2	3/0	75
460	2	4/0	75
510	2	250	75
600	3	3/0	75
690	3	4/0	75
765	3	250	75

Notes:
1. All wire sizes assume separate conduit for each set of parallel conductors.
2. All wire sizes based on NEC Table 310-16 for 75°C THW wire (copper). Canadian electrical code wire ampacities may vary.
3. All wire sizes assume no voltage drop for short power leads.

Figure 17: MPS Power Wiring Knockout Locations



Field Control Wiring

The Maverick rooftop units are available with the following field control connections:

- Space sensor.
- Space sensor with setpoint adjustment.
- Fan operation output.
- VAV box output.
- Remote alarm output.
- External discharge air temperature reset.
- Outdoor air damper minimum position adjustment.

Descriptions of these field connections are included in the MicroTech III Unit Controller manual (OM 920).

WARNING

Electrical shock hazard. Can cause severe injury or death.
Connect only low voltage NEC Class II circuits to terminal block TB2.

Spring Isolated Fans

⚠ WARNING

Moving machinery hazard. Can cause severe injury ordeath. Before servicing equipment, disconnect power and lockoff. More than one disconnect may be required to de-energizeunit. Prior to operating the fans for the first time, refer to Check, Test, and Start Procedures on page 92.

Releasing Spring Mounts

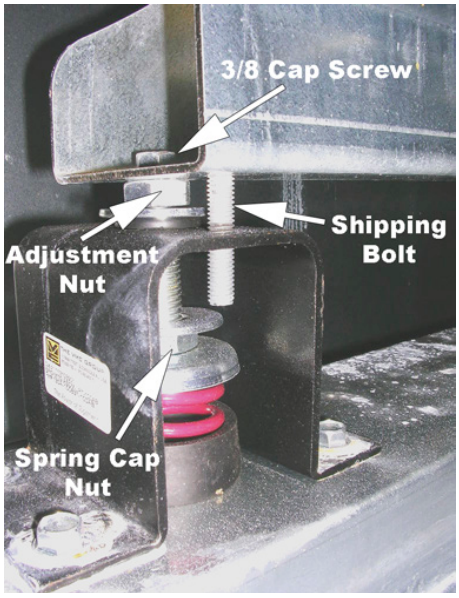
The spring-mounted supply fan is locked down with four shipping bolts for shipment. Remove each shipping bolt before operating the fans. Figure 18 shows a typical spring mount with a height adjustment nut and a shipping bolt.After removing the shipping bolts, rock the fan assembly by hand to check for freedom of movement.

Adjusting Spring Mounts

During operation all fans should ride level. Level the fan assembly by performing the following:

1. Loosen the 3/8" cap screw (do not remove).
2. Loosen the spring cap nut.
3. Rotate the 5/8" adjustment nut counter-clockwise to raise the fan assembly, or clockwise to lower the fan assembly.
4. Tighten the 3/8" cap screw.
5. Tighten the spring cap nut.

Figure 18: Spring Mounts



Daikin Applied Tubular Heater Series Package Heater Module

ANSI Z83.8-2013/CSA 2.6-2013

⚠ DANGER

FIRE OR EXPLOSION HAZARD

- Failure to follow safety warnings exactly could result in serious injury, death or property damage.
- Be sure to read and understand the installation, operation and service instructions in this manual.
- Improper installation, adjustment alteration, service or maintenance can cause serious injury, death or property damages.
- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- WHAT TO DO IF YOU SMELL GAS
  - — Do not try to light any appliance.
  - — Do not touch any electrical switch; do not use any phone in your building.
  - — Leave the building immediately.
  - — Immediately call you gas supplier. Follow the gas supplier's instructions.
  - — If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

DAT heater series modules are a recognized furnace component is design certified by intertek testing services (ETL) for outdoor installation and installation downstream from refrigeration systems in cabinet applications.

This furnace must be installed in the designated non-combustible heat chamber of the cabinet. If it is removed, it is only to be replaced with an approved Original Manufacture Equipment Supplier furnace(s), installed and operated as specified by the approved Original Manufacture Equipment Supplier. It is not designed to have any portion of the heat exchanger outside the cabinet in which the furnace module is housed.

The Rating Plate/Name Plate has been permanently attached to the furnace assembly. It contains information including gas type, maximum and minimum input rating, manifold pressure, maximum and minimum inlet gas pressure, maximum and minimum airflow requirements, output capacity and electrical rating for the furnace. The plate also includes model number, serial number and scan code. This plate is to always remain attached to the furnace.

This furnace must be applied in accordance with the requirements of its listing.

Hooded and screened openings for combustion air have been provided in the furnace(s) access door. The air opening provides unrestricted combustion air to the burners and sized such that a minimum free area is maintained. The minimum free area is defined as 1 in2 (625mm2) per 4000 BTUH (2.345 kW).

The access door provides direct access to the furnace vestibule where the burners, combustion inducer fan, ignition controls and ignition safeties are housed.

The vent discharge is sized such that it is equal to or larger than the discharge area of the combustion exhaust inducer fan.

A non-adjustable High Limit Switch will shut off the gas supply to the main burners should the outlet air reach a temperature exceed 250°F (121°C).

The cabinet supply air flow delivery package has been designed to provide sufficiently well distributed air flow across the heat exchanger to limit temperature rise as follows:

- Aluminized Steel: 1030°F (575°C)
- 409 Stainless Steel: 1080°F (600°C)

Clearance from combustibles to be no less than as listed below:

- Sides and back . . . . . 6 in. (152 mm)
- Bottom . . . . . 2 in. (51 mm)
- Top . . . . . 6 in. (152 mm)
- Front. . . . . 36 in. (914 mm)
- Vent pipe to any combustible surface . . . . 6 in. (152 mm)

Do not use this package heater if any part has been under water. Immediately call a qualified service technician to inspect the heater and any gas control which has been under water.

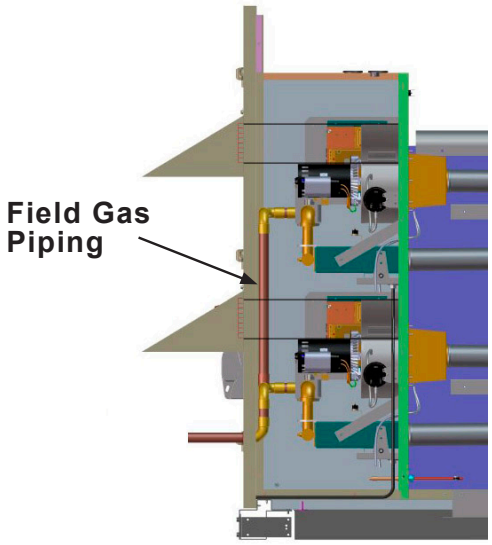
Gas Furnace Design

If the 8th digit in the model number is a “G”, the rooftop unit was furnished with a factory installed furnace (Example, MPS035FG). The Maverick commercial rooftop units are available with either the low heat input or the high heat input furnace (see capacities in Table 15). This packaged gas heat rooftop unit is designed for outdoor non-residential installations only.

The gas heat furnace design consists of a tubular heat exchanger, in-shot burner manifold with gas valve, induced combustion blower, gas heat DDC control module and all operational safeties. The tubular heat exchanger can come with the standard aluminized steel construction or the optional stainless steel construction. The safety switches include a high-limit temperature switch, an auxiliary high-limit switch, a combustion blower proof of airflow, and the flame roll-out switch (see Figure 20).

The high limit switch is an automatic reset switch and it opens up at 160°F to shut the furnace down and closes at 130°F. The auxiliary limit switch is a manual reset and opens up at 180°F to shut the furnace down.

Figure 19: Gas Heat Section



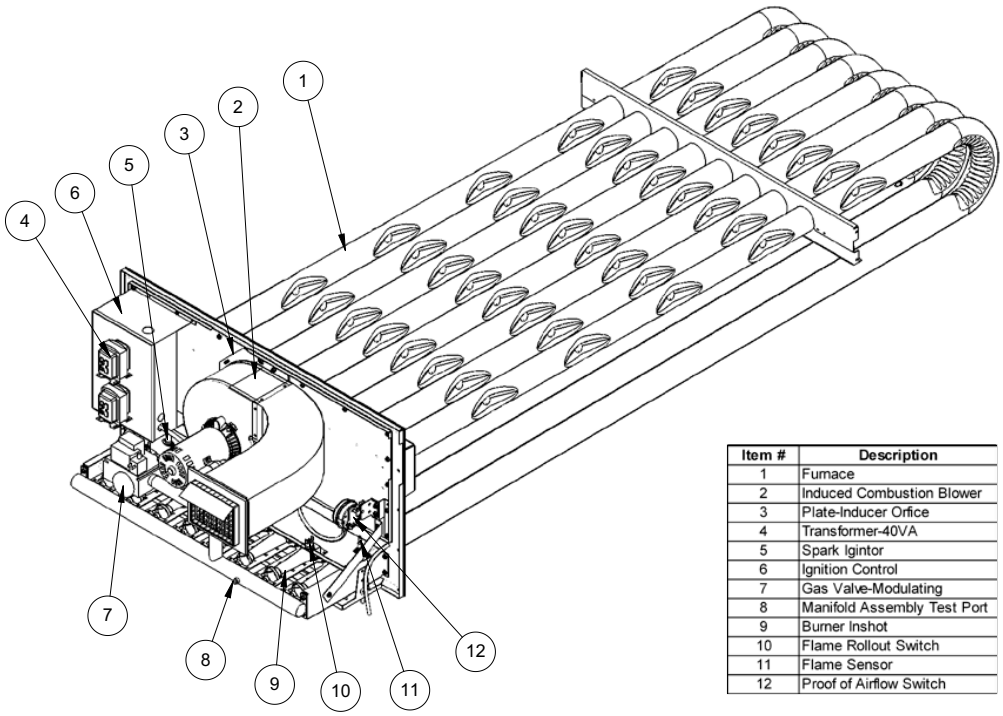
Gas Heating Capacity Data

Table 15: MPS 015F – 050F Gas Heating Capacities

Data	Unit Size					
	015–020		026–035		040–050	
	Low Heat	High Heat	Low Heat	High Heat	Low Heat	High Heat
Heating Input (MBh)	240	480	300	600	400	800
Heating Output (MBh)	192	384	240	480	320	640
Steady State Efficiency	80%	80%	80%	80%	80%	80%
Number of Stages	2	4	2	4	2	4
Turndown[1]	4:1	8:1	4:1	8:1	4:1	8:1
Minimum Airflow	2960	5920	3700	7400	4900	9800
Maximum Temperature Rise	60°F	100°F	60°F	85°F	60°F	85°F
Gas Main Pressure						
Natural Gas (in. wc)	7-14	7-14	7-14	7-14	7-14	7-14
Liquid Propane (in. wc)	12-14	12-14	12-14	12-14	12-14	12-14
Manifold Pressure						
Natural Gas (per gas valve)						
Stage 1 (in. wc)	1.2	1.2	1.2	1.2	1.2	1.2
Stage 2 (in. wc)	3.2	3.2	3.2	3.2	3.2	3.2
Low fire[2]	0.4	0.4	0.4	0.4	0.4	0.4
Propane						
Stage 1 (in. wc)	2.3	2.3	2.3	2.3	2.3	2.3
Stage 2 (in. wc)	10.0	10.0	10.0	10.0	10.0	10.0
Low fire[2]	N/A					

Note:
1 Modulating gas heat only.
2 Modulating gas heat not available with propane.

Figure 20: Staged Furnace Assembly



Item #	Description
1	Furnace
2	Induced Combustion Blower
3	Plate-Inducer Orfice
4	Transformer-40VA
5	Spark Igintor
6	Ignition Control
7	Gas Valve-Modulating
8	Manifold Assembly Test Port
9	Burner Inshot
10	Flame Rollout Switch
11	Flame Sensor
12	Proof of Airflow Switch

Warranty Exclusion

Warranty is void if the furnace is operated in the presence of chlorinated vapors, if the airflow through the furnace is not in accordance with rating plate, or if the wiring or controls have been modified or tampered with.

⚠ WARNING

Hot surface hazard. Can cause severe equipment damage, personal injury, or death. Allow burner assembly to cool before servicing equipment.

⚠ WARNING

Units equipped with gas heating must not be operated in an atmosphere contaminated with chemicals which will corrode the unit such as halogenated hydrocarbons, chlorine, cleaning solvents, refrigerants, swimming pool exhaust, etc. Exposure to these compounds may cause severe damage to the gas furnace and result in improper or dangerous operation. Operation of the gas furnace in such a contaminated atmosphere constitutes product abuse and will void all warranty coverage by the manufacturer. Questions regarding specific contaminants should be referred to your local gas utility.

Ventilation & Flue Pipe Requirements

The Daikin rooftop unit is equipped with an outdoor air hood to supply adequate combustion air. The unit also has a flue outlet assembly and requires no additional chimney, flue pipe, Breidert cap, draft inducer, etc.

Factory Checkout

This complete furnace was fired and tested at the factory. The unit was fired through several complete sequences of start-up through shutoff to check operation. A check was made of the air switch, gas pressure switch, high limit operation.

This checkout normally eliminates on-the-job start-up problems; however, the equipment is subject to variable job conditions and shipping shocks can change adjustments, cause damage, and loosen connections and fasteners. Therefore, it is necessary to go through the complete start-up procedure even though the unit may appear to be operating properly.

Installation

IMPORTANT

This furnace must be installed by an experienced professional installation company that employs fully trained and experienced technicians. Install the furnace in accordance with the manufacturer's instructions and local codes. In the absence of local codes, follow the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or the CSA B149.1, Natural Gas and Propane Installation Code.

WARNING

Sharp edges hazard. Can cause personal injury or death. Sheet metal parts, self-tapping screws, clips, and similar itemsinherently have sharp edges, and it is necessary that theinstaller exercise caution when handling these items.

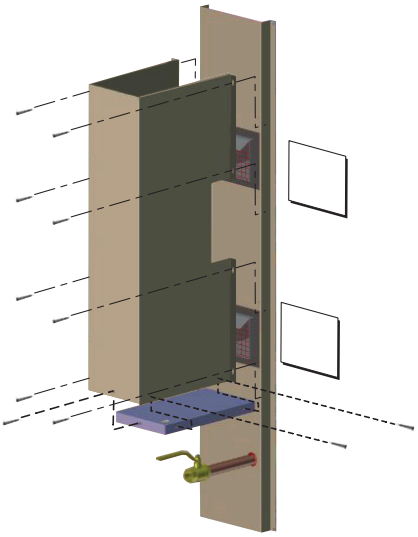
Flue Box

The flue box (Figure 21) is not installed at the factory because it would increase the width of the unit beyond the allowable shipping width.

The flue box must be installed over the combustion exhaust openings. All holes are prepunched, the fasteners are furnished and everything is shipped inside the fan section.

1. Remove and discard the shipping covers.
2. Position the flue box over the exhaust openings.
3. Line assembly holes up.
4. Install screws to fasten the flue box to the side of the unit.

Figure 21: Flue Box Installation



Outdoor Air (OA) Hood

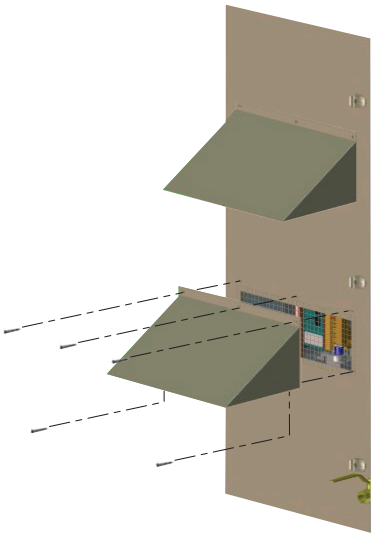
The OA hood (Figure 22) is not installed at the factory becauseit would increase the width of the unit beyond the allowableshipping width. The hood is shipped in a box in the fansection.

The OA hoods must be installed over the outdoor air openings.

1. Remove and discard the shipping covers.
2. Position the hood over the OA openings.
3. Line assembly holes up.
4. Install screws to fasten the OA hood.

The OA hoods must be installed before the furnace is operated.

Figure 22: Outdoor Air (OA) Hood Installation



Electrical

The Daikin burner receives its electrical power from the main unit control panel. No additional power wiring must be routed to the burner. The sequencing of the burner is also controlled through this panel and therefore is factory wired. No additional wiring will be required.

⚠ DANGER

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

What to do if you smell gas:

- Do not try to light any appliance.
- Do not touch any electric switch, do not use any phone in your building.
- Immediately call your gas supplier from a phone in a neighboring building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

Gas Pressure Requirements

The pressure furnished to the main gas valve must not exceed 13.9" wc. When the supply pressure is above 13.9" wc, a high pressure regulator must precede the appliance gas pressure regulator. The inlet gas pressure must not exceed the maximum pressure rating of the high pressure regulator, and the outlet pressure must furnish gas to the appliance pressure regulator within the pressure range mentioned above.

Gas Piping

Gas piping must be sized to provide the minimum required pressure at the burner when the burner is operating at maximum input. Consult your local utility on any questions on gas pressure available, allowing piping pressure drops, and local piping requirements.

Install all piping in accordance with the National Fuel Gas Code (ANSI Z223.1), (NFPA 54-1999) and any applicable local codes.

The weight of the field-supplied gas pipe must be supported by field-installed brackets or hangers.

The proper size piping must be run from the meter to the gas burner without reductions. Undersized piping will result in inadequate pressure at the burner. The pressure will be at its lowest when it is needed the most, at times of maximum demand. Therefore, it can cause intermittent hard-to-find problems because the problem may have left before the service technician has arrived. Avoid the use of bushings wherever possible.

Remove all burrs and obstructions from pipe. Do not bend pipe; use elbows or other pipe fittings to properly locate pipe.

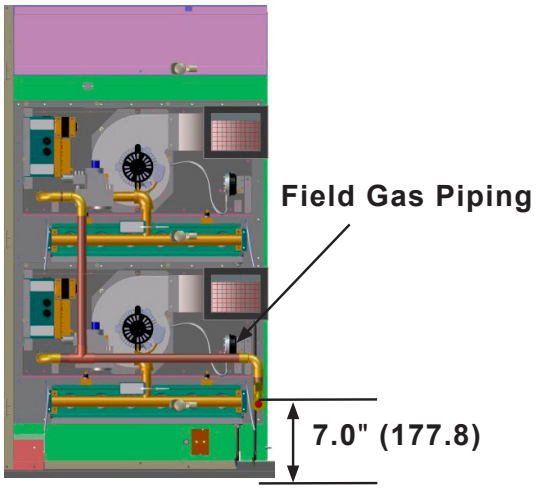
A drip leg and a manual shut-off must be installed in the vertical line before each burner such that it will not freeze. Install unions so gas train components can be removed for service. All pipe threads must have a pipe dope which is resistant to the action of LP gas. After installation, pressurize the piping as required and test all joints for tightness with a rich soap solution. Any bubbling is considered a leak and must be eliminated. Do not use a match or flame to locate leaks.

Gas Piping Routing Into Unit

On-The-Roof Piping

1. Remove knockout on upright (refer to Figure 23).
2. Route gas supply pipe through hole. Carefully plan pipe route and fitting locations to avoid interference with swinging of doors, etc.

Figure 23: Piping Schematic



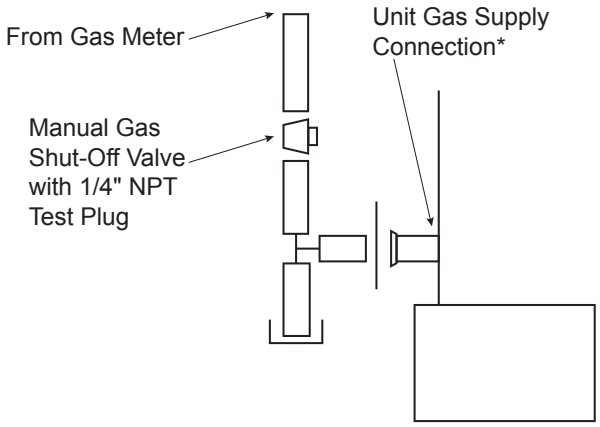
Field Gas Heat Connections

The appliance must be isolated from the gas supply system by closing off the manual shut off valve during any pressure testing less than 0.5 psi (3.5 kPa) of the gas supply piping system.

The appliance and its individual shut-off valve must be disconnected from the gas supply system during any pressure testing greater than or equal to 0.5 psi (3.5 kPa).

Regulator to be sized for the maximum total Btu input required for the heater(s).

Figure 24: Field Gas Heat Connections



* Factory-supplied grommet must be utilized

Altitude Conversion

For elevations up to 2000 feet, rating plate input ratings apply. For high altitudes (elevations over 2000 ft) contact Daikin Applied Parts. See Table 16 for part numbers. Or contact local gas supplier to confirm gas heating value has been devalued for applicable elevations.

Table 16: Furnace Identification for Altitude

Elevation (ft.)	Part Number
Natural Gas Fired Furnace with 50 MBH Burners	
2000–2999	910166410
3000–3999	910166411
4000–4999	910166412
5000–5999	910166413
6000–6999	910166415
Natural Gas Fired Furnace with 45 MBH Burners	
2000–2999	910166412
3000–3999	910166416
4000–4999	910166417
5000–5999	910166415
6000–6999	910166418
LPG Gas Fired Furnace with 50 MBH Burners	
2000–2999	910166419
3000–3999	910166420
4000–4999	910166421
5000–5999	910166422
6000–6999	910166424
LPG Gas Fired Furnace with 45 MBH Burners	
2000–2999	910166425
3000–3999	910166422
4000–4999	910166427
5000–5999	910166428
6000–6999	910166429

Gas Pipe Manifold Pressure Adjustment for Natural Gas Fuel

For Two Stage Furnace

1. Read gas pressure at the Inlet Pressure Tap of the Honeywell VR8305Q Gas Safety Control Valve (Figure 25) and confirm pressure is at 7.0" wc. Adjust upstream pressure reducing gas regulator as required to obtain 7.0" wc gas pressure.
2. The gas pipe manifold pressure for high fire (stage #2) should be set at 3.2" wc. Adjust the High Pressure Adjustment Honeywell VR8305Q Gas Safety Control Valve (Figure 25) as required. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.
3. The gas pipe manifold pressure for low fire (stage #1) should be set at 0.8" wc. Adjust the Low Pressure Adjustment Honeywell VR8305Q Gas Safety Control Valve (Figure 25) as required. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.

For Modulating Furnace:

1. Read gas pressure at the Inlet Pressure Tap of the Honeywell VR8305Q Gas Safety Control Valve (Figure 25) and confirm pressure is at 7.0" wc. Adjust upstream pressure reducing gas regulator as required to obtain 7.0" wc gas pressure.
2. The gas pipe manifold pressure for high fire should be set at 3.2" wc. Adjust the High Pressure Adjustment on the Honeywell VR8305Q Gas Safety Control Valve (Figure 25) as required. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.
3. The gas pipe manifold pressure for low fire (stage #1) should be set at 0.25" wc.

   Adjust the Low Pressure Adjustment on the Honeywell VR8305Q Gas Safety Control Valve (Figure 25) as required until pressure at the Honeywell VR8305Q Gas Safety Control Valve Outlet Pressure Tap reads 0.25" wc. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.

   Adjust the Maxitrol M520B Modulating Valve (Figure 26) Low Flow Adjustment screw until the gas pipe manifold pressure reads 0.25" w.c.

Figure 25: Honeywell VR8305Q Gas Safety Control Valve

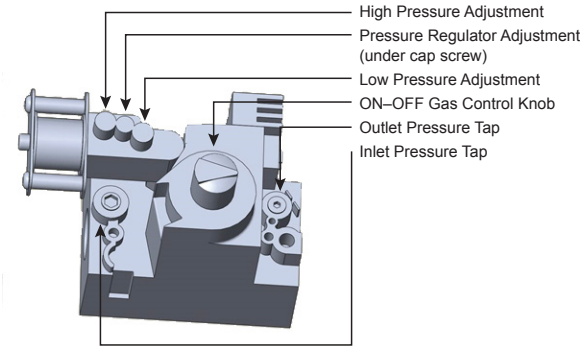
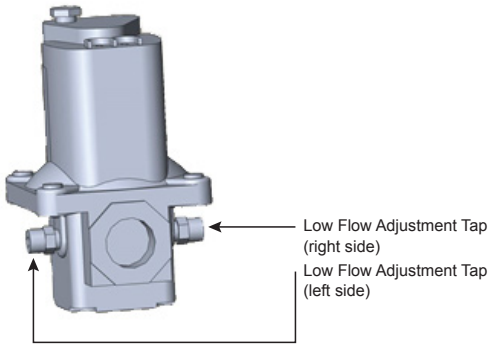


Figure 26: Maxitrol M520B Modulating Valve



Gas Pipe Manifold Pressure Adjustment for Propane Gas Fuel:

For Two Stage Furnace:

1. Read gas pressure at the Inlet Pressure Tap of the Honeywell VR8305Q Gas Safety Control Valve (Figure 25) and confirm pressure is at 11.0" wc. Adjust upstream pressure reducing gas regulator as required to obtain 11.0" wc gas pressure.
2. The gas pipe manifold pressure for high fire (stage #2) should be set at 8.2" wc. Adjust the High Pressure Adjustment Honeywell VR8305Q Gas Safety Control Valve (Figure 25) as required. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.
3. The gas pipe manifold pressure for low fire (stage #1) should be set at 2.05" wc. Adjust the Low Pressure Adjustment Honeywell VR8305Q Gas Safety Control Valve (Figure 25) as required. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.

For Modulating Furnace:

1. Read gas pressure at the Inlet Pressure Tap of the Honeywell VR8305Q Gas Safety Control Valve (Figure 25) and confirm pressure is at 11.0" wc. Adjust upstream pressure reducing gas regulator as required to obtain 11.0" wc gas pressure.
2. The gas pipe manifold pressure for high fire should be set at 8.2" wc. Adjust the High Pressure Adjustment on the Honeywell VR8305Q Gas Safety Control Valve (Figure 25) as required. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.
3. The gas pipe manifold pressure for low fire (stage #1) should be set at 0.51" wc.

   Adjust the Low Pressure Adjustment on the Honeywell VR8305Q Gas Safety Control Valve (Figure 25) as required until pressure at the Honeywell VR8305Q Gas Safety Control Valve Outlet Pressure Tap reads 0.51" wc. Screwing the adjustment clockwise will increase pressure; counter clockwise will decrease pressure.

   Adjust the Maxitrol M520B Modulating Valve (Figure 26) Low Flow Adjustment screw until the gas pipe manifold pressure reads 0.51" w.c.

Figure 27: Capacity of Pipe Natural Gas (CFH)

With Pressure Drop of 0.3" W.C. & Specific Gravity of 0.60									
Pipe Length (ft)	Pipe Size-inches (Ips)								
	½	¾	1	1¼	1½	2	2½	3	4
10	132	278	520	1050	1600	2050	4800	8500	17500
20	92	190	350	730	1100	2100	3300	5900	12000
30	73	152	285	590	890	1650	2700	4700	9700
40	63	130	245	500	760	1450	2300	4100	8300
50	56	115	215	440	670	1270	2000	3600	7400
60	50	105	195	400	610	1150	1850	3250	6800
70	46	96	180	370	560	1050	1700	3000	6200
80	53	90	170	350	530	990	1600	2800	5800
90	40	84	160	320	490	930	1500	2600	5400
100	38	79	150	305	460	870	1400	2500	5100
125	34	72	130	275	410	780	1250	2200	4500
150	31	64	120	250	380	710	1130	2000	4100
175	28	59	110	225	350	650	1050	1850	3800
200	26	55	100	210	320	610	980	1700	3500

NOTE: Use multiplier below for other gravities and pressure drops.

Table 17: Specific Gravity Other Than 0.60

Specific Gravity	Multiplier
0.50	1.100
0.60	1.000
0.70	0.936
0.80	0.867
0.90	0.816
1.00	0.775
Propane-Air	
1.10	0.740
Propane	
1.55	0.622
Butane	
2.00	0.547

Table 18: Pressure Drop Other Than 0.3"

Pressure Drop	Multiplier	Pressure	Multiplier
0.1	0.577	1.0	1.83
0.2	0.815	2.0	2.58
0.3	1.000	3.0	3.16
0.4	1.16	4.0	3.65
0.6	1.42	6.0	4.47
0.8	1.64	8.0	5.15

Sequence of Operation (Staged Control)

Low Heat Option (2 Stage Control)

The following details the sequence of operation for the low heat option.

1. Unit DDC control calls for heat.
2. Furnace DDC control module receives a call for heat.
3. High limit switch is checked for safe condition.
4. Proof of airflow switch is check for combustion airflow.
5. 60 second prepurge cycle starts.
6. Spark ignitor is activated for 3 seconds.
7. Gas valve receives a command for stage 1 of heat.
8. Burner is ignited.
9. Unit DDC controller calls for stage 2 of heat.
10. Furnace DDC controller receives a stage 2 heat command.
11. Gas valve receives a command for stage 2 of heat.

High Heat Option (4 Stage Control)

For a unit with the optional high heat the above sequence is followed for the first two stages.

For the remaining 2 stages the above procedure is repeated on the second furnace module.

Sequence of Operation (Modulating Burner)

Low Heat Option with Modulation

The following details the sequence of operation for the low heat option.

1. Unit DDC controller calls for heat.
2. Furnace DDC control module receives a call for heat.
3. Furnace safety switches and DDC control are checked for safe conditions.
4. 45 second prepurge cycle starts. Proof of airflow switch is checked for combustion airflows.
5. Spark ignitor is activated.
6. Gas valve receives a signal to open fully.
7. Burner is ignited and runs for 20 seconds in high fire.

NOTE: If call for heat is interrupted during this timing, the furnace will be locked in for the 20 seconds cycle.

8. Gas valve and induction blower motor receives a signal to modulate burner output to match the unit discharge air temperature setting.

High Heat Option with Modulation

The following details the sequence of operation for the high heat option. This option includes dual burners with one being modulating and the other being 2 stage control.

1. Unit DDC controller calls for heat.
2. Top Furnace DDC control module receives a call for heat.
3. High limit switch is checked for safe condition.
4. Proof of airflow switch is checked for combustion airflow.
5. 45 second prepurge cycle starts.
6. Spark ignitor is activated.
7. Gas valve receives a signal to open fully.
8. Burner is ignited and runs for 30 seconds in high fire
9. Modulating burner gas valve and induction blower motor receives a signal to modulate burner output to match the unit discharge air temperature setting.
10. If modulating burner is unable to meet discharge temperature set point, furnace DDC control calls for third stage of heating. The top furnace is reduced to low (50%) fire. The bottom furnace is sequenced on per stage furnaces sequence of operation (steps 2 - 8).
11. Staged burner gas valve receives a signal to open to 50%.
12. Modulating burner gas valve and induction blower motor receives a signal to modulate burner output to match the unit discharge air temperature setting.
13. If stage 3 and modulating furnace is unable to meet discharge temperature setpoint, furnace DDC controller calls for stage 4 heat. The bottom furnace will stage up to high fire and the modulating furnace will reduce to 50% operation.
14. Staged burner gas valve receives a signal to open fully.
15. Modulating furnace's gas valve and induction blower motor receives a signal to modulate burner output to match the unit discharge air temperature setting.

Start-Up Procedures

Start-up and service of this equipment must be performed by trained and experienced technicians. It is highly recommended that the initial start-up and future service be performed by Daikin trained technicians who are familiar with working on live equipment. A representative of the owner or the operator of the equipment should be present during start-up to receive instructions in the operation, care and adjustment of the unit.

⚠ WARNING

Overheating or failure of the gas supply to shut off can cause equipment damage, severe personal injury or death. Turn off the manual gas valve to the appliance before shutting off the electrical supply.

⚠ DANGER

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

What to do if you smell gas:

- Do not try to light any appliance.
- Do not touch any electric switch, do not use any phone in your building.
- Immediately call your gas supplier from a phone in a neighboring building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

Start-Up Responsibility

The start-up organization is responsible for determining that the furnace, as installed and as applied, will operate within the limits specified on the furnace rating plate.

1. The furnace must not operate at an airflow below the specified Minimum Airflow CFM (refer to Table 15 on page 23). On variable air volume systems it must be determined that the furnace will not be operated if or when system cfm is reduced below the specified minimum airflow cfm.
2. It must be established that the gas supply is within the proper pressure range (refer to Table 15 on page 23).

Operating Procedures

Before Start-Up

1. Notify inspectors or representatives who may be required to be present during start-up of gas fuel equipment. These could include the gas utility company, city gas inspectors, heating inspectors, etc.
2. Review the equipment and service literature and become familiar with the location and purpose of the furnace controls. Determine where the gas and power can be turned off at the unit and before the unit.
3. Determine that power is connected to the unit and available.
4. Determine that the gas piping, meter, and service regulator have been installed, tested, and meet the equipment requirements.
5. Determine that proper instruments will be available for the start-up. A proper start-up requires the following: voltmeter, manometer or gauges with ranges for both manifold pressure and inlet gas pressure.

Start-Up Preliminary

Close gas main.

1. Check the burner fan wheel for binding, rubbing, or loose setscrews.
2. Check power.
3. Purge the gas lines.
4. Leak check. Using a rich soap-water mixture and a brush, check the gas lines for leaks. Correct all leaks before starting furnace.

Start-Up

1. Set the thermostat to the lowest setting.
2. Turn off all electric power to the appliance.
3. This appliance is equipped with an ignition device which automatically lights the burner. Do NOT try to light the pilot by hand.
4. Open the control access panel.
5. Turn the gas control clockwise to “OFF”.
6. Wait five (5) minutes to clear out any gas. Then, smell for gas, including near the floor. If you smell gas, STOP! Follow step “B” in the DANGER label on this page. If you don't smell gas, proceed to the next step.
7. Turn the gas control counter-clockwise to “ON”.
8. Close the control access panel.
9. Turn on all electric power to the appliance.
10. Set thermostat to desired setting.
11. If the furnace will not operate, refer to Turning off Gas to the Unit, and call your service technician or gas supplier.

Turning off Gas to the Unit

1. Set the thermostat to the lowest setting.
2. Turn off all electrical power to the appliance if service is to be performed.
3. Open the control access panel.
4. Turn the gas control knob clockwise to “OFF”. Do not force.
5. Close the control access panel.

Service

The furnace DDC controller has diagnostic information for troubleshooting the furnace operation. The ignition control module has a LED light that will flash when an abnormal condition occurs. See Table 19 and Table 21 for an explanation of the diagnostic information.

Maintenance

Planned maintenance is the best way to avoid unnecessary expense and inconvenience. Have this system inspected at regular intervals by a trained and experienced service technician. The following service intervals are typical for average situations but will have to be adjusted to suit your particular circumstances.

Fuel pressure settings and control settings should be made only by persons thoroughly experienced with the burner and control system, and must not be tampered with by persons without such experience.

Always replace covers on burner controls and boxes as the electrical contacts are sensitive to dust and dirt. Perform maintenance of controls, gas valves, and other components in accordance with instructions contained in the manufacturer's bulletins.

Monthly

Check air filters and replace if dirty.

Twice Yearly

Burner Air - Check burner fan wheel for dirt buildup and lint. Check combustion air intake louver and flue box for dirt buildup and accumulation of windborne debris.

Cleaning - Inspect flue tubes and combustion chamber, cleaning as required. Keep burner vestibule clean. Dirt and debris can result in burner air blockages.

Yearly

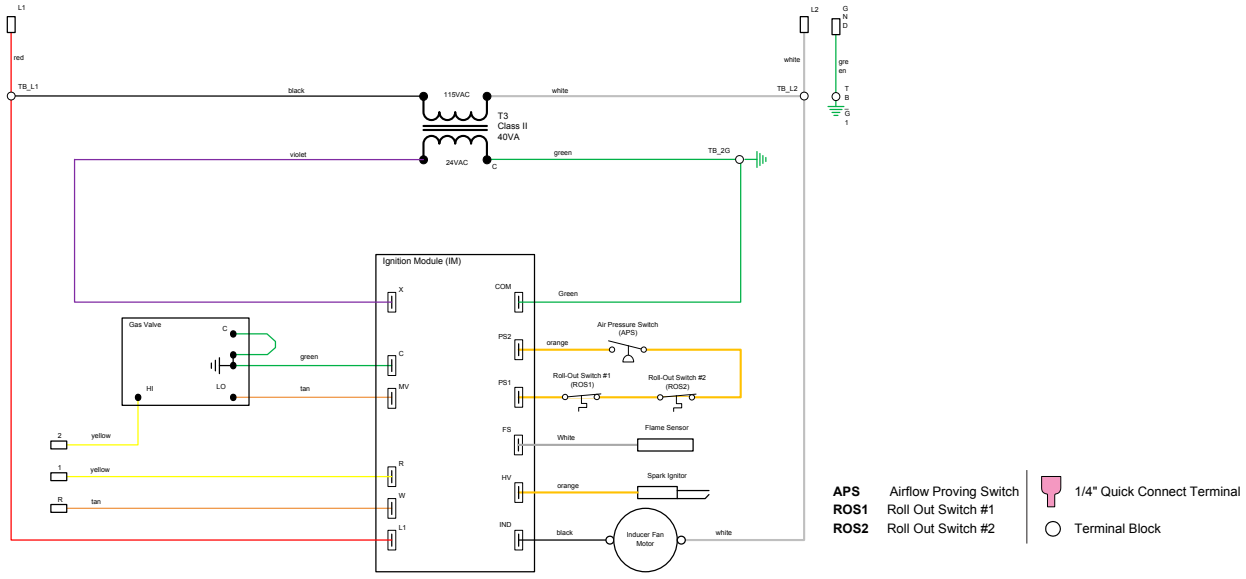
Heater and Ventilating systems - Inspected by a qualified service agency once a year.

Gas Train - Check all valves, piping and connections for leakage. Inspect and clean flame rod, ignition electrode, and burner manifold.

Condensate Pan/Drain/P-Trap - Check pan, drain, and p-trap.

Ignition Control Module for Staged Gas Furnace

Figure 28: Typical Staged Gas Furnace Electrical Schematic with Sensor



Ignition Control Module LED Diagnostics

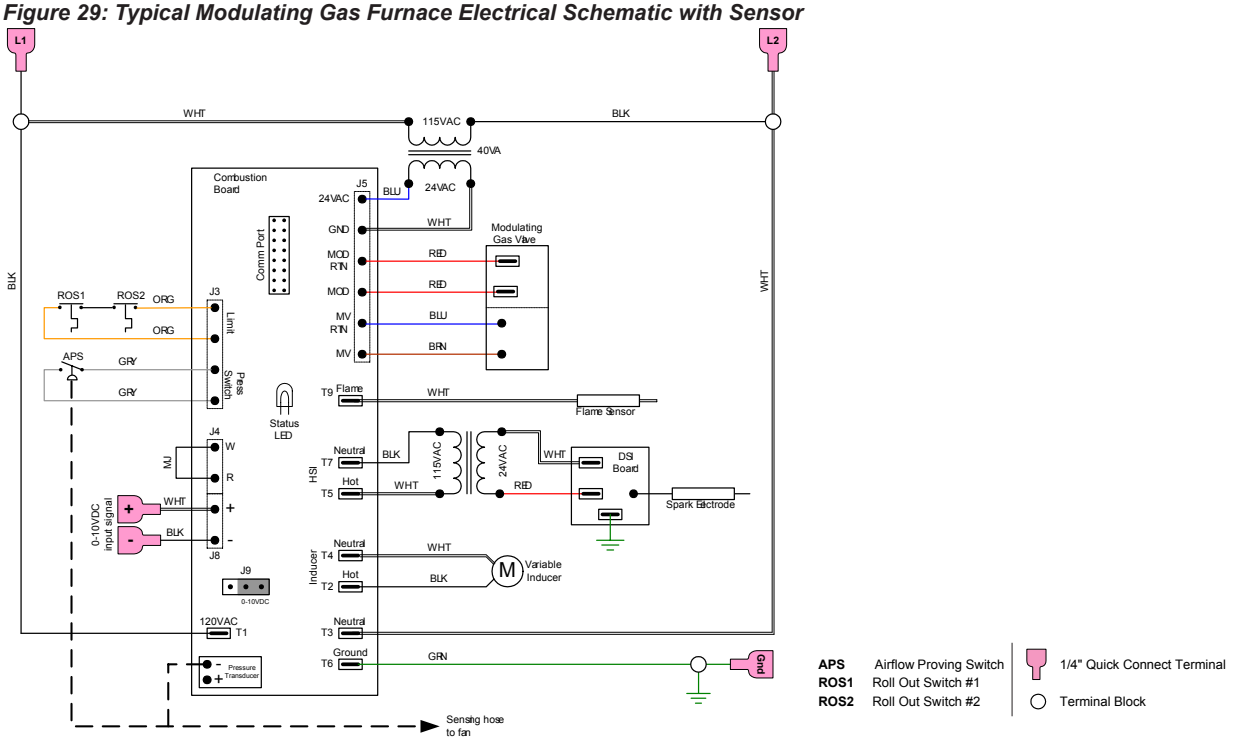
The LED indicators (Table 19) can be used to diagnose faults associated with the staged gas furnace.

Table 19: Staged Ignition Control Troubleshooting Guide (UTEC 1016 Ignition Board)

LED Indicator	System Status	Fault Description	Possible Causes and Corrective Action
Steady ON	System Normal	N/A	**Power applied, control OK**
LED OFF	Lockout	LED is OFF	**No power or control hardware fault** 1. Check 120V is being supplied to heater transformer. 2. Check that 24 VAC is being supplied by transformer. Replace transformer if not being supplied 24 VAC.
1 Flashes	Lockout	Combustion air pressure switch contact is open with inducer fan running.	**Combustion fan motor energized, pressure switch open** 1. Check air pressure switch hose and hose connection between switch and fan. 2. Check reset switch is not tripped for rollout switch(s). 3. Check high limit switch is not open. 4. Replace pressure switch if contact does not close when fan is running.
2 Flashes	Lockout	Combustion air pressure switch contact is closed when inducer fan is not running.	**Combustion fan motor OFF, pressure switch closed** 1. Check wiring between PS1 and PS2 on ignition control board for correct connection and proper wiring. 2. Check pressure switch functions correctly with and without pressure. 3. Replace pressure switch if fails to function correctly.
3 Flashes	Lockout	Ignition locked out from too many ignition attempts	**Ignition lockout from too many trials** 1. Verify gas supply is present. 2. Verify gas safety valve is working correctly. 3. Verify gas manifold pressure is adequate and correct. 4. Check spark igniter is not cracked or dirty. Check spark igniter wire is not covered with oil and debris or cracked. Check wire is connected correctly. 5. Check flame sensor wiring. Check to see if flame sensor is grounded.
4 Flashes	Lockout	Ignition lockout from too many flame losses within a single heat.	**Ignition lockout from too many flame losses within single call for heat** 1. Check pressure switch hose for leaks or poor connection 2. Check for condensate in pressure switch hose. 3. Check pressure tap on combustion blower and combustion pressure switch for blockage. 4. Check functionality of combustion inducer fan.
5 Flashes	Lockout	Control hardware fault detected	**Control hardware fault detected** 1. Change ignition board.

Ignition Control Module for Modulating Gas Furnace (240 MBH Furnace Only)

Figure 29: Typical Modulating Gas Furnace Electrical Schematic with Sensor



Variable Furnace Controller

Daikin's furnace controller is an electronic device that delivers full control of the modulating furnace. Control includes sequencing, ignition, safety, modulation of the control valve, and the induced draft motor. Inputs to the furnace control board are an a 0-10V signal. The analog signal will modulate the burner down to 25% of full load. Safety inputs include pressure line and electrical connection from the airflow proofing switch and electrical connection from the rollout switches. Control board outputs are to the igniter board, modulating gas valve, and to the induce draft motor.

Ignition Control Module LED Diagnostics

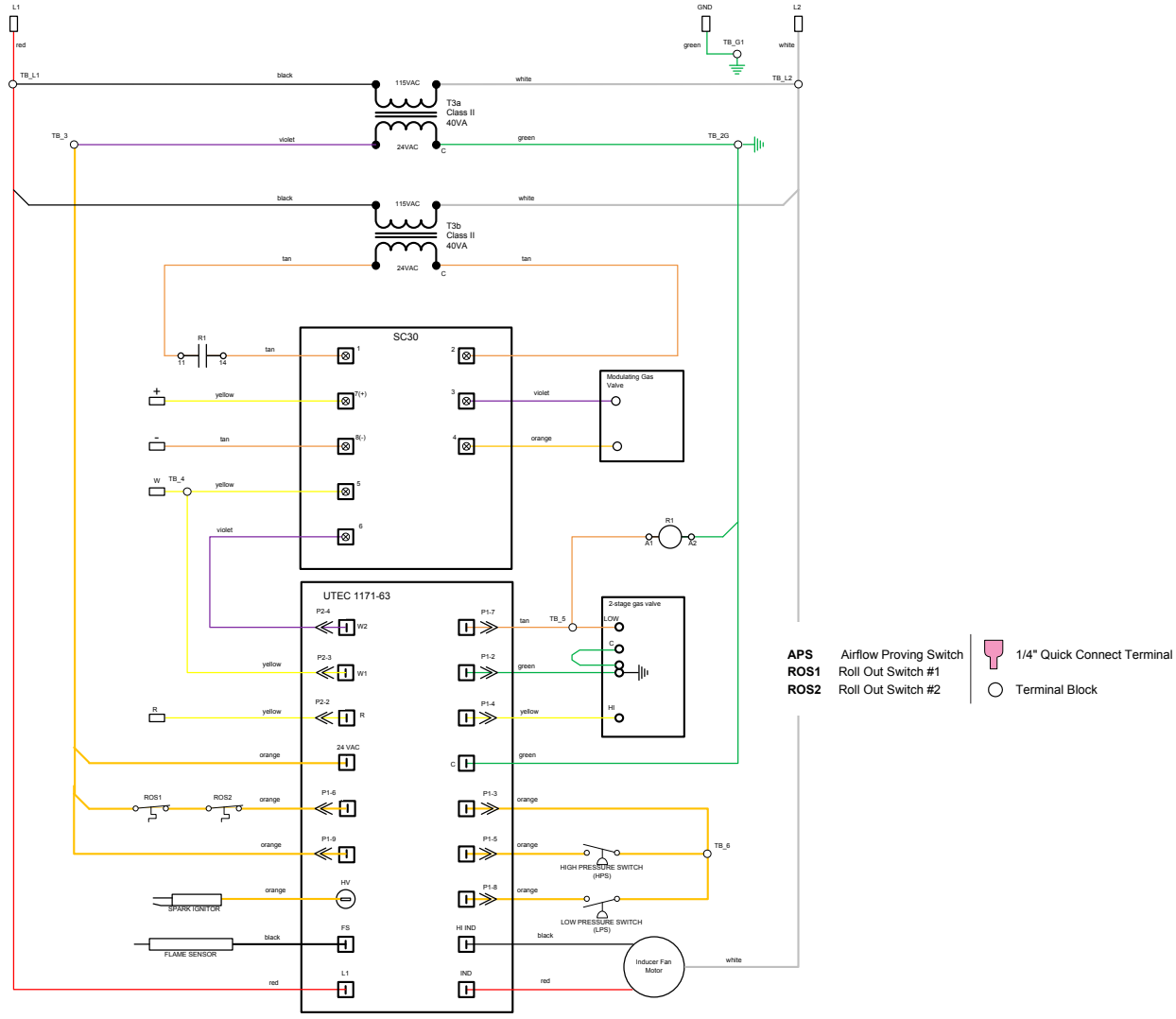
The LED indicators (Table 20) can be used to diagnose faults associated with the modulating gas furnace.

Table 20: LED Indicator and Fault Conditions

Indicator	Fault Condition
Steady Off	No power or control hardware fault Indicator Fault Condition
Steady On	Control fault detected or no 24 VAC power
1 Flash	Combustion fan motor energized, pressure switch open
2 Flashes	Inducer air pressure reads above zero level when the inducer is off
3 Flashes	Flame is on when is should be off or flame is off when it should be on
4 Flashes	Gas valve is on when is should be off or gas valve is off when it should be on
5 Flashes	Safety relay is on when it should be off or safety relay is off when it should be on
6 Flashes	Excessive plenum temperature
7 Flashes	High limit switch is open or fuse is open
8 Flashes	Pressure switch failed to operate or modulation current is incorrect
Slow Flash	Normal operation - no call for heat
1 Slow	Flash Call for heat
2 Slow	Flashes Gas on - call for heat
3 Slow	Flashes Gas on - no call for heat
Rapid Flash	Retry

Ignition Control Module for Modulating Gas Furnace (300 & 400 MBH Furnace Only)

Figure 30: Typical Modulating Gas Furnace Electrical Schematic with Sensor



Variable Furnace Controller

Daikin's furnace controller is an electronic device that delivers full control of the modulating furnace. Control includes sequencing, ignition, safety, modulation of the control valve, and the induced draft motor. Inputs to the furnace control board are an a 0-10V signal. The analog signal will modulate the burner down to 25% of full load. Safety inputs include pressure line and electrical connection from the airflow proofing switch and electrical connection from the rollout switches. Control board outputs are to the igniter board, modulating gas valve, and to the induce draft motor.

Ignition Control Module LED Diagnostics

The LED indicators (Table 21) can be used to diagnose faults associated with the modulating gas furnace.

Table 21: Modulating Ignition Control Troubleshooting Guide (UTEC 1171 Ignition Board)

LED Indicator	System Status	Fault Description	Possible Causes and Corrective Action
Heartbeat	System Normal	N/A	**All conditions are normal**
2 Flashes	Inducer ON No gas	Combustion air flow pressure switch contact is open; combustion inducer fan is running	**Pressure switch open with inducer ON** 1. Combustion air flow pressure switch hose leaking; repair and/or replace 2. Combustion air flow pressure switch hose plugged; repair and/or replace 3. Combustion air flow pressure switch hose fittings plugged or damaged; repair and/or replace 4 Combustion air pressure hose and/or switch has condensate accumulation; repair and/or replace 5. Combustion air pressure switch not functioning; replace 6. Combustion inducer fan not working; repair or replace
3 Flashes	No Flame	Combustion air pressure switch contact is closed when fan is not running.	**Pressure switch close with inducer ON** 1. Check wiring to the combustion air flow pressure switch. 2. Check combustion air flow pressure switch continuity with OHM meter; if not open replace
4 Flashes	Lockout	Failed to ignite after too many failed attempts	**Lockout from too many failed ignition tries** 1. Confirm gas supply available; verify manifold gas pressure is correct. 2. Verify manual gas shut-off valve is open. 3. Verify Gas Safety Control valve is in On position. 4. Confirm that spark is present. If not, check spark igniter for debris between electrodes, cracked ceramic and damaged or disconnected wire connection. Check ignition wire for cracks, coated with oil and debris. 5. Check for air leaks at inducer fan assembly and flue 6. Check for recirculation of exhaust flue gases. 7. If all above condition are OK, replace ignition board
5 Flashes	Lockout	Burners light and then drop out resulting in too many flame failures	**Lockout from too many flame losses** 1. Check flame sensor ceramic is not cracked; check flame rod for being coated with debris and oil. 2. Check flame sensor wire is connected correctly; not cracked, no abrasions and not covered with debris. 3. Check for recirculation of exhaust gases. 4. Check flame stability and proper location from sensor. 5. Check that pressure switch is not dripping due to loss of pressure.
6 Flashes	No Flame	Inducer fan is running on high speed, burners are OFF, high limit is open.	**High temperature switch open** 1. Check temperature rise and air flow over furnace heat exchanger 2. If high limit does not reset, change high limit switch
7 Flashes	No Flame	Rollout switch has tripped open	**Rollout switch open** 1. Check for blockages in exhaust vent assembly 2. Check for air leaks inside the burner compartment 3. Reset the Rollout switch and observe flame for any signs of rollout.
8 Flashes	Lockout	Flame is present without any call for heat	**Flame present with gas OFF** 1. Verify there is no voltage to the gas valve 2. Check gas line pressure making sure it is not higher than allowed by gas valve manufacturer 3. If valve is not energized, check for gas flow. If gas is flowing, replace gas valve; verify line and manifold gas pressure are correct.
9 Flashes	Lockout	Exceeded max limit trips in one call for heat	**Exceeded maximum limit trips in on call for heat (5)**

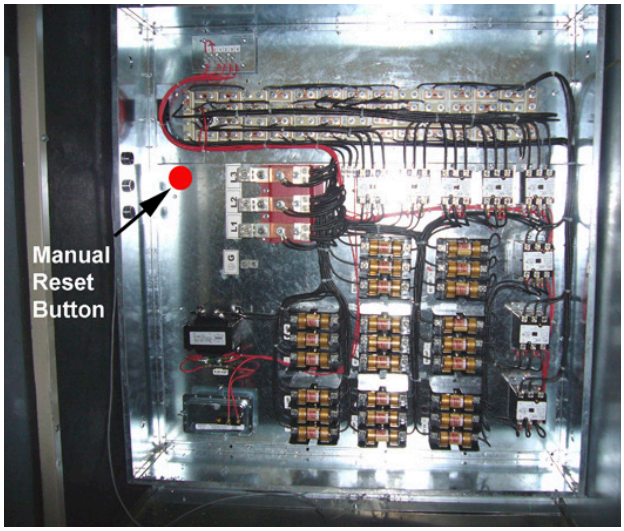
Electric Heater Design

If the 8th digit in the model number is an “E”, the rooftop unit was furnished with a factory installed electric furnace (Example, MPS035FE). The Maverick commercial rooftop units are available with low, medium, or high heat output (see capacities in Table 22). This packaged electric heat rooftop unit is designed for outdoor non-residential installations only.

The electric heat design consists of a heating coil, DDC staging control, and all operational safeties. The safety switches include high-limit temperature switches and individual coil fusing.

The high limit switch is an automatic reset switch. It opens the control circuit and shuts the heater down when the temperature reaches 160°F. The high limit switch closes again allows the heater to run when the temperature gets to 130°F. There is a second level of protection with an auxiliary high limit switch. This switch opens up and shuts the heater down when the temperature reaches 250°F. The auxiliary switch automatically resets again at 220°F. The third level of protection is the secondary auxiliary high limit switch which shut the heater down at 285°F. This switch requires a manual reset.

Figure 31: Electric Heat Section



Electric Heating Capacity Data

Table 22: MPS 015 – 050 Electric Heating Capacities

Tons	Nom cfm	Stages	Low				Medium				High			
			kW	Min cfm	MBh	Delta T*	kW	Min cfm	MBh	Delta T*	kW	Min cfm	MBh	Delta T*
15	6000	4	18	950	61	9.5	36	1900	123	19.0	72	3800	246	38.0
17	6800	4	18	950	61	8.4	36	1900	123	16.7	72	3800	246	33.5
20	8000	4	36	1900	123	14.2	72	3800	246	28.5	90	4740	307	35.5
26	10,000	4	54	2900	184	16.9	72	3800	246	25.5	90	4800	307	31.4
30	12,000	4	54	2900	184	14.2	72	3800	246	19.0	90	4800	307	23.7
35	14,000	4	54	2900	184	12.2	72	3800	246	16.3	90	4800	307	20.3
40	16,000	4	72	3800	246	14.2	90	4800	307	17.8	108	5700	369	21.3
50	20,000	4	72	3800	246	11.4	90	4800	307	14.2	108	5700	369	17.1

* Temperature rise is calculated at nominal cfm

Electric Heater Data

Table 23: MPS 015 – 050 Electric Heater Data (Maximum Temp. 60°F)

kW	Voltage	Amps
18	208	50
	230	45
	460	23
	575	18
36	208	100
	230	90
	460	45
	575	36
54	208	150
	230	136
	460	68
	575	54

kW	Voltage	Amps
72	208	200
	230	181
	460	90
	575	72
90	208	250
	230	226
	460	113
	575	90
108	460	136
	575	108

Modulating Hot Gas Reheat

The reheat coil option comes complete with an aluminum micro channel coil and modulating hot gas valves for leaving air temperature control.

On a call for dehumidification, the unit will enable the supply to be over-cooled by the DX coil. Hot gas from the unit condenser will be routed to an indoor coil downstream of the DX coil to reheat the air. Hot gas reheat valves will control how much hot gas is routed to the indoor coil to maintain a discharge air setpoint (Figure 33).

Figure 32: Ideal for Neutral Air Ventilation Control

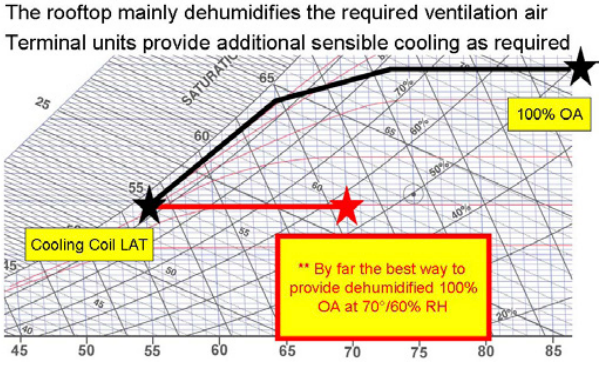
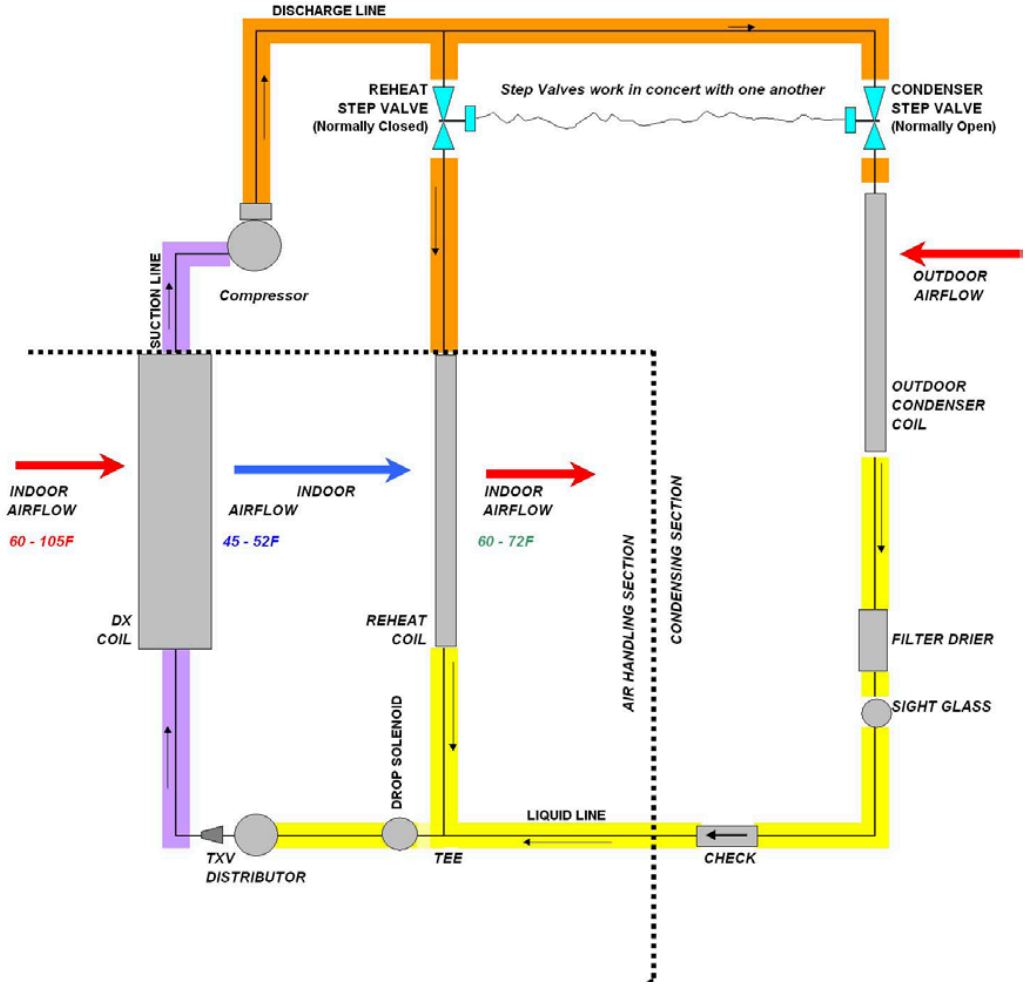


Figure 33: Dual 2-Way Valve Refrigeration Schematic



Dehumidification Initiation

An analog sensor is mounted in the return duct, the space, or outdoors to sense Relative Humidity. The location is selected by setting the Sensor Location value on the keypad to Return, Space, or OAT. OAT can only be selected for units with DAT control. Dehumidification is disabled when the unit is in either the Heating or Minimum DAT state. When Dehumidification is enabled, Dehumidification operation is initiated when Humidity Control is set to either Relative Humidity or Dew Point and that value rises above the appropriate setpoint by more than half its deadband. Economizer operation is disabled in the Dehumidification mode so the unit immediately transitions to Cooling if Dehumidification is initiated in Economizer state.

Dehumidification Termination

Dehumidification is terminated if the selected variable, Relative Humidity or Dew Point, drops below the appropriate humidity setpoint by more than half its deadband. Dehumidification is also terminated if cooling is disabled for any reason or the unit enters either the Heating or Minimum DAT state. For units with compressors, the number of cooling stages is reduced by one and control reverts to normal control when dehumidification is terminated in the Cooling state. Another compressor stage change could then occur after one Cooling Stage Time has elapsed.

Control & Arrangement

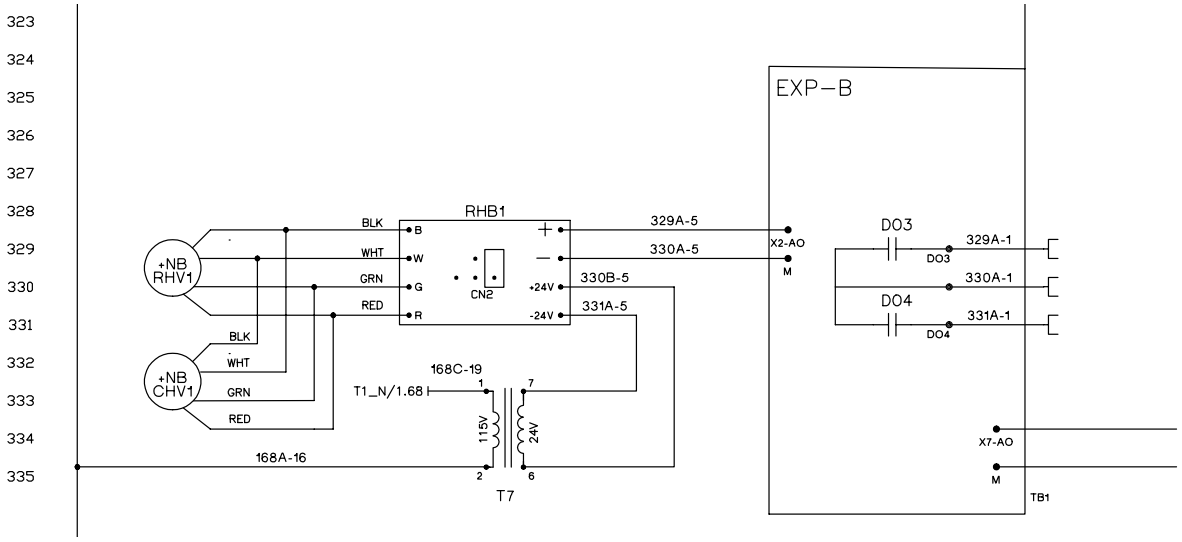
In conjunction with dehumidification, MHGRH is used to raise the temperature of the cooled air to a desirable value. MHGRH is comprised of a parallel coil arrangement, with both the condenser and reheat coils of the micro channel type, dual reheat valves (which operate in concert with one another) and a check valve. MHGRH components will always be installed in circuit #2.

During Dehumidification control w/ modulating Hot Gas Reheat (MHGRH) an analog signal (0-10Vdc) is controlled as described below.

- A PI Loop is used to control the HGRH valves to maintain the Discharge Air Temperature from the reheat coil.
- Compressor staging during reheat (or dehumidification) will be controlled by the Leaving DX Coil Temperature. For increased dehumidification during reheat, the standard default compressor staging range is 45 - 52°F.
- When dehumidification is active in the Cooling state, the reheat set point equals the DAT Cooling Setpoint. For DAT units, this is the normal DAT set point resulting from any reset. For Zone Control units, this set point is the result of a PI Loop based on the Control Temperature.
- Communication with the reheat control valves is accomplished by providing a 0-10Vdc signal to a pair of interface boards which in turn supply the control signal to the reheat valves (step type).
- In the Fan Only state, no sensible cooling is required, but dehumidification mode will still be enabled if the dew point or humidity sensor is not satisfied. Reheat set point varies from a maximum value (default 65°F) when the Control Temperature is at or below the heating changeover setpoint to a minimum value (default 55°F) when the Control Temperature is at or above the cooling changeover setpoint.

- Lead/Lag Arrangement w/ MHGRH (when applicable)
  - — Alternate staging with circuit #1 as lead will be the standard default arrangement.
  - — During cooling mode, circuit #1 will lead and load up before starting circuit #2.
  - — During reheat mode, circuit #2 will lead and load up before starting circuit #1.
  - — For reheat operation, compressor(s) in circuit #2 must be active. If the unit is operating in the cooling mode when a call for dehumidification/reheat arises,circuit #2 will become the lead and the controller will bring on an additional stage of coolingfor dehumidification. If any compressors in circuit #1 are operating at this moment they will be switched over to compressors in circuit #2. Dehumidification operation is disabled if circuit #2 is disabled for any reason.
- In the reheat mode, the minimum position for the reheat valves is 10% (1.0 Vdc). The controller will modulate the reheat valves from this starting position.
- Reheat valve(s) must be at 0% (0 Vdc) position before starting the first compressor in the reheat circuit to prevent pressure spikes.
- Upon termination of dehumidification (reheat), the maximum ramp down or decay rate of the reheat control valves shall be 1% per sec (or 0.1V per sec).
- Upon termination of dehumidification (reheat), staging of compressor(s) is delayed for 1 minute after reheat capacity = 0% (0 Vdc).
- Every 24 hours, the reheat control valves will be driven to their maximum position (10Vdc) and then returned to their normal operating position (0Vdc). If unit is operating in cooling or dehumidification (reheat) at the prescribed time it will be deferred to the next time.
- Dehumidification status can now be found under the MTIII main system menu. Reheat capacity (valve position) can also be found under the main system menu, display based on percentage (0-100%).

Figure 34: Modulating Hot Gas Reheat Schematic



Hot Water Heater Design

If the 8th digit of the model number is a “W”, the rooftop unit was furnished with a factory installed hot water coil (Example: MPS035FW). The hot water coil comes with a piping vestibule for field supplied and installed control valve and piping. The coil is furnished with ODM copper connections. The Maverick commercial rooftop units are available with a low heat (one row coil) or a high heat (two row coil) configuration.

See certified drawings for the recommended piping entrance locations. Seal all piping penetrations to prevent air and water leakage.

NOTE: Factory installed piping is copper. Dissimilar metal within the plumbing system can cause galvanic corrosion. To avoid corrosion, provide proper di-electric fittings as well as appropriate water treatment.

⚠ CAUTION

Coil freeze possible. Can damage equipment. Follow instructions for mixing antifreeze solution. Some products have higher freeze points in natural state than when mixed with water. The freezing of coils is not the responsibility of Daikin.

Figure 35: Hot Water Heating Schematic

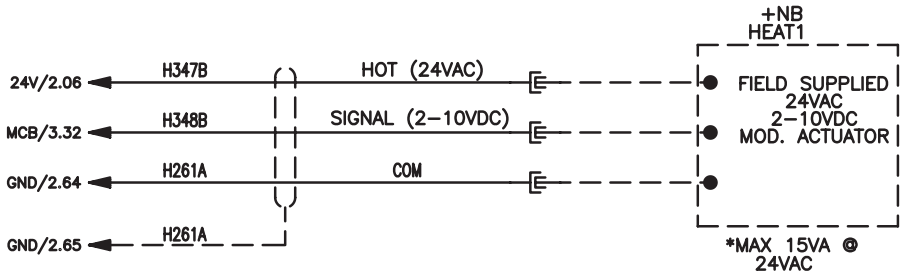
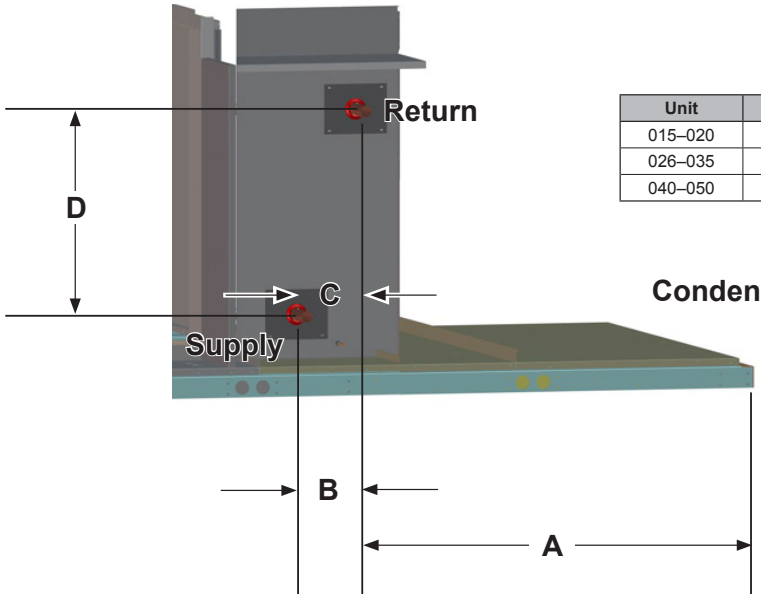


Figure 36: Hot Water Heat Vestibule



Unit	A	B	C	D
015–020	64.5	8.5	8.5	28.5
026–035	64.5	8.5	8.5	28.5
040–050	90.2	8.5	8.5	28.5

Hot Water Pressure Drop Data

Figure 37: MPS 015 – 017 Low and High Heat

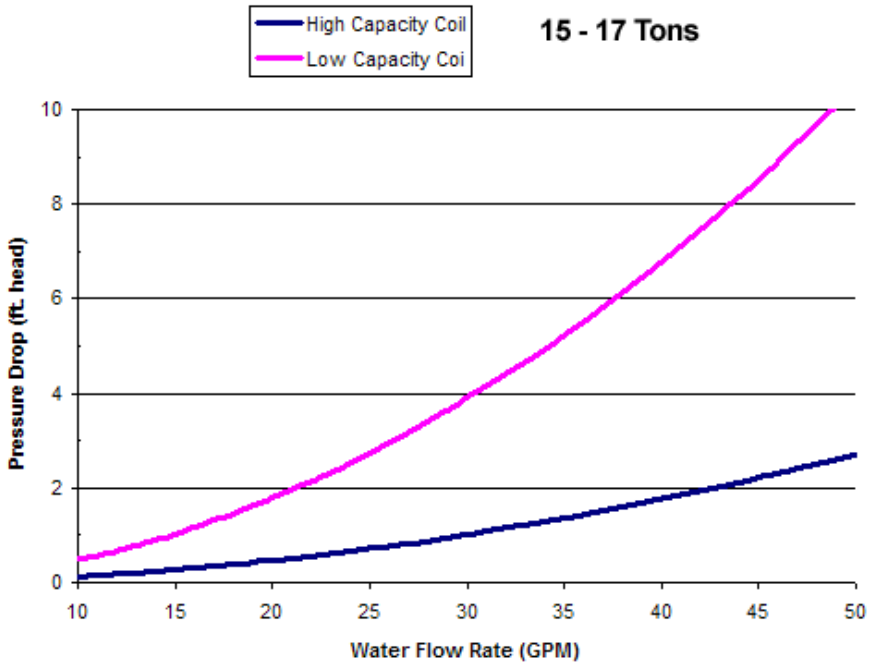


Figure 38: MPS 020 Low and High Heat

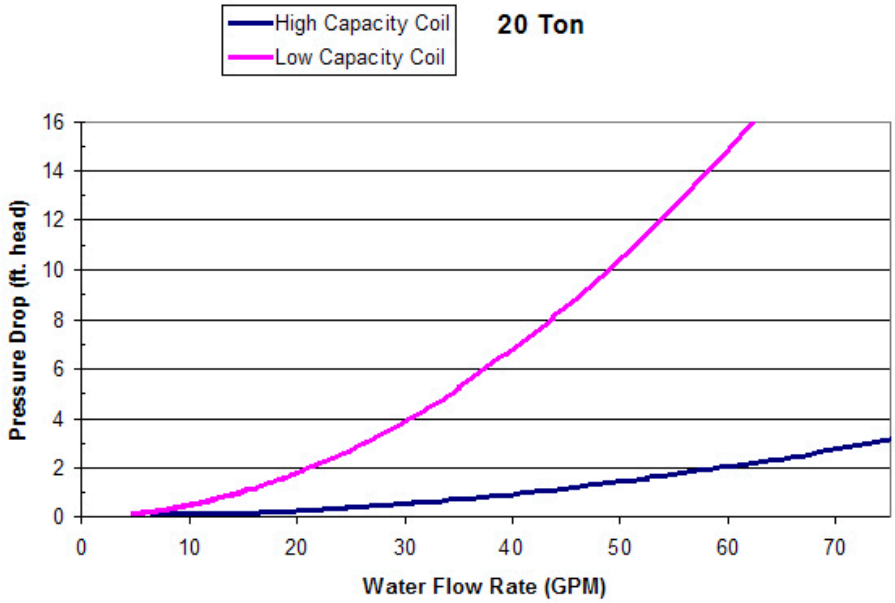


Figure 39: MPS 026 – 035 Low and High Heat

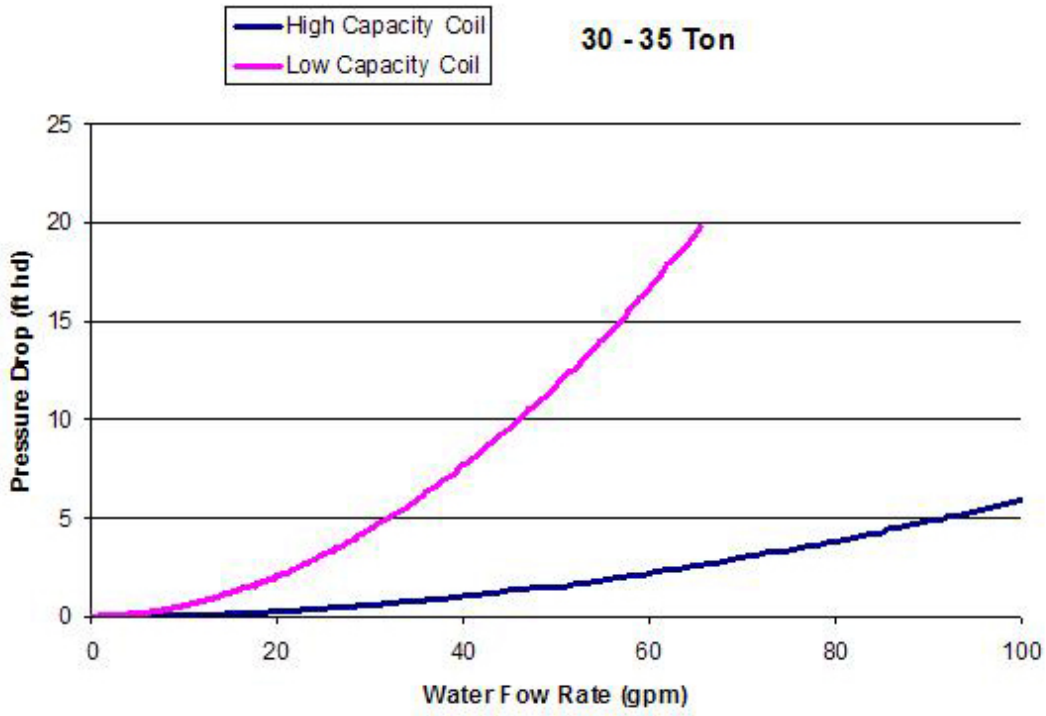
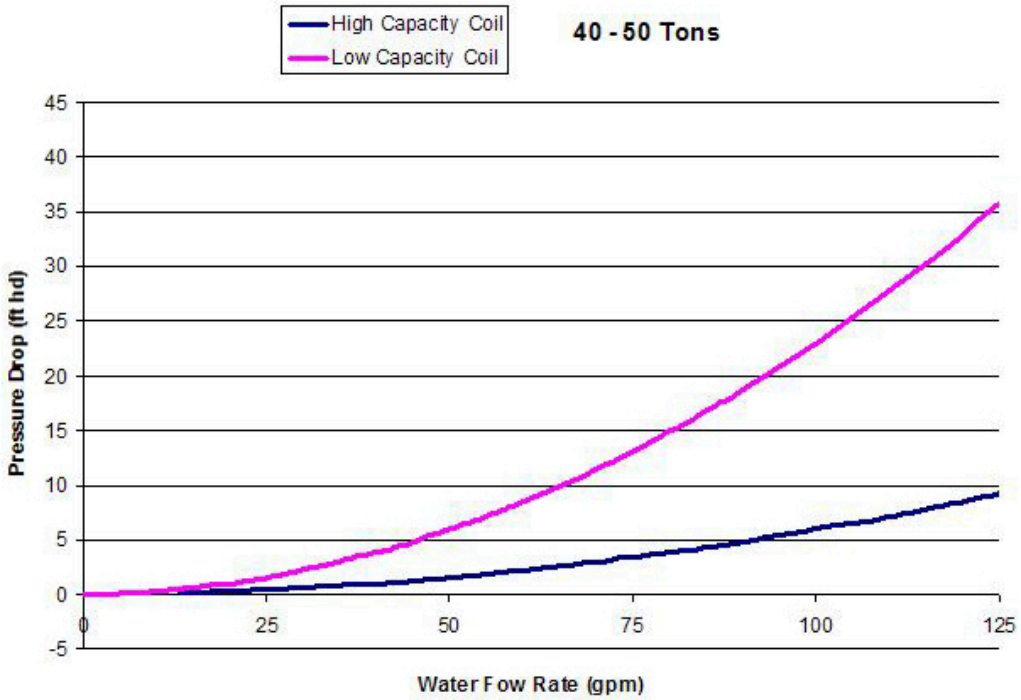


Figure 40: MPS 040 – 050 Low and High Heat



Energy Recovery Wheel Design

When a unit is equipped with an optional enthalpy wheel, energy recovery is provided by drawing outside air across half of the enthalpy wheel and drawing exhaust air across the other half. Latent heat and sensible heat are transferred from the hotter and moist exhaust air to the colder and dry outside air during winter conditions. Latent heat and sensible heat are transferred from the hotter and moist outside air to the cooler and dry exhaust air during summer conditions. Energy recovery control consists of starting and stopping an exhaust fan, modulating the speed of the exhaust fan, starting and stopping an enthalpy wheel, optionally controlling the speed of the enthalpy wheel and opening and closing a set of bypass dampers. The outdoor dampers are controlled in the normal manner.

Arrangements

Three arrangements are offered for the enthalpy wheel:

1. Single enthalpy wheel with economizer and bypass (see Figure 41). This arrangement is available for all units.
2. Single enthalpy wheel without economizer (100% outdoor air unit) for airflow up to about 7000 CFM. This arrangement is available on sizes 015 - 040C and 800 - 802C only.

Wheel Construction

Your Daikin enthalpy wheel is delivered completely assembled and ready to run. The wheel is built to provide many years of trouble free service following proper installation and performance of the minimal maintenance requirements.

Definitions

The following are descriptions of various components related to the enthalpy wheel construction (see Figure 41):

Bearing, external – The wheel and bearing rotate on the shaft, no field lubrication is required.

Brush seal – The seal used for both the circumferential seal and the inner seal in the cassettes. They are constructed of nylon brush and configured to seal against the enthalpy wheel band in the case of the circumferential seal, and against the wheel face in the case of the inner seal. These seals are full contact seals, have an integral clip, and they are clipped to the cassette face panel cutout (concumferential) or to the (inner) post.

Cassette – The steel structure that houses the rotor. Cassettes are of punched sheet metal panelized construction.

Enthalpy wheel – A generic name for an energy conservation wheel. The term “enthalpy” refers to an air stream’s total energy (temperature and humidity level).

Exhaust air – The air stream that is exhausted to the outside. Exhaust air is building return air that has been run through the enthalpy wheel.

Heat wheel – Synonymous with an enthalpy wheel, energy conservation wheel, or total energy recovery wheel. Some heat wheels are sensible only wheels and should not be confused with Daikin total energy recovery wheels.

Hub – The center support of an enthalpy wheel.

Latent energy – Latent energy, in the context of enthalpy wheel discussions, is the work done by the wheel to transfer moisture from one air stream to another. Latent work is accompanied by humidity changes in the air streams.

Media – The chemical composite part of the enthalpy wheel which actually performs the latent and sensible exchange.

Outdoor air – The air stream that is brought in from the outside. Outdoor air becomes supply air after going through the enthalpy wheel.

Purge – A small segment of supply air defined by the gap between the inner seal on the outdoor air edge of the center post and the supply air edge of the center post. The purge angle is adjustable. The purge captures the small amount of supply air captive in the enthalpy wheel when the wheel moves from return to supply and routes it to return to minimize cross contamination.

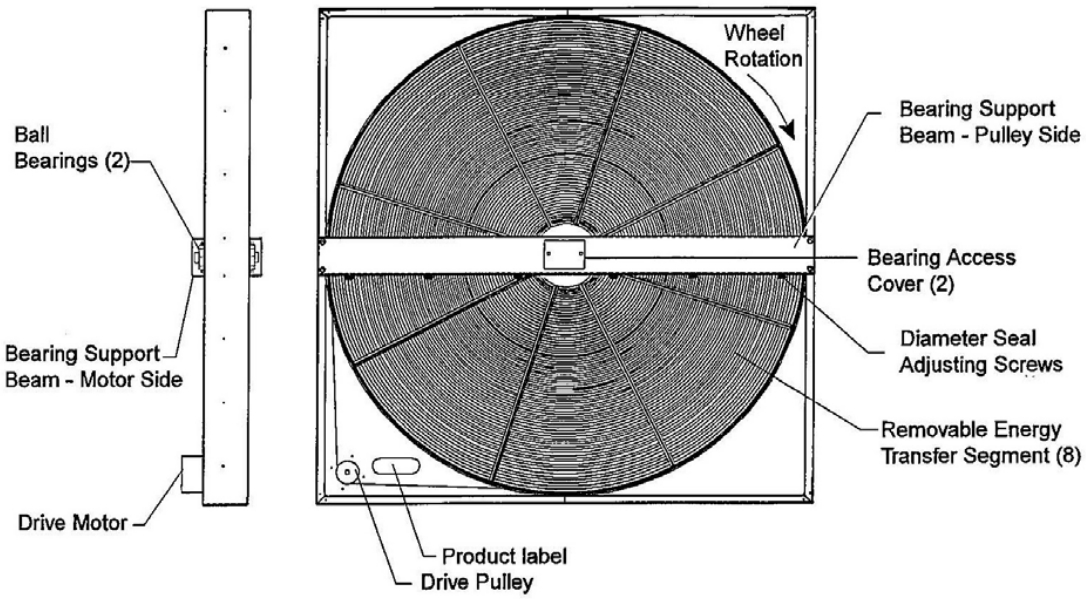
Return air – The air stream that is returned from the building. Return air becomes exhaust air after going through the enthalpy wheel.

Rotor – The part of an enthalpy wheel that performs the energy exchange and consists of the wheel media, hub, spokes and band.

Sensible heat – Sensible energy, in the context of enthalpy wheel discussion, is the work done by the enthalpy wheel to transfer heat from one air stream to another. Sensible work is accompanied by temperature changes in the air stream.

Supply air – The air stream that is supplied to the building space. Supply air is outdoor air that has been run through the enthalpy wheel.

Figure 41: Wheel Construction (Side-by-Side)

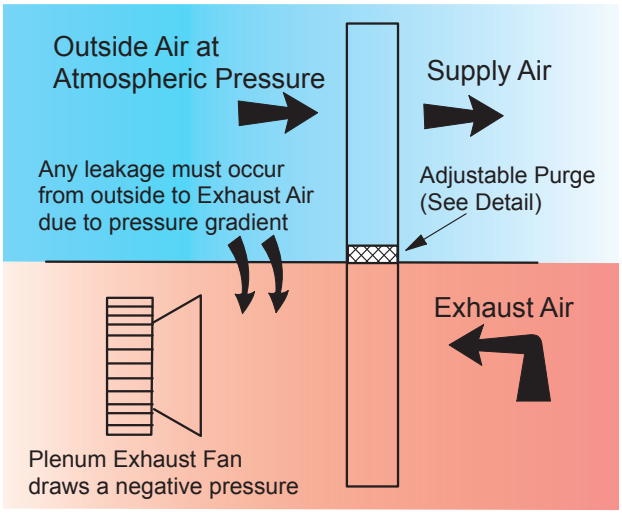


(1) Currently, only the Over-Under configuration is offered on Daikin roof-top systems and air handlers.

Purge and Pressurization

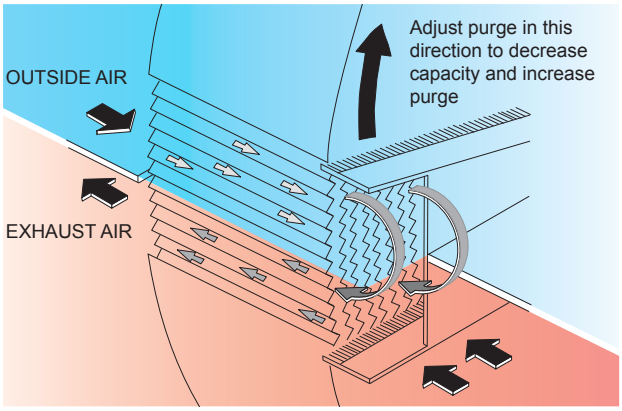
Pressurization is critical to minimize crossover from exhaust to Figure 42: Purge Detail supply and to allow the purge to operate.

Figure 42: Purge and Pressurization



NOTE:
Maintain the pressure gradient to prevent cross contamination from the Exhaust to Outside Supply Air

Figure 43: Purge Detail



Drive Motor

The enthalpy wheel comes standard with a constant speed drive motor which is prewired to turn in the proper direction.

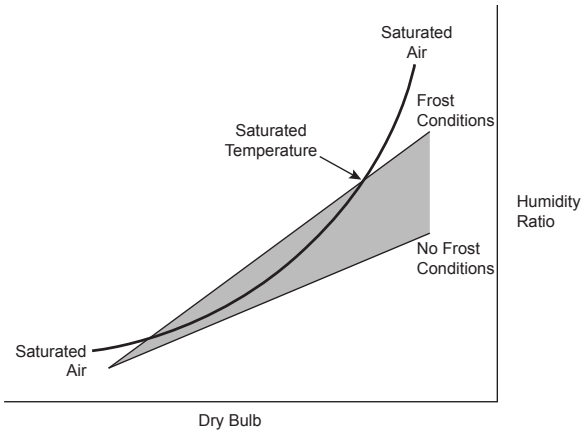
Frost Protection Option

During extremely cold winter conditions, exhaust air stream To circumvent this possiblity, Daikin offers three factory installed frost protection options with the MicroTech III system.

Defrost ON/OFF Control (Standard)

With this method the enthalpy wheel is stopped periodically for a defrost time duration when the outdoor air temperature is below an outdoor frost temperature threshold setpoint.

Figure 44: Frost Prevention Psychrometric Chart



Constant Speed Frost Prevention

When there is a threat of frost on the enthalpy wheel, the wheel is jogged so that less enthalpy transfer occurs and frosting of the wheel is avoided. Frosting can occur on the enthalpy wheel when the exhaust air leaving the wheel is saturated. This condition occurs when two lines intersect on a psychrometric chart, and it does not occur when these two lines do not intersect (see Figure 39).

Varible Speed Frost Prevention

When there is a threat of frost on the enthalpy wheel, the wheel is slowed down so that less enthalpy transfer occurs and frosting of the wheel is avoided. Frosting can occur on the enthalpy wheel when the exhaust air leaving the wheel is saturated. This condition occurs when two lines intersect on a psychrometric chart, and it does not occur when these two lines do not intersect (see Figure 44).

Energy Recovery Exhaust Hoods

Units with the optional energy recovery section have one or two (depending on model) exhaust hoods. Each hood is shipped in three pieces, consisting of one top and tow sides. Install exhaust hood over the barometric relief dampers by installing tow sides first and then install the top.

Variable Speed Frequency Control

A variable frequency drive is included with the frost protection option and it controls the speed of the enthalpy wheel. The unit has also been programmed for the recommended range of wheel speed operation. Typical wheel speed is 45 RPM, but the programming can allow for wheel speeds above or below 45 RPM. Check all factory settings to make sure they are consistent with the application.

Enthalpy wheel speed will be controlled by exhaust temperature measurement.

Thermal Dispersion Airflow Measurement Technology

Thermal dispersion technology relates the velocity of the air to the power and rise in temperature of a heated element in a moving airstream. A precise bead-in glass thermistor probes the airflow rate and air temperature. Multiple sensing points are used to produce an average velocity for true volumetric airflow (CFM/LPS). Each individual sensor node is calibrated to NIST traceable airflow standards at 16 points, resulting in a accuracy of 2% of the reading.

Figure 45: Bead-in-Glass Thermistor

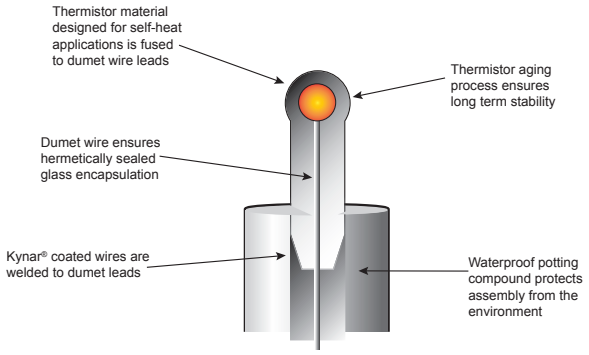
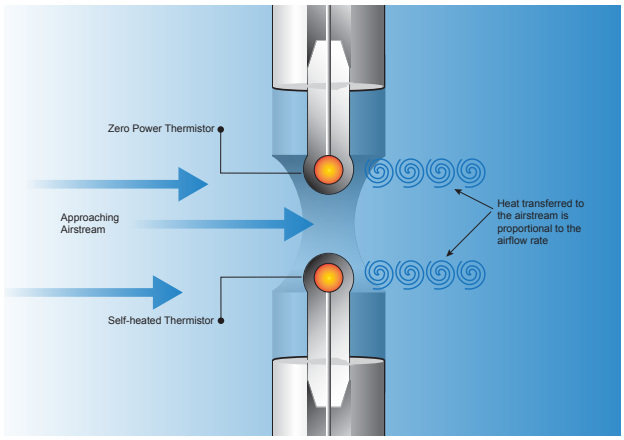


Figure 46: Bead-in-Glass Thermistor Probe



Connecting to MicroTech III Controllers

Wiring

1. Connect analog control wires from the MicroTech III Controller to the outdoor air monitor controller.
   a. MicroTech III controller (X1 on the MCB or X11 on the EXP_D) to the controller's analog output terminal 1.
   b. MicroTech III controller (M on the MCB or M on the EXP_D) to the controller's analog output terminal COM.
2. Power Wires (24 VAC) to the outdoor air monitor controller.
   a. 24VAC from the unit control panel to the controller terminals L1 and L2.

Outdoor Air Monitor Controller Settings

1. Set Controller SW1 switch to Vdc.
2. Set power switch to ON.

Outdoor Air Monitor Controller Configuration/ Set Up

(see Appendix, Figure 102 on page 129 for navigating the Controller keypad)

1. Set LCD1 U/M to "CFM"
2. Set AR1 (see Table 24)
3. Set OUT1 U/M =CFM
4. Set OUT1 =0–10V
5. Set FSI (see Table 24)

Table 24: Settings by Cabinet Size

Unit size	Economizer and 0–100%	0–30% Area sq.ft. (AR1)	Full scale output CFM (FS1)
Small cabinet	7.3	4.75	10,000
Medium cabinet	10.0	9.5	10,000
Large cabinet	14.5	10.0	10,000

Figure 47: MicroTech III Controller

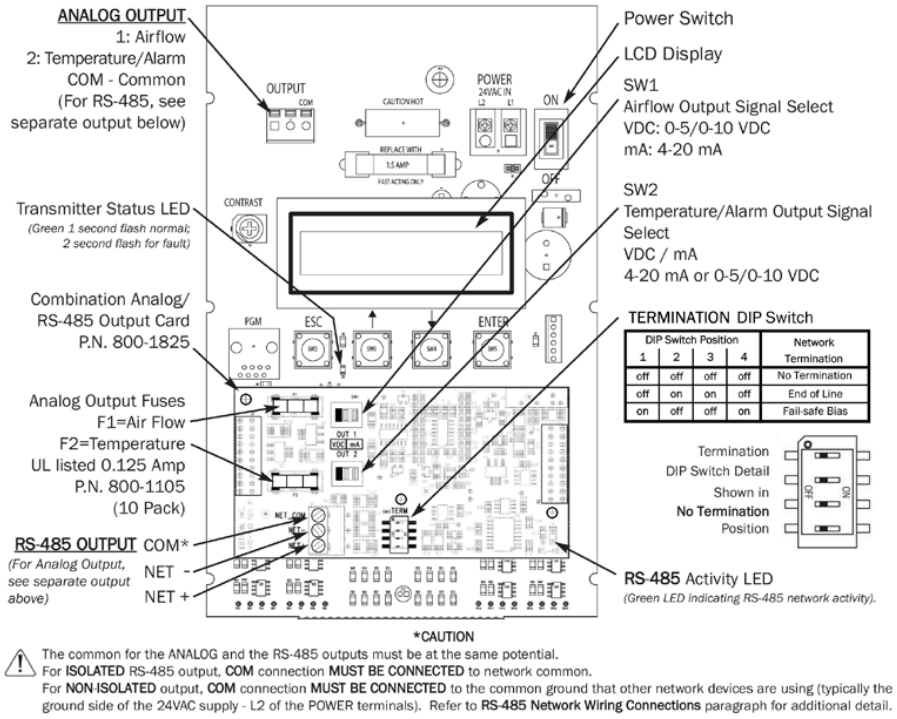
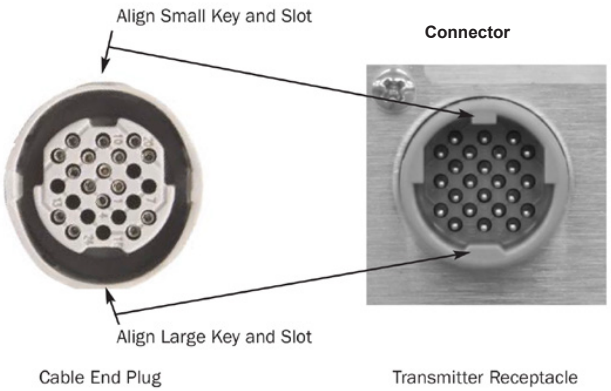
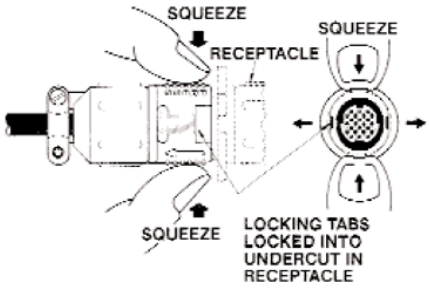


Figure 48: Transmitter and Connector Detail

Accepts 1 or 2 probes up to 8 sensors each.





Squeeze and Pull to Remove
DO NOT TWIST!

Changing the System of Units

The transmitter is provided with the system of units set to I-P. To change to S.I., simultaneously press and release the “UP” and “DOWN” arrow buttons during normal operation. “IP/SI UNITS” will be indicated on the LCD display. Press “ENTER” three times and use the “UP” and “DOWN” arrow buttons until the system of units desired is indicated. Press the “ENTER” button to select changes then press “ESC” twice to return to the normal operating mode. See Appendix, Figure 102 on page 129.

LCD Display Notifications

Following a brief initialization at power up, the LCD display automatically displays airflow and temperature as all upper case (caps) characters. The display provides additional information on system status and alarm conditions as follows:

Last LCD Character Shown in Lower Case (Probe Malfunction)

If the last character of the flow rate units on the LCD display is lower case (for example FPm or CFm), this indicates that an improper/malfunctioning probe is connected to the transmitter.

All LCD Characters Shown in Lower Case

When all characters of the flow rate units are displayed in lower case (for example cfm) the transmitter is operating in the Field Calibration Wizard mode. Daikin users do not need to use this function.

*LCD Blinks ** LOW ALARM **, ** HIGH ALARM ** or ** TRBL ALARM**

The LCD will alternately flash to indicate an active alarm condition for the type of alarm that has been set. The LCD displays airflow/temperature readings between the alarm notifications. Alarm will cease when the alarm is cleared.

Converting the Analog Output Signal from FPM to CFM (MPS to LPS for SI units scaling)

The transmitter is shipped from the factory with analog output “OUTPUT 1” set to indicate velocity in FPM. To automatically convert this analog velocity output to volumetric flow (CFM or LPS), simply set the *OUT1 U/M from FPM (default) to CFM in the Setup Menu (See Appendix, Figure 103 on page 130). If you wish to manually convert the velocity output to volumetric flow (CFM or LPS), simply multiply the indicated output velocity (in FPM or MPS) by the free area of the air flow probe installation location (free area x 1000 for SI units when area is calculated in square meters). For -P sensors, the total free area is programmed into the probe at the factory and is printed on the probe hang-tag. For -F and -B sensor probes, determine the free area following installation in accordance with the installation guidelines. Refer also to Tables 4 and 9 for a complete listing of conversions for each of the analog outputs of the transmitter.

NOTE: The full scale analog output (OUTPUT1) value is determined by the FS1 setting within the SETUP MENU.

Altitude Correction Adjustment

The Altitude Correction Adjustment allows for correction of airflow readings at the installed site altitude and more precise readings regardless on installed altitude. Refer to the SETUP MENUS of Figure 102 for the *ALT= menu item, and set this vale to the installation altitude.

Adjusting The Digital Output Filter

The digital output filter is useful for dampening signal fluctuations resulting from transient wind gusts on outdoor air intakes or excessive turbulence generated from duct disturbances. The digital output filter range can be set between 0 (OFF) and 99%. Increasing the filter percentage limits the allowable change of the output signal. To change the amount of filtering, enter the Setup menu and set “*FILTER1={desired value}” as shown in Figure 102.

IMPORTANT

Fluctuations in the airflow output signal are normal. Laboratory research indicates that dampening true fluctuations will result in poor control and a larger dead-band of operation. Therefore, the use of the dampening filters in control devices is not recommended. Warnings indicate potentially hazardous situations, which can result in property damage, severe personal injury, or death if not avoided.

Table 25: General Troubleshooting

Problem	Possible Cause	Remedy
No LCD display indication and the green Transmitter Status LED (D3) on the main circuit board is not illuminated.	Power switch not in the "ON" position.	Move the power switch to the "ON" position.
	Improper supply voltage to the power input terminal block.	Ensure that 24VAC power is connected to L1 and L2 of the POWER terminal block and that the voltage with the power switch in the "ON" position is between 22.8 and 26.4 VAC.
	Blown fuse.	Check power wiring. Ensure that multiple devices wired on a single transformer are wired "in-phase". Replace fuse only with a 1.5 amp, fast-acting fuse after the problem has been identified and corrected.
No LCD display indication and the green Transmitter Status LED (D3) on the main circuit board is flashing.	LCD contrast too low.	Turn “Contrast” potentiometer on the main circuit board "clockwise".
The LCD display is scrambled or there is no LCD display indication after touching the switches, LCD display or circuit board.	Static electricity.	Touch an earth-grounded object, such as a duct, to discharge static electricity then reset the power. Avoid direct contact with the LCD display or circuit board.
The LCD display indicates "No Probes".	The power switch on the transmitter was moved to the "ON" position before the sensor probes were connected.	Reset 24VAC power by moving the power switch from the "ON" to "OFF" position and then back to the "ON" position.
The LCD display indicates "DiffSensor Type".	Sensor probes have been mismatched.	Transmitters must have the same sensor type connected (GP1, GF1 or GB1 sensor probes).
The LCD display indicates "Too Many Sensors".	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
The last digit of the flow rate unit is displayed as a lower case letter. (When the Field Calibration Wizard is engaged, the last character of the flow rate units is displayed as an upper case letter.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe’s hang tag.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
The green Transmitter Status LED (D3) on the main circuit board is "ON" but not flashing.	The microprocessor is not running.	Reset 24VAC power by moving the power switch from the "ON" to "OFF" position and then back to the "ON" position.
The green Transmitter Status LED (D3) on the main circuit board is flashing at 1-second intervals.	No problem, normal operation.	No remedy required.
The green Transmitter Status LED (D3) on the main circuit board is flashing at 2-second intervals.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe's hang tag.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
The transmitter indicates airflow when the HVAC system is not operating.	Sensors are sensitive and can measure very low air velocities. If a reading is indicated, there is airflow present where the airflow measuring station is located.	Do not attempt to adjust zero ("offset"). Doing so will result in an error in airflow measurement. The Low Limit airflow cutoff value can be set to force the output signal to zero.
No output signal can be measured at the OUTPUT terminal block of the transmitter.	Output card is not securely mounted on main circuit board.	Turn the transmitter power "OFF", and then press the output card firmly onto main circuit board. Turn the transmitter power back "ON".
	Blown output fuse (output 1 and output 2 are fused and protected independently on the transmitter).	Make sure that power has not been connected to the output terminal block. Correct the problem and replace with 0.125 amp, fast acting fuse only.
		Make sure that the host control system is not configured for a 2-wire device (no excitation voltage should be present on the signals from the host controls). Correct the problem and replace with 0.125 amp, fast acting fuse only.
	The Low Limit airflow cutoff value is above the actual airflow reading.	Decrease the Low Limit airflow cutoff value in the Setup menu until it is below the actual airflow reading.
The output signal on the transmitter fluctuates while the flow and/or temperature readings on the LCD are steady.	Electrical interference from other devices is creating noise in the signal wires to the host control system.	The output signal wiring must be shielded. Individually ground one or more of the following points: the signal wire shield at host controls; signal wire shield at the transmitter, or L2 of the power terminal block of the transmitter.
The LCD display does not match the readings indicated by the host control system.	The scaling in the host control system is incorrect.	Compare the current configuration of the transmitter with that of the host control system. Compare the minimum and full scale settings for each output by navigating through the Setup menu.

Table 26: Transmitter Troubleshooting

Problem	Possible Cause	Remedy
The host control system is unable to communicate with the transmitter.	Output card is not securely mounted on main circuit board.	Turn the transmitter power "OFF" and press the output card firmly onto main circuit board. Turn the transmitter power back "ON".
	Network signal wiring is not properly connected to the transmitter or the host controls.	Verify that the network signal wires from the host controls are connected to the proper terminals of the OUTPUT block. On the transmitter OUTPUT terminal block, NET+ is for A, NET- is for B and COM for common.
	Network protocol is not properly set on the transmitter.	Set network protocol based on the network requirements and reset transmitter power.
	Network address is not properly set on the transmitter.	Set address based on network requirements and reset transmitter power. The address must be unique for the network.
	Network termination is not properly set on the transmitter.	Set transmitter termination based on network requirements and reset the transmitter power.
The LCD display does not match the readings indicated by the host control system.	The Area or K factor of the transmitter does not match that of the host controls.	Compare the value of the Area or K factor of the transmitter with that of the host control system and make adjustments to ensure a match.
The returned value for airflow is zero when airflow is indicated on the LCD display of the transmitter.	The Low Limit airflow cutoff value is above the actual airflow reading.	Decrease the Low Limit airflow cutoff value in the Setup menu until it is below the actual airflow reading.
The status point from the transmitter has a Trouble value.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe's hang tag.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
There is no value for the differential pressure point	Differential pressure is only available from transmitters that have a Bi-directional Bleed Airflow Sensors connected.	If a differential pressure measurement is required, contact your local Daikin Representative about a Bi-directional Bleed Airflow Sensor.

Economizer Enthalpy Control

The economizer can be ordered with the optional differential enthalpy control. With this option a solid-state humidity and temperature sensing device is located in the return and outdoor airstreams. These devices are labeled RAE and OAE respectively. When the outdoor enthalpy is lower than the return air enthalpy, the economizer operation will be initiated. If the outdoor air enthalpy is higher than the return air, the outdoor air damper position will be at the minimum setpoint. See OM 920 for further information on the economizer operation.

External Time Clock

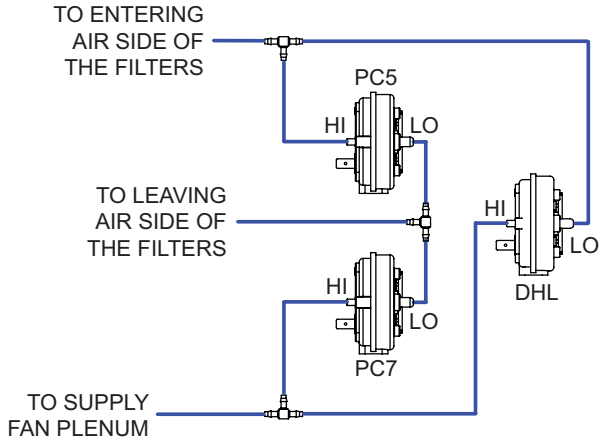
You can use an external time clock as an alternative to (or in addition to) the MicroTech III controller's internal scheduling function. The external timing mechanism is set up to open and close the circuit between field terminals 101 and 102. When the circuit is open, power is not supplied to binary input ID1. This is the normal condition where the controller follows the programmable internal schedule. When the circuit is closed, power is fed to ID1. The MicroTech III controller responds by placing the unit in the occupied mode, overriding any set internal schedule.

Exhaust Fan Option

Economizer units may include exhaust fan options. For units with CAV applications, the exhaust fans can be ordered as staged control or they may be ordered with building pressure control. The building pressure control option has a VFD that runs the exhaust fan motors and is controlled by the static pressure sensor number 2 (SPS2). Refer to OM 920 for setting up the unit controller with these two options. The units are only available with building pressure control on VAV units.

The exhaust fan motors are permanently lubricated and do not require any additional periodic lubrication.

Figure 49: Pressure Tubing Diagram



Proof-of-Airflow and Dirty Filter Switch

The proof-of-airflow switch (PC7) and the dirty filter switch (PC5) are supplied on all CAV units. The tubing is installed to the switches per Figure 49. The proof of airflow switches senses the pressure difference between the positive pressure in the supply air fan compartment and the suction pressure on the leaving air side of the filters. The differential pressure is factory set at 0.25" for this switch. The dirty filter switch senses the pressure difference across the filter; from the entering air side of the filter to the leaving air side of the filters. The switch is factory set at 1.0". When the pressure difference across the filters is sensed at this value, the dirty filter alarm will appear on the DDC controller.

All VAV units also have the PC7 and PC5 switches as standard (see Figure 40). These switches are tied into the Duct High Limit switch (DHL) as shown in Figure 49.

The DHL is factory set at 4.0". When this differential pressure is sensed the normally closed contacts will open on the switch giving the DHL alarm at the unit controller.

Duct High Pressure Limit

The duct high pressure limit control (DHL) is provided on all VAV units. The DHL protects the duct work, terminal boxes, and the unit from over pressurization, which could be caused by, for example, tripped fire dampers or control failure.

The DHL control opens when the discharge plenum pressure rises to 3.5" wc (872 Pa). This setting should be correct for most applications and should not be adjusted.

If the DHL switch opens, digital input ID9 on the Unit Control Board will be de-energized. The MicroTech III controller then shuts down the unit and enters the Off-Alarm state. The alarm must be manually cleared before the unit can start again. Refer to the operation manual supplied with your unit for more information on clearing alarms (refer to OM 920).

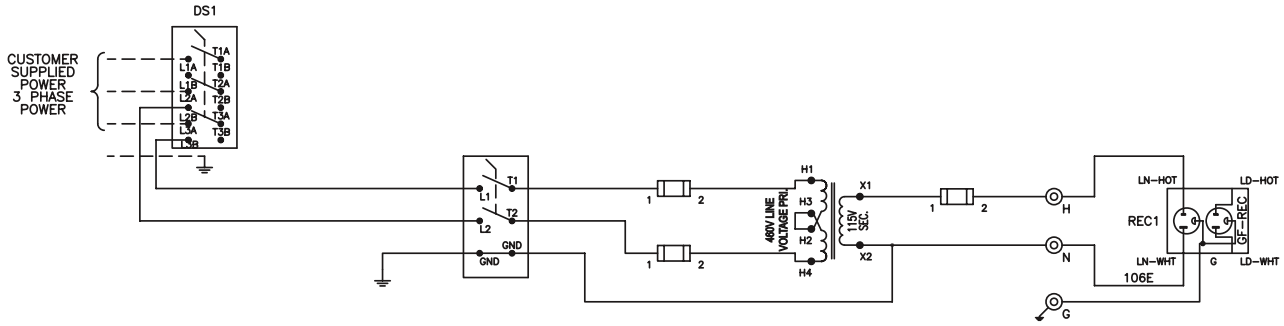
Convenience Receptacle (Field Powered)

A Ground Fault Circuit Interrupter (GFCI) convenience receptacle is provided in the main control box on all units. To use this receptacle, connect a separate field-supplied 115 V power wiring circuit to the outlet.

Convenience Receptacle (Unit Powered)

A Ground Fault Circuit Interrupter (GFCI) convenience receptacle is provided in the main control box on all units. The receptacle shall be powered by a factory installed and wired 120V, 20 amp power supply. The power supply shall be wired to the line side of the unit's main disconnect, so the receptacle is powered when the main unit disconnect is off. This option shall include a GFI receptacle, transformer, and a branch circuit disconnect. The electrical circuit shall be complete with primary and secondary overload protection. See Figure 50 for a branch circuit diagram.

Figure 50: Unit Powered GFCI Receptacle Schematic



Condenser Fan Operation for Variable Speed Compressor Low Ambient Option

(MPS 040 and 050 Only)

Daikin's head pressure control operates by modulating the motor speed of one condenser fan on the VFD compressor refrigeration circuit in response to the condenser pressure. VFD compressor refrigerant circuit contains a solenoid valve that blocks refrigerant flow to half of the condenser coil, which effectively removes 50% of the condenser surface from the circuit for low load/low ambient conditions.

This option allows for mechanical cooling operation down to 0F (-18C). The VFD option senses refrigerant head pressure and varies the fan speed accordingly. When the pressure rises, the SpeedTrol increases the speed of the fan, when the pressure falls. SpeedTrol decreases the speed of the fan.

The VFD throttling range is 250 to 400 psig, fixed, with a corresponding fan speed range of 10Hz to 60Hz. The fan motor is a three-phase motor, identical to the unit voltage (208V to 575V) and is controlled by a variable frequency drive. The variable frequency drive receives a signal from a pressure transducer and varies the speed of the condenser fan accordingly.

The SpeedTrol arrangement for VFD compressors is also employing "Start-Stop control by Speed reference Level" in which the VFD will stop the condenser fan motor under certain conditions. If the head pressure were to fall below 250 PSIG with the condenser fan operating at minimum speed of 10Hz (possibly due to a low ambient or high wind condition) the VFD will shut down the condenser fan. The VFD will restart the condenser fan at 20 Hz if head pressure rises to a level above 250 PSIG. In addition to modulating fan speed, a refrigerant solenoid valve is included in circuit #1. Operation of the solenoid valve is based on head pressure. If the average condensing pressure falls below 250 PSIG (83F sat) for 60 seconds, the condenser solenoid valve closes, effectively removing 50% of the condensing surface. If the averaging condensing pressure rises above 350 PSIG (105F sat) for 60 seconds, the condenser solenoid valve is opened, activating the entire condenser surface. The solenoid valve is disabled above an outdoor ambient of 80F. The solenoid valve is in a normally open configuration.

Refer to Figure 51 for wiring schematics of SpeedTrol. Refer to Figure 52 and Figure 53 for SpeedTrol operating characteristics.

Figure 51: R-410A Speedtrol

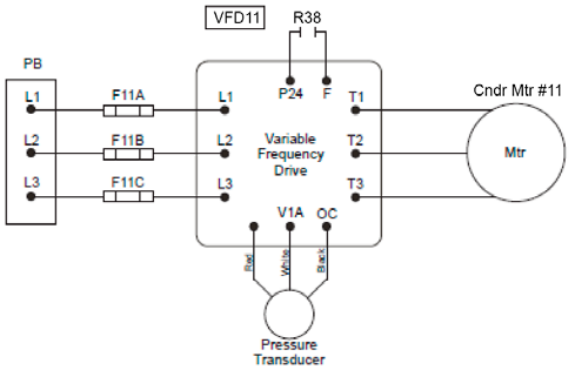


Figure 52: Speedtrol Operating Characteristics (for Variable Speed Inverter Compressor Units)

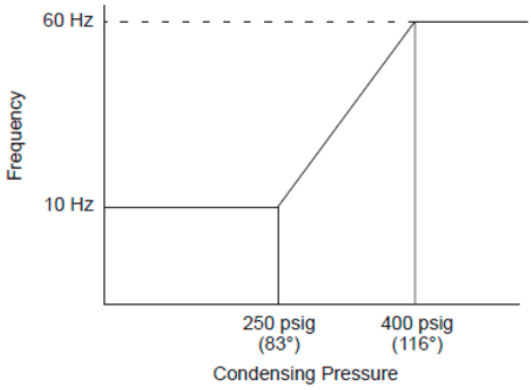
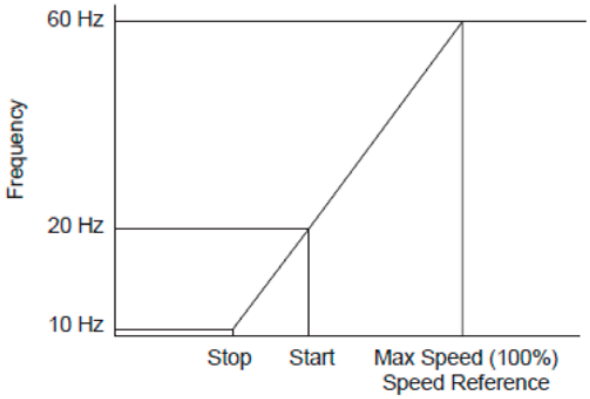


Figure 53: Speedtrol Operating Characteristics (for Variable Speed Inverter Compressor Units with Start-Stop Control)



VFD Compressor Operation

When a MPS is equipped with the VFD compressor option there are two refrigeration circuits, one VFD controlled compressor with up to 3 fixed speed compressors depending on unit model. The VFD compressor must always be the “lead” circuit or first one on and last one off.

VFD compressor modulation is controlled by an analog signal (0 – 10 Vdc) from the unit controller. Refer to Figure 101. The minimum VFD compressor speed is 25 rps (1500 rpm) and the maximum VFD compressor speed is 100 rps (6000 rpm), but the minimum and maximum limits per unit may vary depending on operating conditions and unit model size.

The VFD compressor is a 4 pole motor design that operates off a frequency signal from the VFD between 50Hz and 200Hz.

At Start-up the VFD compressor will automatically ramp up to 50 rps for first 10 seconds for lubrication requirements.

Crankcase heating for VFD Compressor model VZH-088 is performed by the VFD via DC-holding current through the motor windings.

VFD compressor modulation is additionally monitored and adjusted in order to maintain operation within the approved compressor operating envelope.

If the VFD compressor were to become inoperative, any other compressors on the VFD circuit will be disabled. The unit can continue to operate on the remaining fixed speed compressors of the non-VFD circuit until the unit can be serviced.

When the VFD compressor is at its maximum speed and more capacity is required, a fixed speed compressor is started while the VFD compressor is reduced to minimum speed at which point it resumes modulating to maintain the discharge temperature. When the VFD compressor is at its minimum speed and less capacity is required, a fixed speed compressor is turned off while the VFD compressor is increased to maximum speed at which point it resumes modulating to maintain discharge temperature.

Figure 54: VFD Compressor Modulation Signal

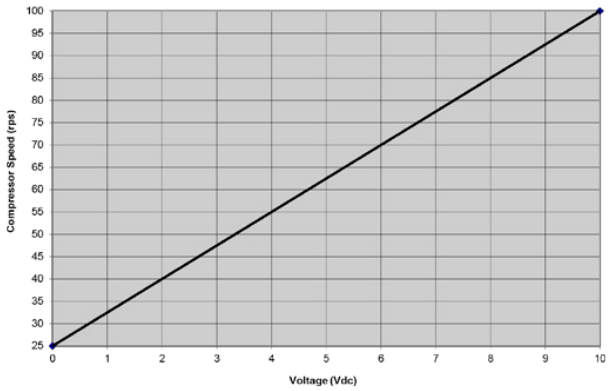


Table 27: VFD Compressor Modulation Ranges

MPS Unit Model	VFD Modulation Range					OilBoostrps/ OilBoostV*
	VFD Min rps/ VFD Min V	VFD Max rps				
		VFD and Fixed Comp(s) On			VFD Comp Only VFDMax rps/ VFDMaxV	
		1 Fixed On	2 Fixed On	3 Fixed On		
		VFD1Max rps/ VFD1MaxV	VFD2Max rps/ VFD2MaxV	VFD3Max rps/ VFD3MaxV		
026	39 rps / 0 Vdc	60 rps / 4.0 V	55 rps / 4.0 V	NA	70 rps / 6.0 V	70 rps / 4.0 V
030	39 rps / 0 Vdc	100 rps / 8.7 V	80 rps / 7.3 V	NA	100 rps / 10.0 V	100 rps / 7.3 V
035	39 rps / 0 Vdc	100 rps / 8.7 V	80 rps / 7.3 V	NA	100 rps / 10.0 V	100 rps / 7.3 V
040	39 rps / 0 Vdc	85 rps / 8.0 V	85 rps / 8.0 V	80 rps/ 7.3 V	100 rps / 10.0 V	100 rps / 7.3 V
050	39 rps / 0 Vdc	85 rps / 8.0 V	85 rps / 8.0 V	80 rps/ 7.3 V	100 rps / 10.0 V	100 rps / 7.3 V

* High and Low Oil Boost are explained on page 57

VFD Compressor Control

Control of the VFD compressor is accomplished with a digital output enable signal and a 0-10VDC analog modulating control signal.

General VFD Compressor Start Sequence

On a call for VFD compressor operation the VFD enable output is energized (on) and the 0-10VDC analog control signal is set to 3.33VDC (50 rps) for 10 seconds. During this 10 second initial period the VFD compressor's internal logic ramps the compressor to 50 rps to insure compressor startup oil lubrication. After 10 seconds the VFD compressor control signal begins modulation to maintain the cooling discharge set point.

NOTE: In addition to enabling VFD compressor operation the VFD enable output is used to energize the liquid line drop solenoid on the VFD circuit. (Only for Low Ambient Option)

Compressor Stage Up Transition

When the VFD compressor has been operating at maximum capacity for the cooling stage time period and there is a call for more cooling capacity the following transition sequence is followed when staging up.

During each fixed compressor stage UP sequence, the VFD compressor speed is reduced to its minimum, as a fixed speed compressor is turned on. Note that the VFD compressor speed range is extended for these staging points to assure smooth transition and to minimize capacity gaps. Typically, the VFD compressor is overdriven (higher speed than normal full load rating speed) before staging up a fixed compressor. The VFD is held at minimum speed for 30 seconds before normal modulation resumes.

Compressor Stage Down Transition

When the VFD compressor has been operating at minimum capacity for the cooling stage time period and there is a call for less capacity the following transition sequence is followed when staging down.

During each fixed speed compressor stage DOWN sequence, the VFD compressor speed is increased to maximum speed (which varies with unit size and number of operating fixed compressors) as a fixed speed compressor is turned off. Note that the VFD compressor speed range has been extended for these staging points to assure smooth transition and to minimize capacity gaps. Typically, the VFD compressor will be overdriven (higher speed than normal full load rating speed) when staging down a fixed compressor.

Dehumidification Transition During Cooling State

When dehumidification operation becomes active while the unit is in the Cooling operating state, The VFD compressor is ramped to its maximum capacity. If the VFD capacity at this point is already above 75% of its full modulation a fixed compressor is also turned on. The compressors are held at this capacity for 1 minute before normal modulation resumes, to maintain leaving coil temperature (LCT).

- VFD compressor will load up completely before starting any fixed speed compressors to achieve LCT of 45F (default) with the VFD compressor option. LCT may be set between 45F to 52F.
- If reheat signal is at 100% for 10 minutes and the unit is unable to raise the DAT to desired point, the controller will stage off 1 fixed compressor and modulate the VFD compressor speed to achieve the DAT set point.

Oil Balance/Boost Operational Sequence

When a low oil level is indicated in the VFD compressor sump, the unit switches to either an oil balance or oil boost state. The VFD compressor speed is increased during these modes to promote the return of refrigerant oil to the VFD compressor.

To avoid short cycling of the oil balance/boost sequence, no action is taken until a low oil indication has been present for 5 consecutive run minutes.

The unit determines whether to enter the oil balance or oil boost mode based on the running conditions when a low oil indication is experienced. The balance mode is only used when a VFD compressor is part of a tandem compressor set. The balance mode is usually entered first, and is utilized to move oil from the fixed speed compressor to the VFD compressor. If this mode fails to resolve the low oil indication issue, the unit will then go into the boost mode. The boost mode is utilized to return oil from the refrigerant system to the compressors. VFD compressors that are not part of a tandem compressor arrangement will skip the balance mode and only utilize the boost mode.

The balance mode will be entered if the VFD compressor is part of a tandem compressor arrangement and the fixed speed compressor is running, and there is a low oil indication. Upon entering the oil balance mode the fixed speed compressor is turned off and the VFD compressor speed is increased to the oil boost value shown in Table 20. The VFD compressor runs at this condition until the optical oil sensor verifies that oil is present for 3 continuous minutes. Unit Controller default is set for a 10 minute max balance.

If the oil balance mode fails to resolve the low oil condition, or the fixed speed compressor was not running when the low oil indication occurred, or the VFD compressor was not part of a tandemized compressor set, when the low oil indication occurred, the unit will enter boost mode

Upon entering oil boost mode, the VFD compressor speed is increased to the oil boost value shown in Table 20. If the VFD compressor is part of a tandem arrangement, the fixed speed compressor is started as well. The VFD compressor runs at this condition until the optical oil sensor verifies that oil is present for 3 continuous minutes. Unit Controller default is set for a 10 minute max boost.

During the oil balance/boost sequence the DAT temperature is overridden to allow the VFD compressor to continue operating until oil balance/boost sequence termination.

If one or more fixed speed compressors on the non VFD compressor circuit is operating, and the fixed speed compressor on the VFD compressor circuit was not already running when entering the oil boost mode, one fixed speed compressor on the non VFD compressor circuit will be turned off to minimize the disturbance to the DAT.

Oil balance/boost sequences and durations are logged in the unit controller.

If low oil indication does not clear, the VFD compressor will be shut down and oil level will be monitored for an additional 15 minutes. If low oil indication still does not clear within these 15 minutes, the VFD compressor will be locked out on alarm.

The low oil problem is also generated and the VFD compressor circuit is disabled if the oil boost sequence is initiated more than 4 times in a 24 hour period. If the oil balance/boost sequence successfully restores the VFD compressor oil level the fixed compressor stage is returned to its pre-oil balance/boost condition and normal compressor sequencing and modulation resumes

VFD Compressor Protection Unloading Control

There are several modulating control functions that adjust the speed control range of the VFD compressor to protect it from damage under abnormal operating conditions. The following functions are provided by the unit controller

- High Pressure Unloading Control
- High Discharge Line Temperature Unloading Control
- High/Low Discharge Superheat Control
- Condenser Coil Splitter Valve Control (For Low Ambient Option)

High Pressure Unloading Control

The VFD compressor has an upper operating sat discharge pressure limit of 575 PSIG. If the discharge pressure exceeds 575 PSIG, the compressor speed is reduced 1 rps every 10 seconds until the discharge pressure is at or below 575 psig.

If the discharge pressure does not drop below 575 PSIG with the VFD compressor operating at minimum speed (30 rps), the compressor is locked out on alarm.

In addition, when the VFD compressor is operating above a sat discharge pressure of 525 PSIG, the VFD compressor maximum speed is limited to 90 rps and the minimum speed is limited to 30 rps.

A high side pressure transducer is standard on the VFD circuit allowing the discharge pressure of the refrigerant circuit to be viewed at the unit controller display.

If the unit controller needs to reduce the compressor speed in order to limit discharge pressure, the action is recorded in unit controller event log section.

High Discharge Line Temperature Unloading Control

A compressor discharge temperature sensor (Thermistor) is installed on the VFD compressor as standard. The temperature is used to measure discharge temperature and superheat levels at the VFD compressor discharge.

If the compressor discharge temp reaches 250F, the VFD compressor speed is reduced by 10 rps and monitored for 3 additional minutes. The unit controller will continue to reduce VFD compressor speed by 10-rps increments until the discharge temp drops below 250F. If the VFD compressor discharge temp reaches 250F a warning will be logged in the controller. If reduced compressor speed does not resolve the issue, the VFD compressor is shut down and allowed to cool for 30 minutes. The VFD compressor is then re-started and if the discharge temperature cannot be held under 250F, the VFD compressor is locked out. The root cause may be connected to a number of issues (low charge, blocked condenser coil, condenser fan failure, malfunctioning TEV, etc.) and service is needed.

The VFD compressor discharge Temp has an upper limit of 275F. The VFD compressor will be shut down if discharge temp reaches 275F.

NOTE: The fixed speed compressor circuit does not contain this feature.

Low/High Discharge Superheat

With the high side pressure transducer and discharge thermistor, the unit controller is capable of monitoring the variable speed compressor discharge superheat. This feature protects the VFD compressor against flood back, undercharged conditions, overcharged conditions, malfunctioning TEV, etc. Typical compressor superheat range is 20F to 75F. The discharge temperature of the VFD compressor can be viewed at the unit controller display.

Low Superheat

If the compressor discharge superheat falls below 20F for 15 consecutive run minutes, the VFD compressor speed is increased by 5 rps increments up to a 60 rps operating speed. Superheat is monitored at each speed for 10 minutes and if superheat remains below 20F, the VFD compressor speed is increased an additional 5 rps. When compressor discharge superheat level is at 20F or above, the compressor speed is no longer increased. If speed correction resolves problem, the unit controller will have logged that a speed correction was needed for superheat in the event log. If increasing speed does not correct issue, the VFD compressor is locked out and an alarm is logged in the unit controller.

High Superheat

If the VFD compressor discharge superheat rises to 75F for 10 consecutive minutes, the VFD compressor speed is reduced by 10 rps increments down to a 40 rps operating speed. Superheat is monitored at each speed for 10 minutes and if superheat remains above 75F, the VFD compressor speed is decreased an additional 10 rps. When compressor discharge superheat level is at 75F or below, the compressor speed is no longer decreased. If speed correction resolves problem,

the unit controller will have logged that a speed correction was needed for superheat in the event log. If decreasing speed does not correct issue, the VFD compressor is locked out and an alarm is logged in the unit controller.

Manual Control (with VFD Compressor)

For service and troubleshooting the unit controller has capability to allow the VFD compressor to be operated manually. Refer to the controller OM-920 for more detail.

The basic manual operations include the following:

- Start or Stop the VFD compressor
- Modulate VFD compressor from 0 – 100% speed
- Ability to energize condenser coil splitter solenoids (Only for low ambient option)
- Ability to initiate or terminate oil boost sequence

If an electrical issue with the VFD compressor is suspected, the winding resistance can be checked at the motor terminals.

Table 28: VFD Compressor Winding Resistance

Compressor Model	Voltage	Winding Resistance (Ohms)
VZH-088B-X	208-230V	0.03
VZH-088B-X	460V	0.10
VZH-088B-X	575V	0.10

Condenser Coil Splitter Solenoid Valve Control (MPS 040 and 050 Only)

Condenser coil splitting is avaialble only on VFD compressor circuit of a unit with low ambinet option. This feature assists in maintaining head pressure during low ambient/low modulating operation. A solenoid valve on each circuit is controlled by a digital output from the MicroTech III controller.

The coil splitter solenoid valve is controlled based on the average discharge line pressure equivalent saturation temperature determined from the corresponding discharge pressure transducer monitored via an analog input to the MicroTech III controller.

The splitter solenoid valve on each circuit is normally open (digital output de-energized). The splitter valve on a circuit is closed (energized) when that circuit's saturation temperature remains below 83.0°F (250 psig) continuously for 60 seconds and the OAT is less than or equal to 80.0°F. The solenoid valve is re-opened when the saturation temperature rises above 105.0°F (350 psig) continuously for 60 seconds and the OAT rises above 80°F or when all the compressors on the circuit are OFF.

If the average saturated discharge temp falls below 250 PSIG (83F) for 60 seconds and condenser coil splitter solenoid coil is energized (closed), the VFD compressor modulation rate is increased until an average saturated discharge temp of 250 PSIG (83F) is achieved. This operation will raise the lower modulation limit of the VFD compressor, but is needed to keep the VFD compressor inside its operating envelope and maintain head pressure for TEV control.

When the condenser coil splitter is energized (closed) and the VFD compressor discharge pressure is below 250 PSIG, the VFD compressor speed is increased by 5rps increments every 30 seconds until the discharge pressure exceeds 250 PSIG. When the VFD compressor reaches 250 PSIG, this speed becomes the new minimum speed of the VFD compressor. As the discharge pressure rises above 250 PSIG, the minimum allowable compressor speed is decreased in 5 rps increments every 30 seconds.

If the condenser coil splitter valve is closed and the VFD compressor discharge remains below 250 PSIG for 15 minutes the circuit is locked out and an alarm is logged in the unit controller.

If a speed correction was performed to increase the compressor discharge pressure, there will be a record of the action in the unit controller under the event log.

VFD Compressor Emergency Stop Control

If the VFD compressor enable output signal has been ON for 30 seconds and the controller fails to receive the VFD run verification input, VFD Compressor Emergency Stop Control is activated. When this function is active, VFD compressor enable output will be turned OFF for 5 seconds and then turned ON and ramp VFD compressor speed to 60Hz. If controller receives a VFD run verification input, a log event is set on VFD Emergency Stop Control. If controller fails to receive the VFD run verification input after 3 attempts in 30 minutes, the VFD compressor is locked out and the problem is logged.

Once active the VFD Compressor Emergency Stop Control function remains active until one of the conditions are met.

- VFD compressor enable output signal has been ON for 30 seconds and VFD compressor status Input is ON
- VFD compressor is OFF

If the controller fails to receive the VFD run verification input after the VFD compressor enable output signal has been ON for 30 seconds, the circuit is shut OFF on VFD Compressor Emergency Stop Control alarm.

Whenever this protection function becomes active a VFD Compressor Emergency Stop Control event is recorded in the Event Log with date and time stamp. Whenever this protection function returns to normal a VFD Compressor Emergency Stop Control return to normal event is recorded in the Event Log with date and time stamp.

Variable Speed Scroll Compressor

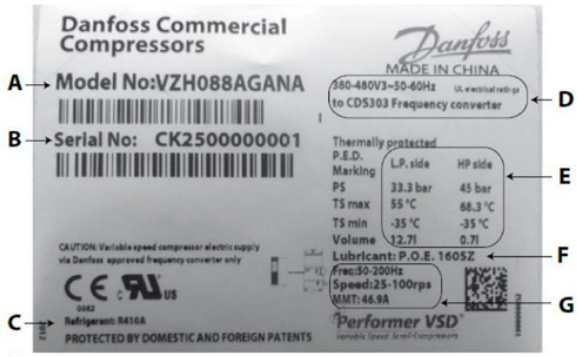
⚠ WARNING

The compressor must only be used for its designed purpose(s) and within its scope of application (refer to the Operating Limits). Consult the Application Guidelines. Under all circumstances, the EN378 (or other applicable local safety regulations) requirements must be fulfilled.

Daikin units with variable speed inverter compressor are engineered with fixed speed compressor(s) in such a way that the unit delivers only the required energy to satisfy space conditions and provides you with exceptional energy savings. It improves comfort through precise temperature and humidity control. Variable speed compressor enhances energy efficiency and capable of providing unit capacity modulation down to 20% and reduces compressor cycling and wear on compressor.

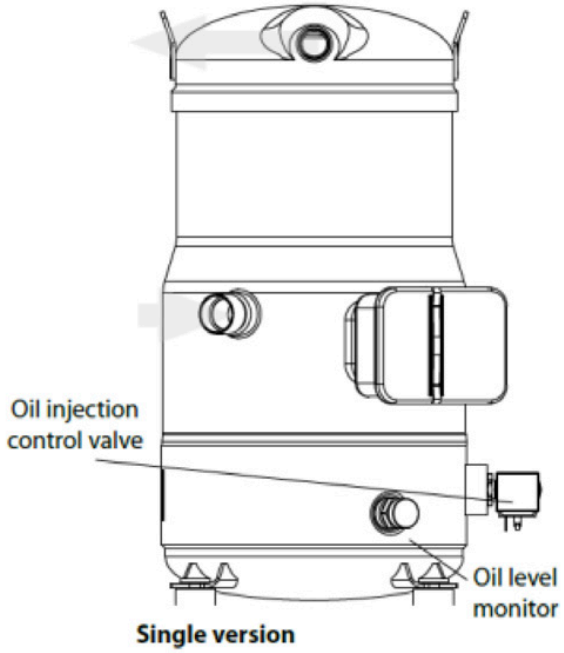
Daikin rooftop units with variable speed Inverter compressors are provided with Internal Permanent Magnet (IPM) motors. Compressors are designed to vary capacity by modulating the speed of the scroll set. The speed ratio for the IPM motor compressor is 4:1 (25 rps to 100 rps). Condenser fans staging and an oil management/monitoring system are provided for reliable operation. The VFD compressor will always be on the “lead” circuit and will be the first one ON and last one OFF.

Figure 55: Compressor Nameplate Information



A.	Model number
B.	Serial number
C.	Refrigerant
D.	Supply voltage to CDS303 frequency converter
E.	Housing service pressure
F.	Factory charged lubrication
G.	Compressor frequency and MaxMust trip current

Figure 56: Compressor Components



Oil Injection Control

The VFD compressor contains an oil injection valve and solenoid (SV11) as standard. The oil injection valve provides lubrication to the scroll set under low speed/low refrigerant velocity situations. The oil injection valve is a normally closed valve. Below 50 rps (100 Hz) the valve is closed and directs oil to the scroll set suction port. Above 50 rps (100 Hz) the solenoid is bypassed and sends oil into sump. The oil injection valve/ solenoid is mounted directly on the compressor and is controlled by the Compressor VFD (relay 1 output, terminals NO & Com). The coil voltage for the oil injection solenoid is 24 Vac.

The coil can be removed if required by carefully prying off the valve stem. The wiring connector is attached to the coil by a screw in the center of the housing. Refer to Figure 57 and Figure 58.

Figure 57: Assembly Components

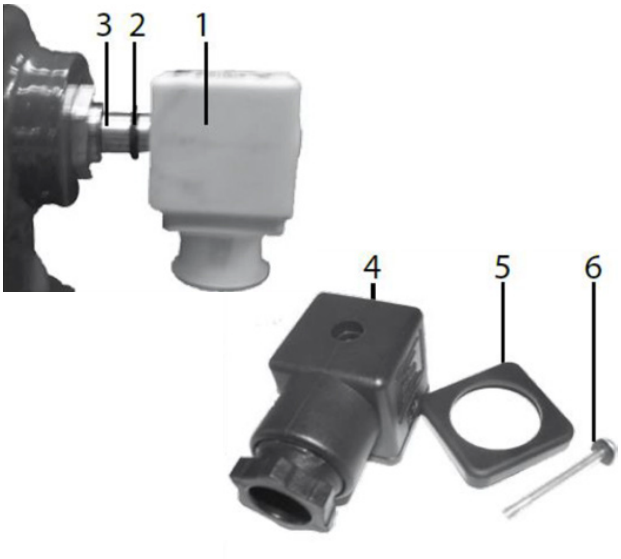
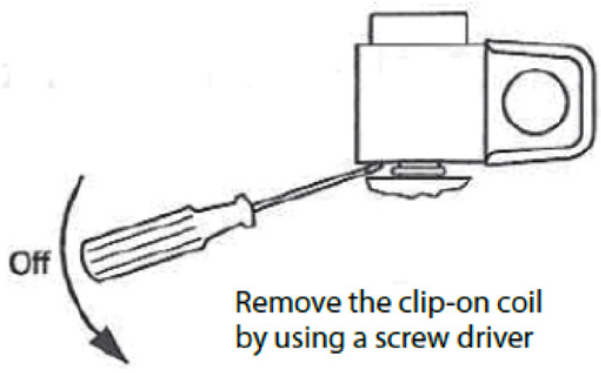


Figure 58: Oil Injection Control Dismanteling



Optical Oil Level Sensor

An optical oil sensor is used to monitor oil level in VFD compressor sump. The sensor is mounted directly to a fitting on the VFD compressor shell and can be removed without having to depressurize/reclaim the refrigeration system. Optical oil indication signal is sent to MTIII Expansion Module 'C' (terminals X3 & M). Normal oil indication will provide a contact closure from relay R40. Relay R40 will de-energize during low oil indication, removing signal to terminal X3 and will start the unit in an oil boost sequence. Refer to Figure 59 and Figure 60

Figure 59: Sightglass for Optical Oil Sensor/Switch

Figure 60: Optical Oil Level Sensor/Switch

Electrical Connections and Wiring

Basic Connections

Depending on the frequency converter version, the physical position of individual connectors may differ. Always make sure that the compressor terminals, U, V and W are connected to the frequency converter terminals, 96, 97 and 98 respectively.

The compressor motor cable is shielded and the armoured part of the cable is connected to a ground on both cable ends; at the side of the compressor and at the side of the frequency converter.

Variable Frequency Drive for VFD Compressor

⚠ WARNING

Never bypass the compressor drive or directly connect the VFD compressor to the main power supply.

⚠ WARNING

The compressor drive is preset to run the compressor clockwise.

⚠ WARNING

Variable Speed Inverter Compressor

The VFD is factory-programmed and should not be modified in the field. Any modifications will void the warranty. Compressors are compatible with the manufacturer's VFD only.

The compressor drive used for this option is a special series (CDS 303) that is intended for use with an IPM compressor motor and cannot be replaced with any off the shelf VFD.

The compressor drive is mounted in the main control box.

The compressor drive and the LCP (local control panel) are preset with parameters from the factory and should not need to be changed in the field. The LCP is removable and is interchangeable with any of the compressor drives used by any of the VFD compressors. If the need arises to replace the compressor drive, the parameters can be downloaded from the LCP to the new compressor drive.

The compressor drive is preset to run the compressor clockwise and must be connected as shown in the unit schematic.

The compressor drive is preset for an open loop configuration with 0-10Vdc reference corresponding to 1500-6000 Rpm.

The compressor drive generates a soft start with an initial ramp of 2 seconds. In-rush current (or LRA) to the VFD compressor is typically not more than a few percent more than rated nominal Current.

Compressor Speed, modulation signal %, frequency signal, compressor amperage are all displayed in real time on the compressor drive screen. Alarms and descriptions will also be visible on the compressor drive screen.

Basic Operation of Compressor Drive:

Start= Connect terminals 12 & 18 for minimum of 5 secs, connect terminals 12 &27 and terminals 13 &37

Stop= Disconnect terminals 12 & 27

Emergency Stop= Disconnect terminals 13 & 37

Control/Modulation= 0 to 10Vdc signal to terminals 53 & 55

Run Verification= A contact closure from relay 02 (terminals 04 & 05) is provided when drive is running

Oil Injection= A contact closure from relay 01 (terminals 01 & 02) is provided when compressor speed is greater than 50 rps (3000 rpm) which energizes the oil solenoid coil.

The compressor drive contains protection for the compressor against short circuits at the compressor terminals, overload protection , phase loss and earth faults. The compressor drive is protected against short-circuits.

Table 29: Compressor Drive Model & Frame Size

Compressor Model	Drive Model	Frame Size	
		208-230V	460V
VZH-088B	CDS303-15kW	B4	B3
VZH-117B	CDS303-18kW	C3	B4
VZH-170B	CDS303-22kW	C3	B4

Refer to the VFD operational manual for more information.

Figure 61: VAV Power – Fixed Speed Scroll Compressor

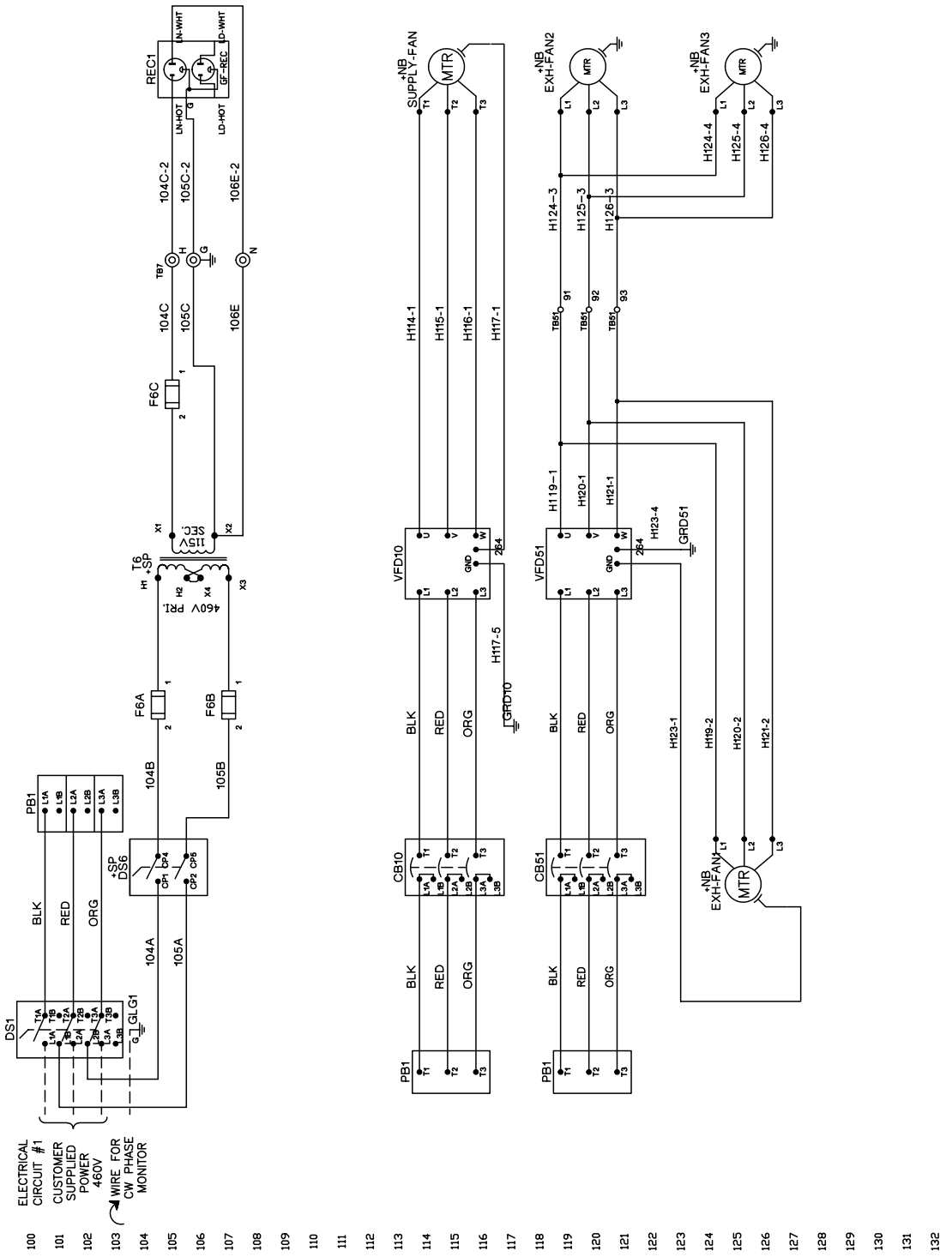


Figure 61 continued: VAV Power – Fixed Speed Scroll Compressor

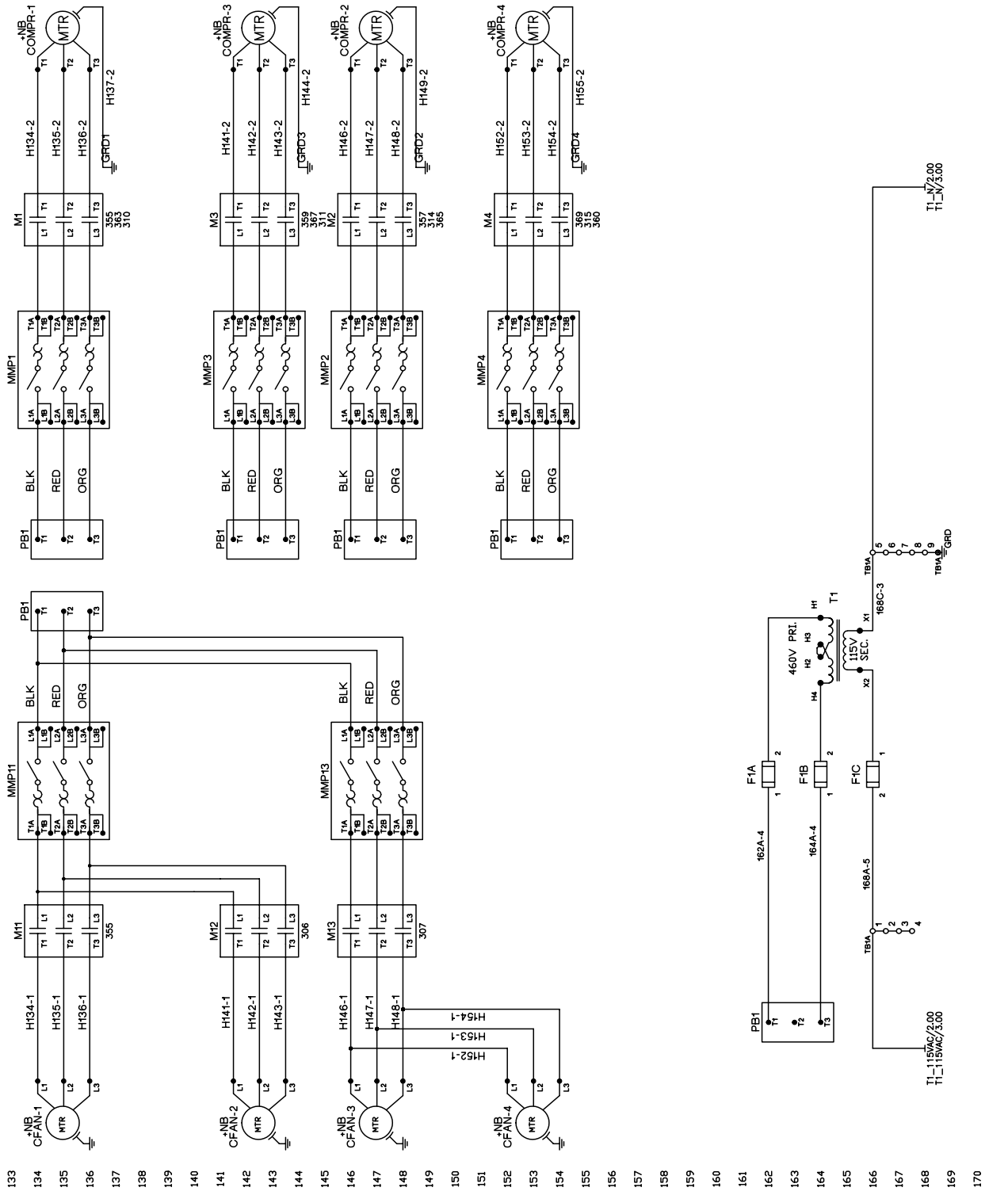


Figure 62: MPS 026 VAV Power with Variable Speed Inverter Compressor

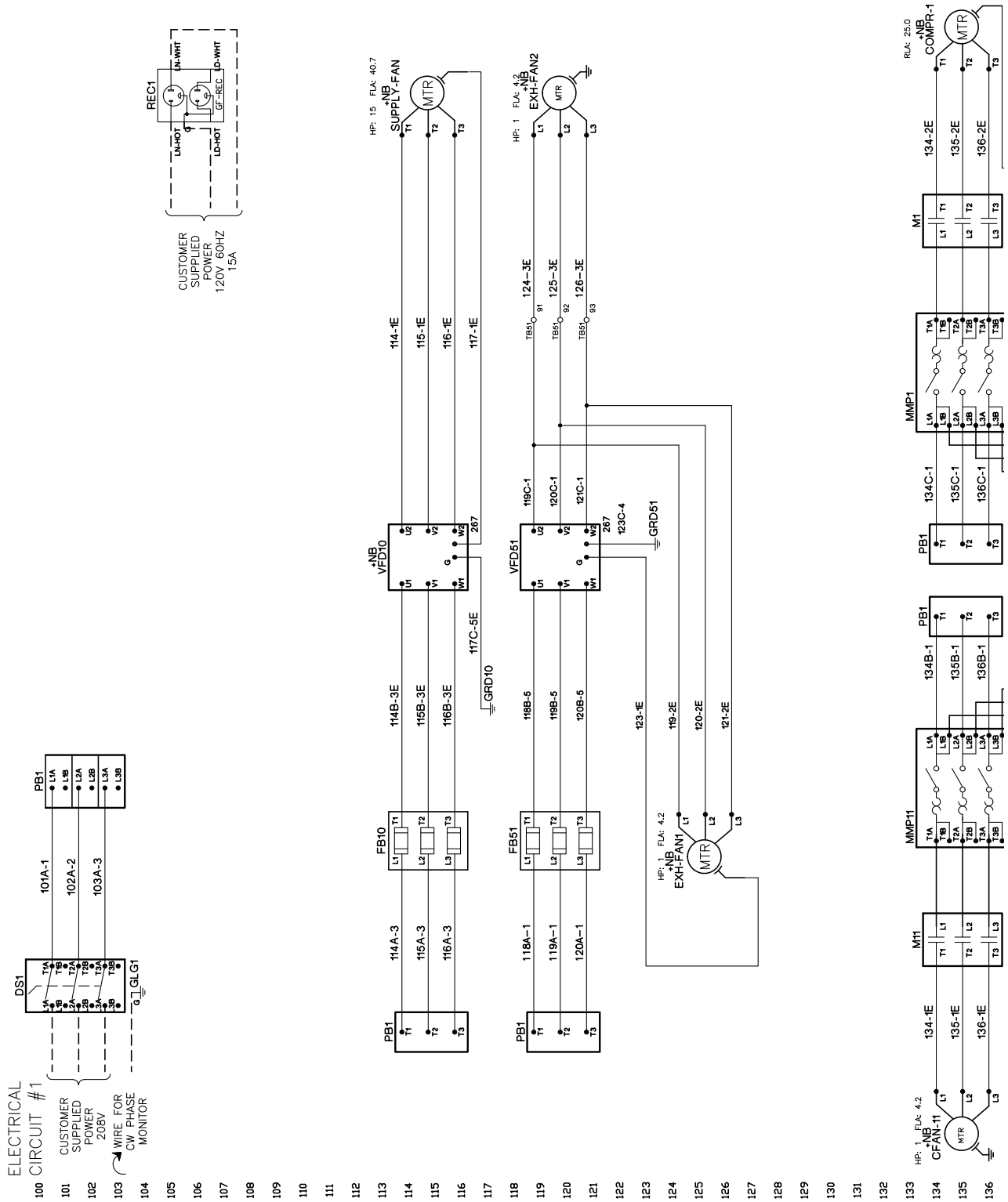


Figure 62 continued: MPS 026 VAV Power with Variable Speed Inverter Compressor

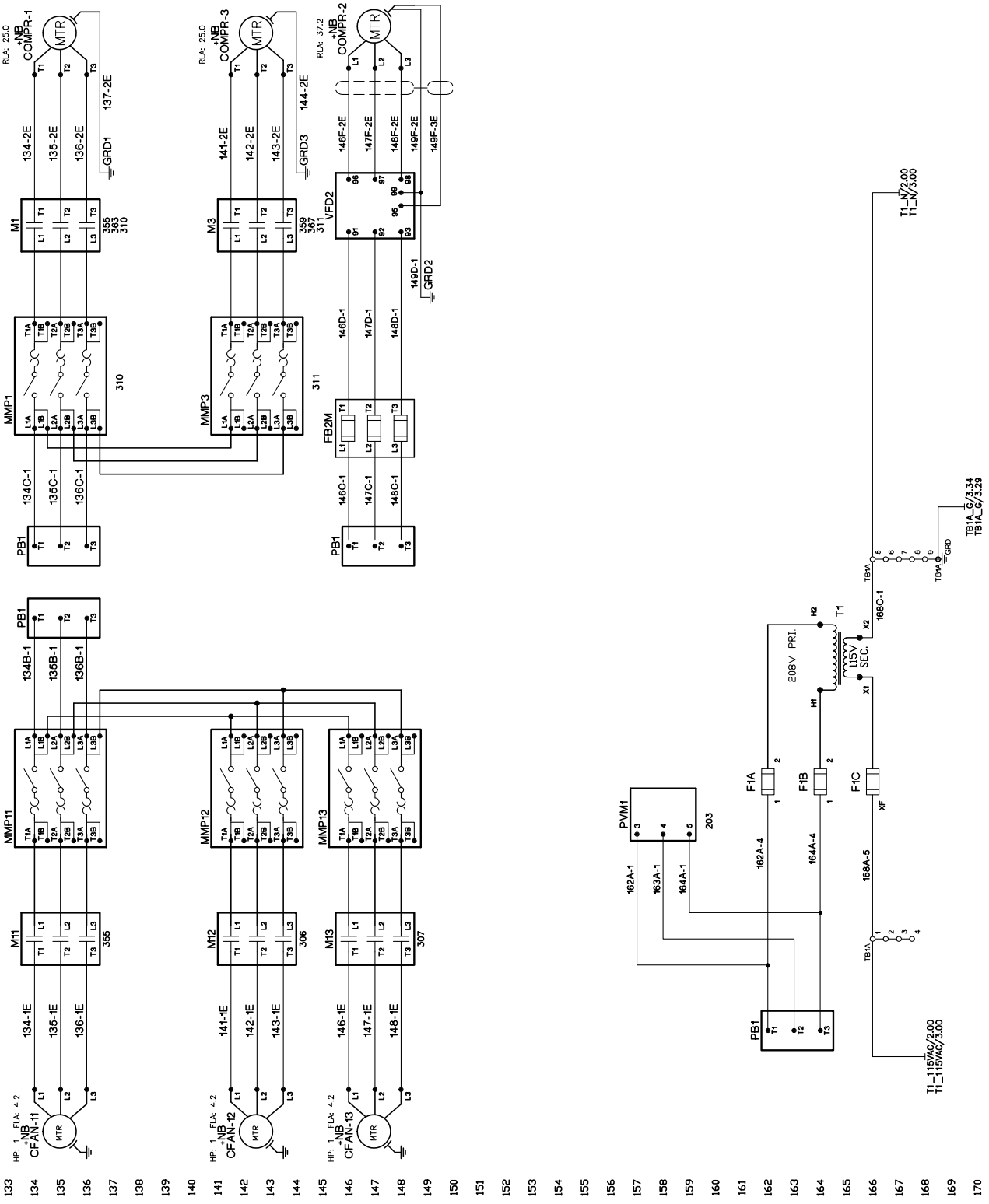


Figure 63: MPS 030–050 VAV Power with Variable Speed Inverter Compressor

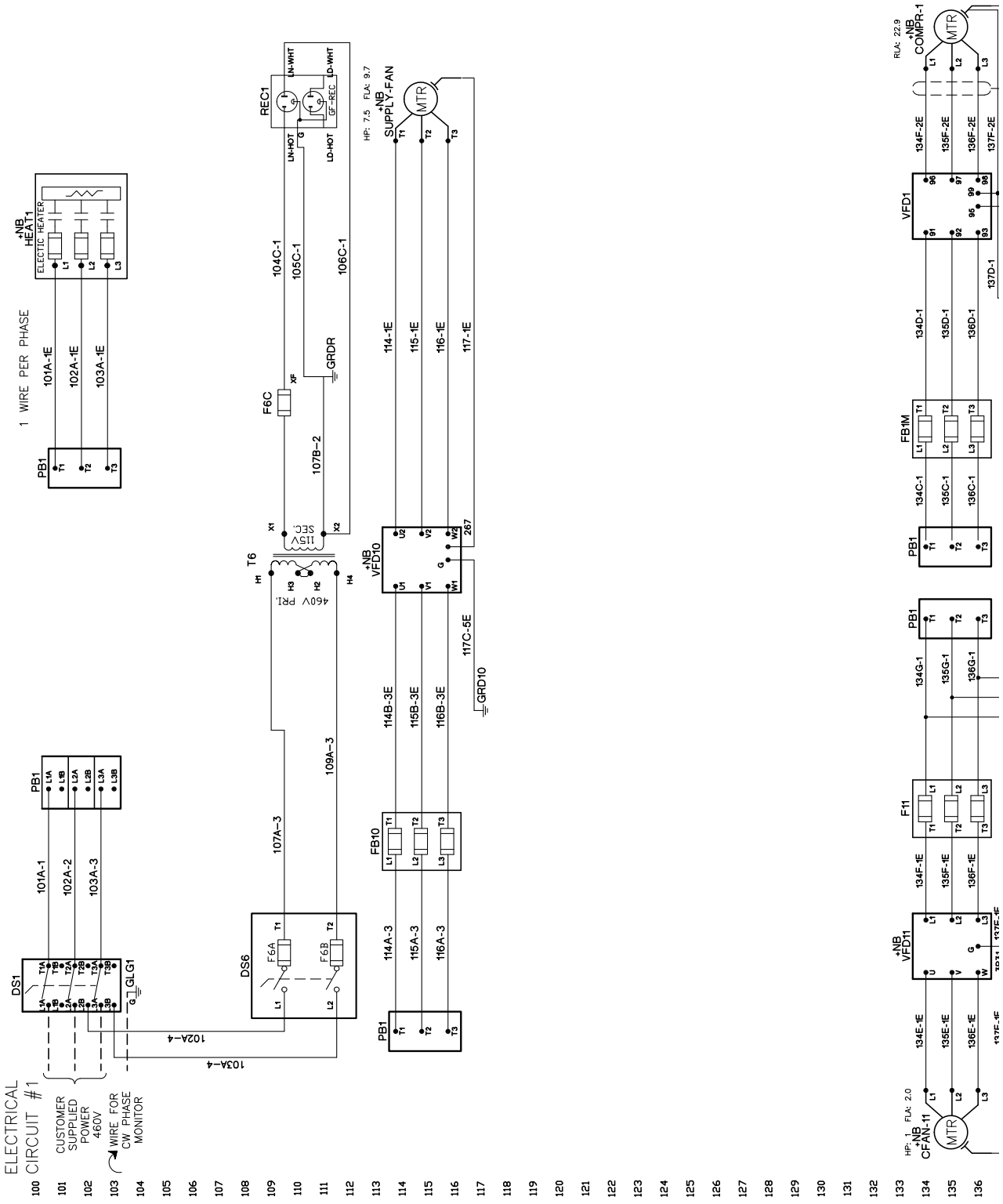


Figure 63 continued: MPS 030–050 VAV Power with Variable Speed Inverter Compressor

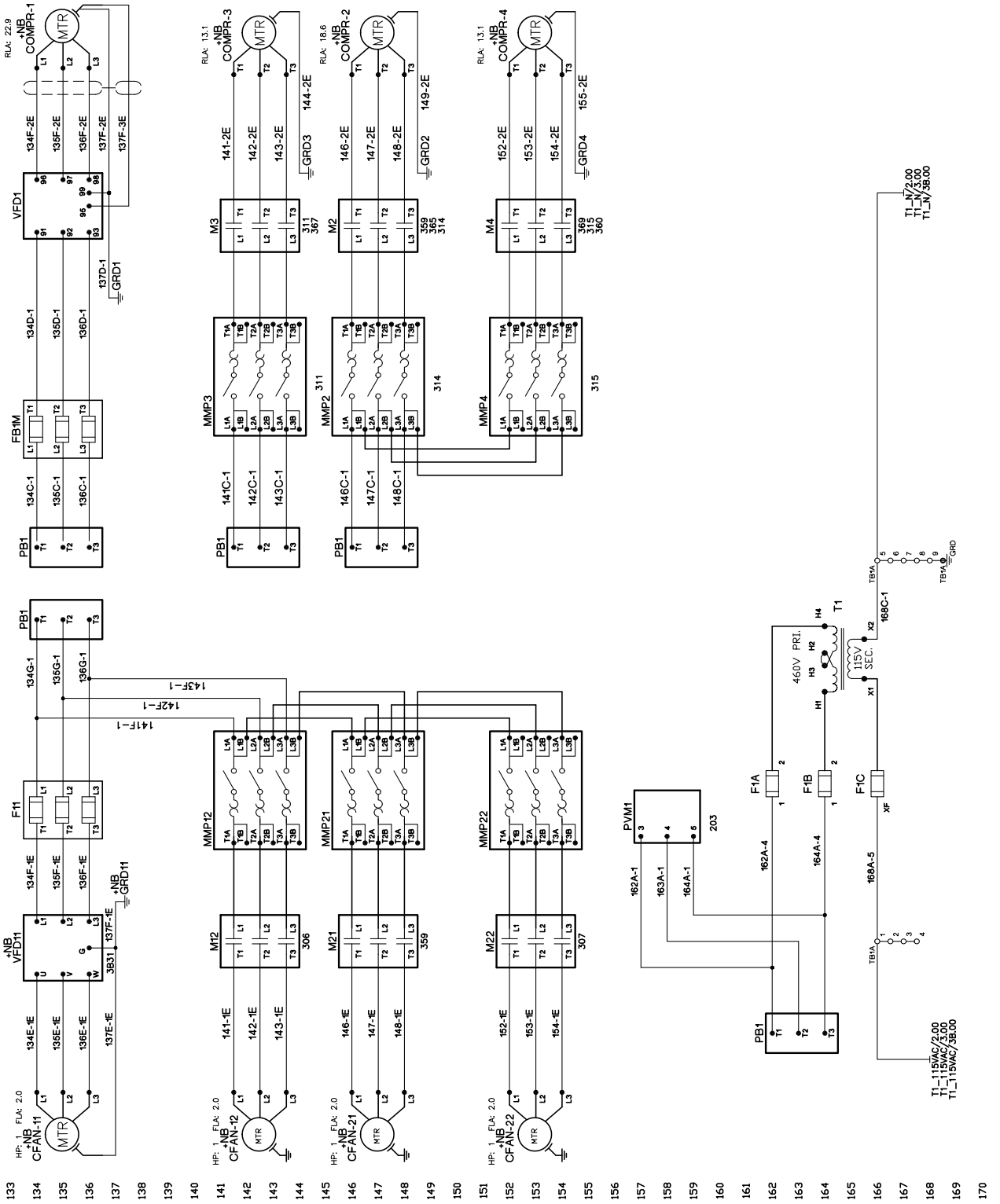


Figure 64: VAV Control – Inputs

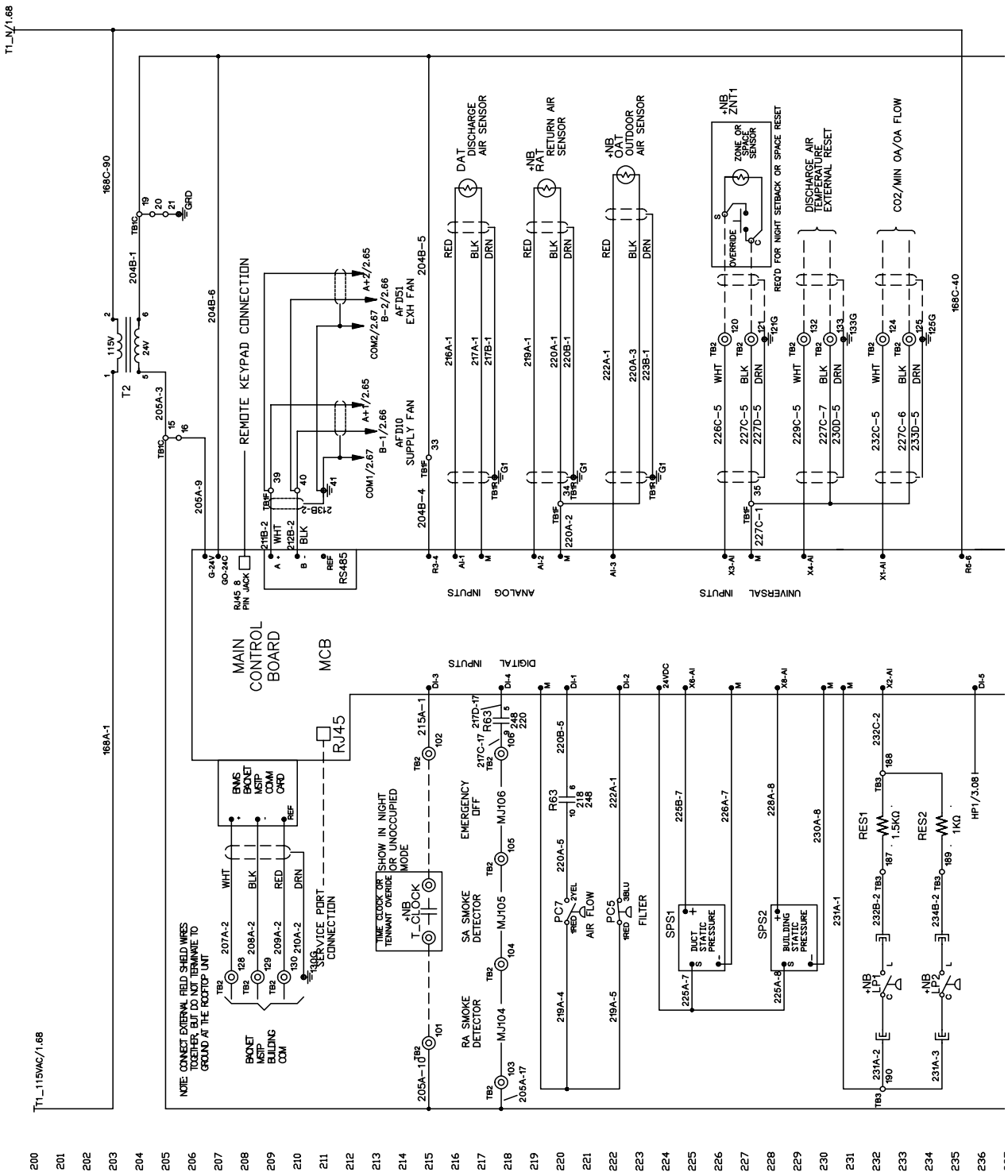


Figure 64 continued: VAV Control – Inputs

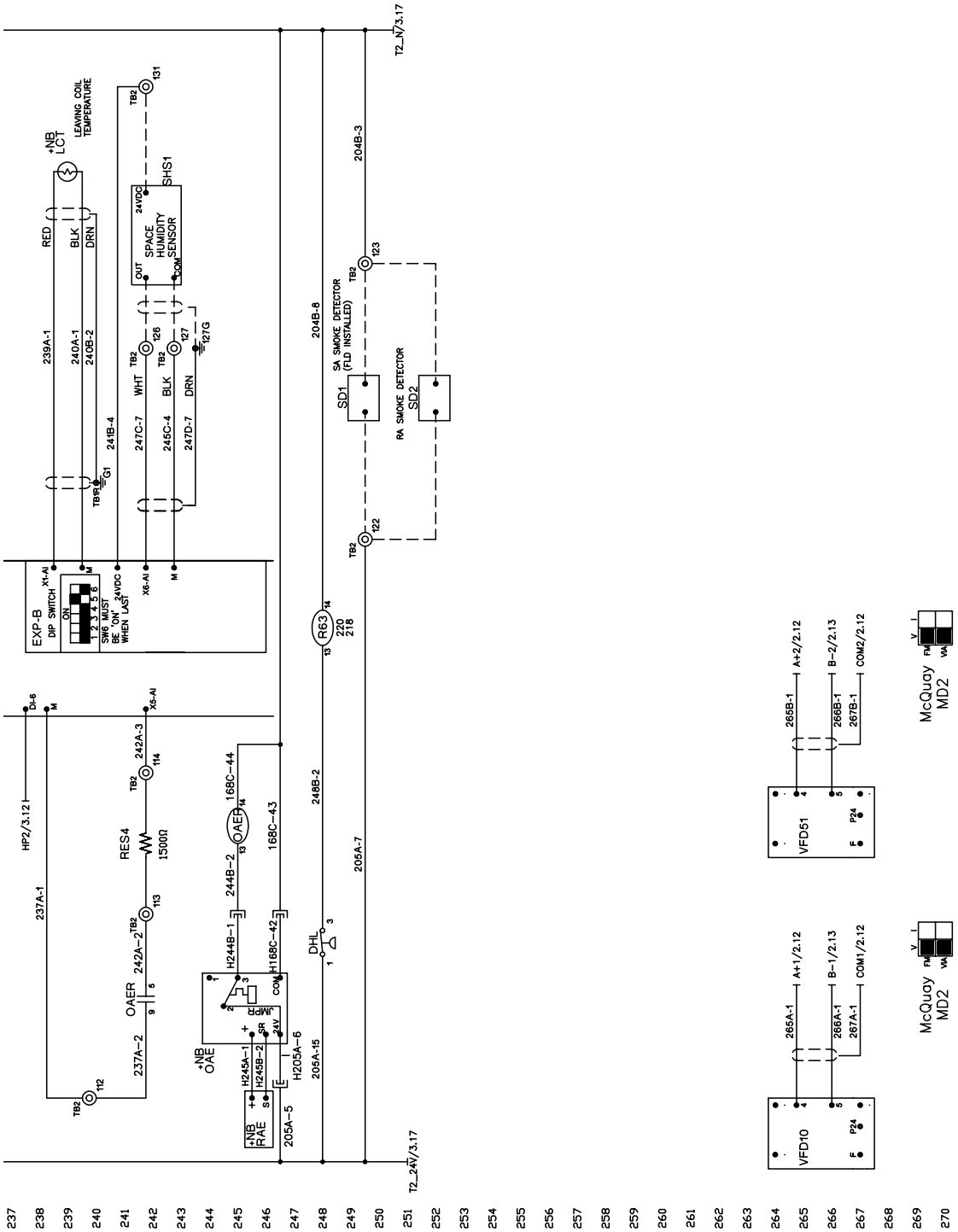


Figure 65: MPS 026 VAV Control with Variable Speed Inverter Compressor

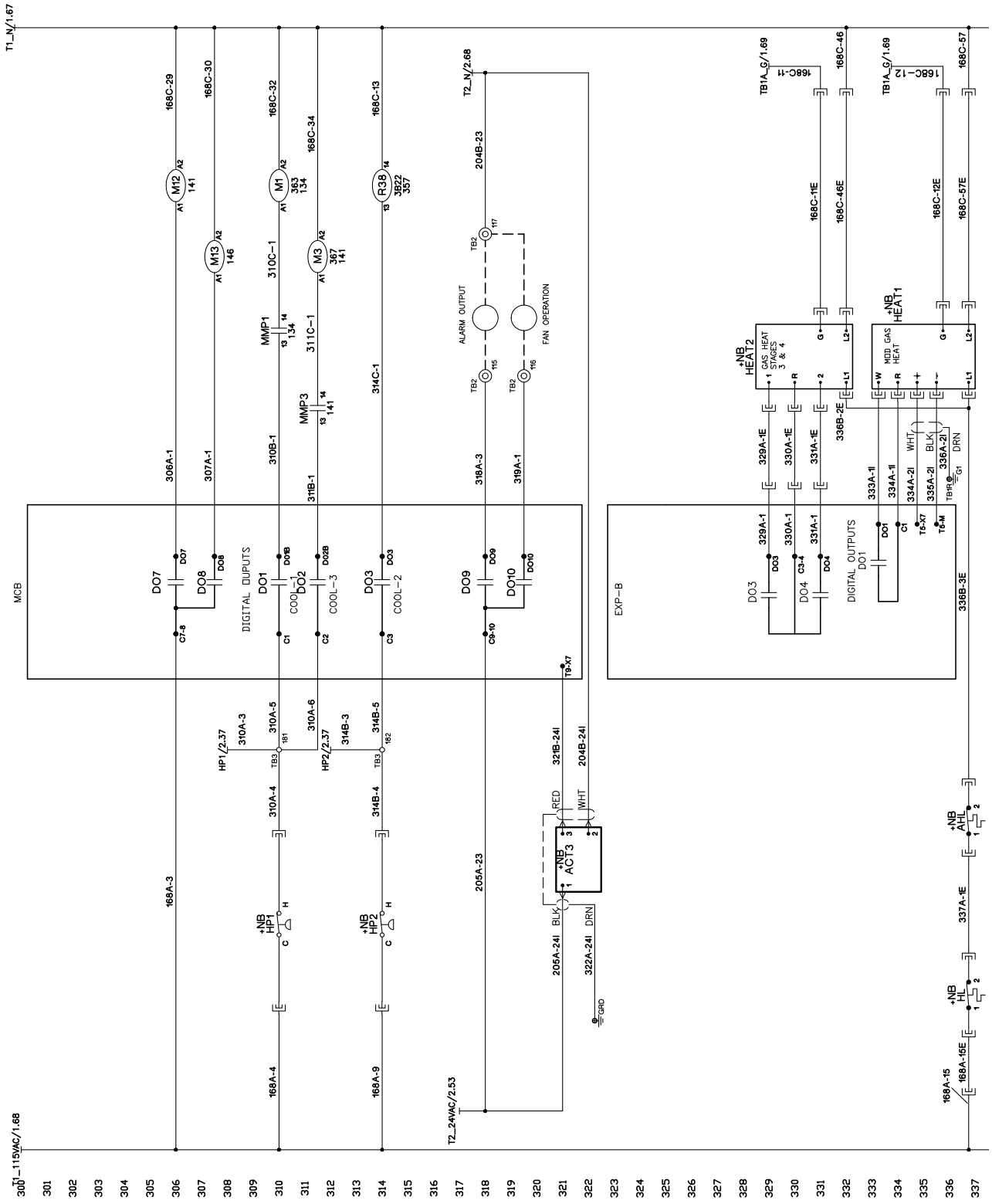


Figure 65 continued: MPS 026 VAV Control with Variable Speed Inverter Compressor

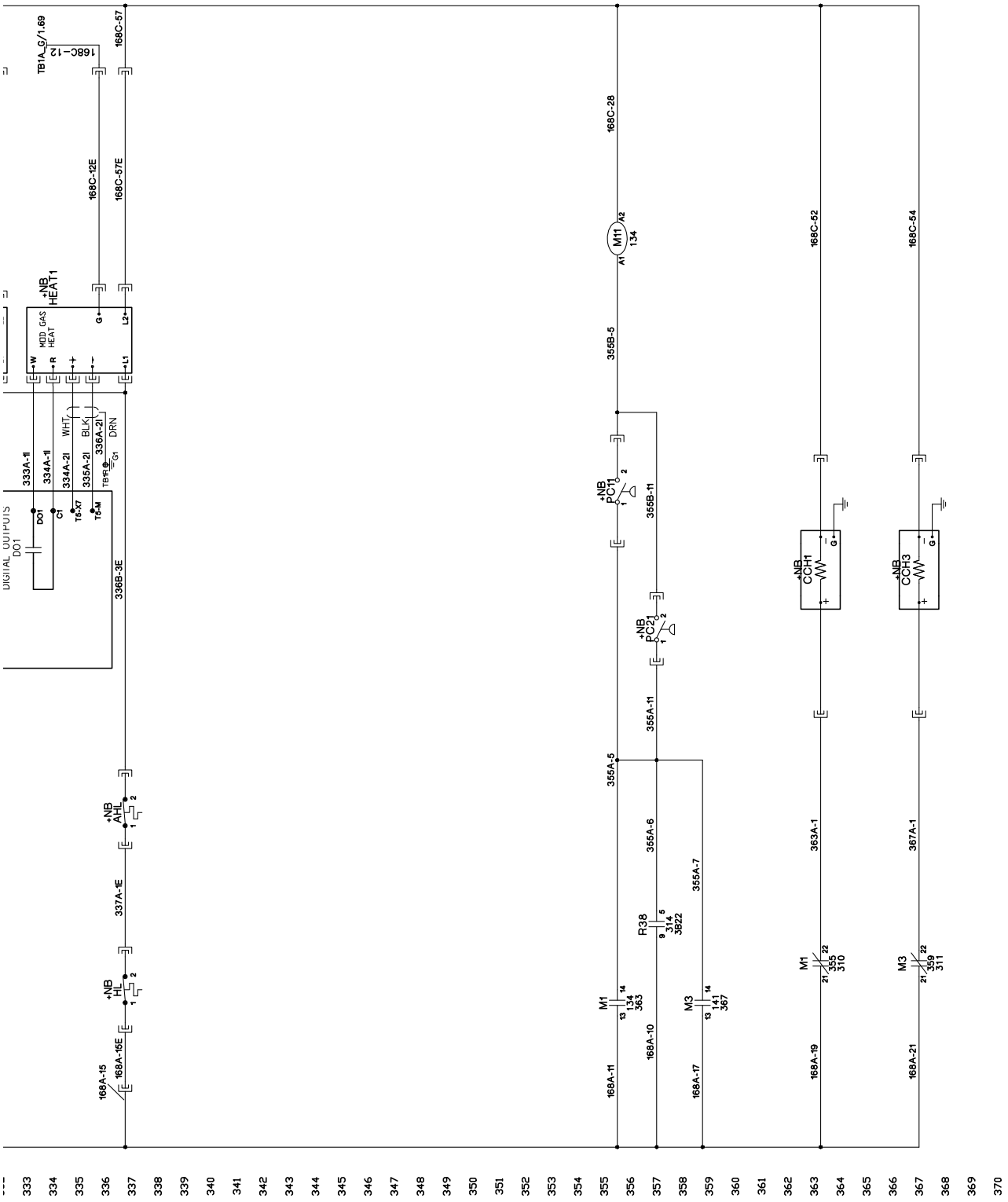


Figure 66: MPS 026 with Variable Speed Inverter Compressor – without Low Ambient Option

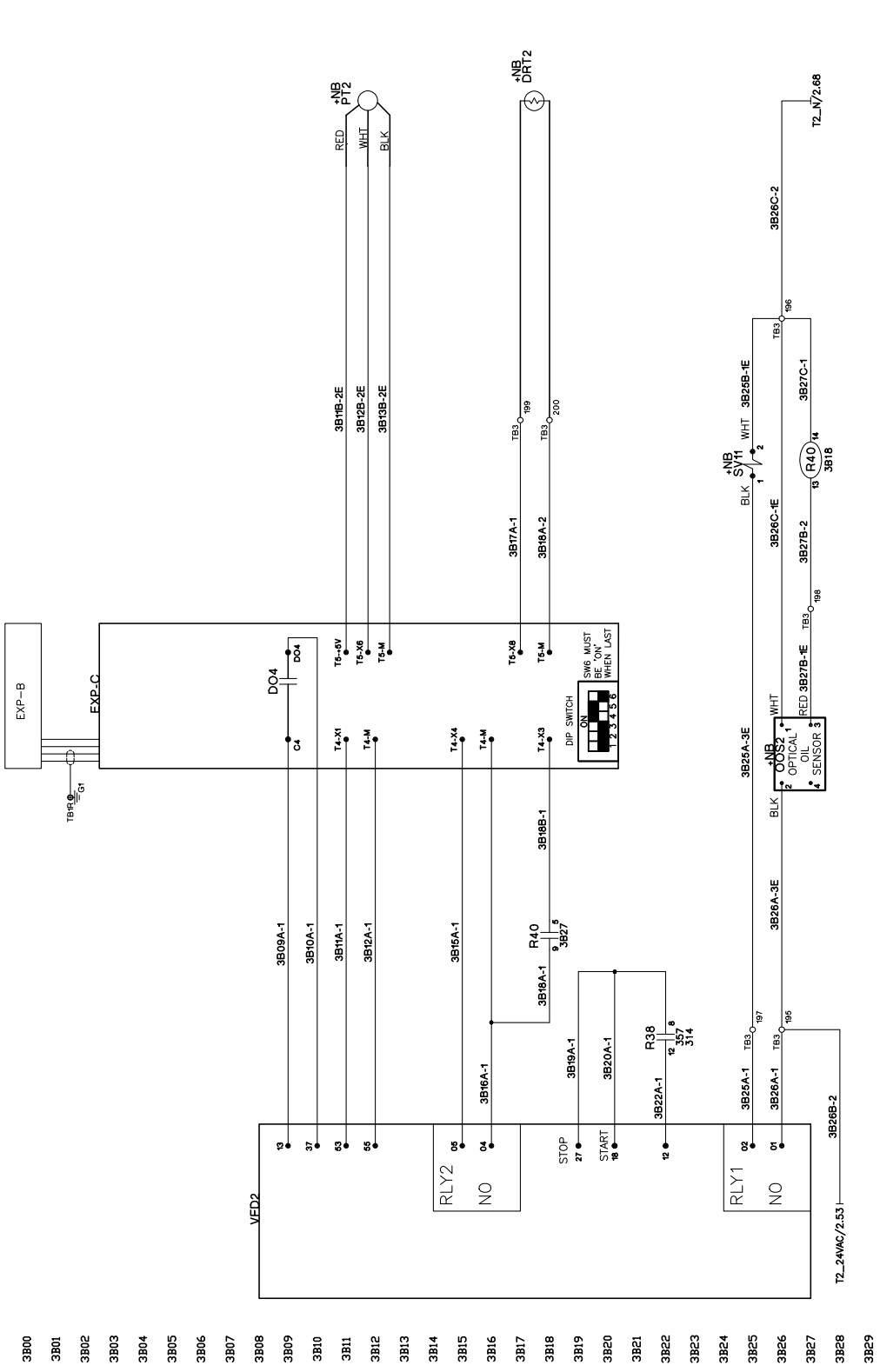


Figure 67: MPS 030 – 050 VAV Control with Variable Speed Inverter Compressor

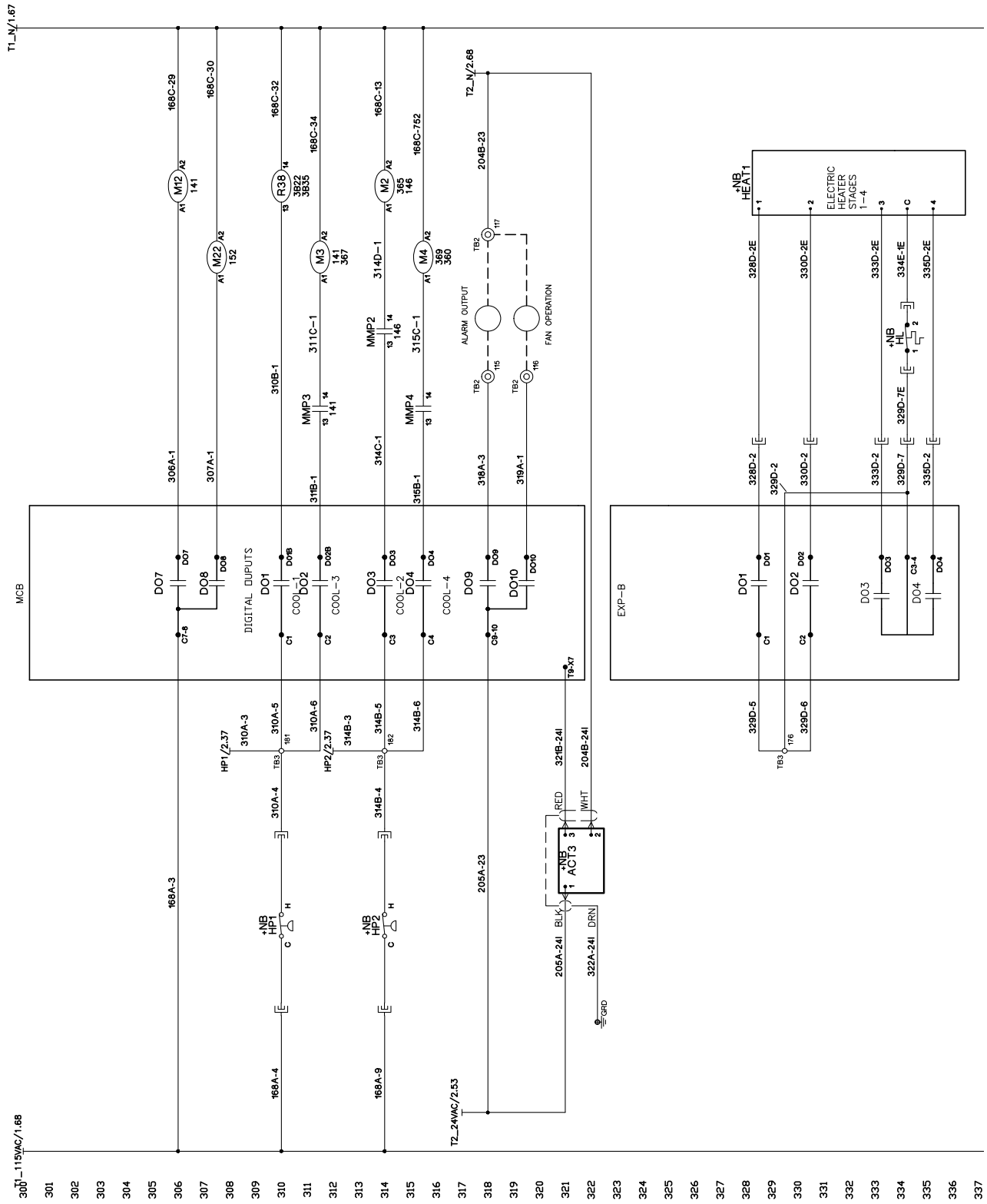


Figure 67 continued: MPS 030 – 050 VAV Control with Variable Speed Inverter Compressor

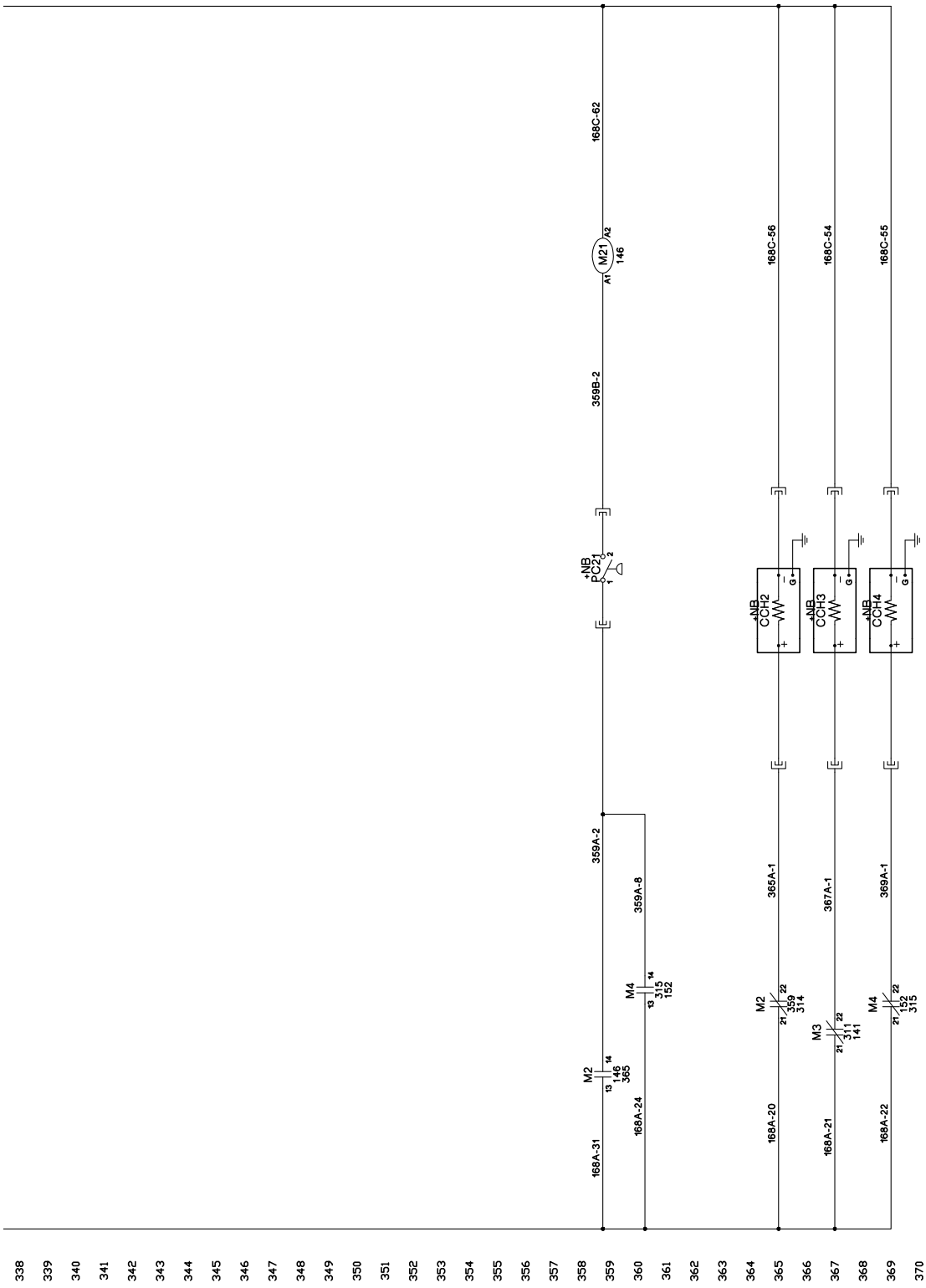


Figure 68: MPS 040 – 050 with Variable Speed Inverter Compressor – with Low Ambient Option

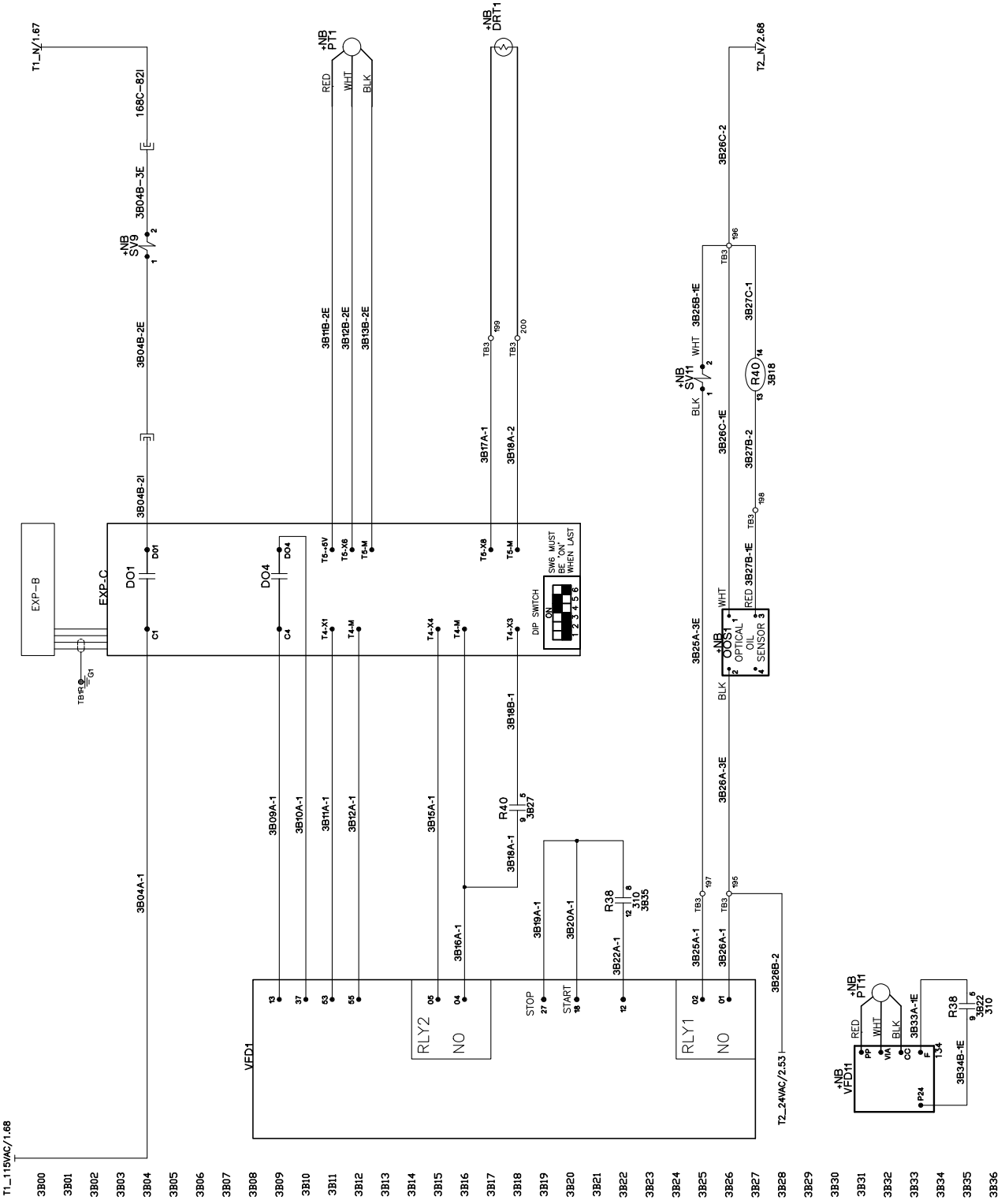


Figure 69: VAV Control – Outputs (Staged Gas Heat)

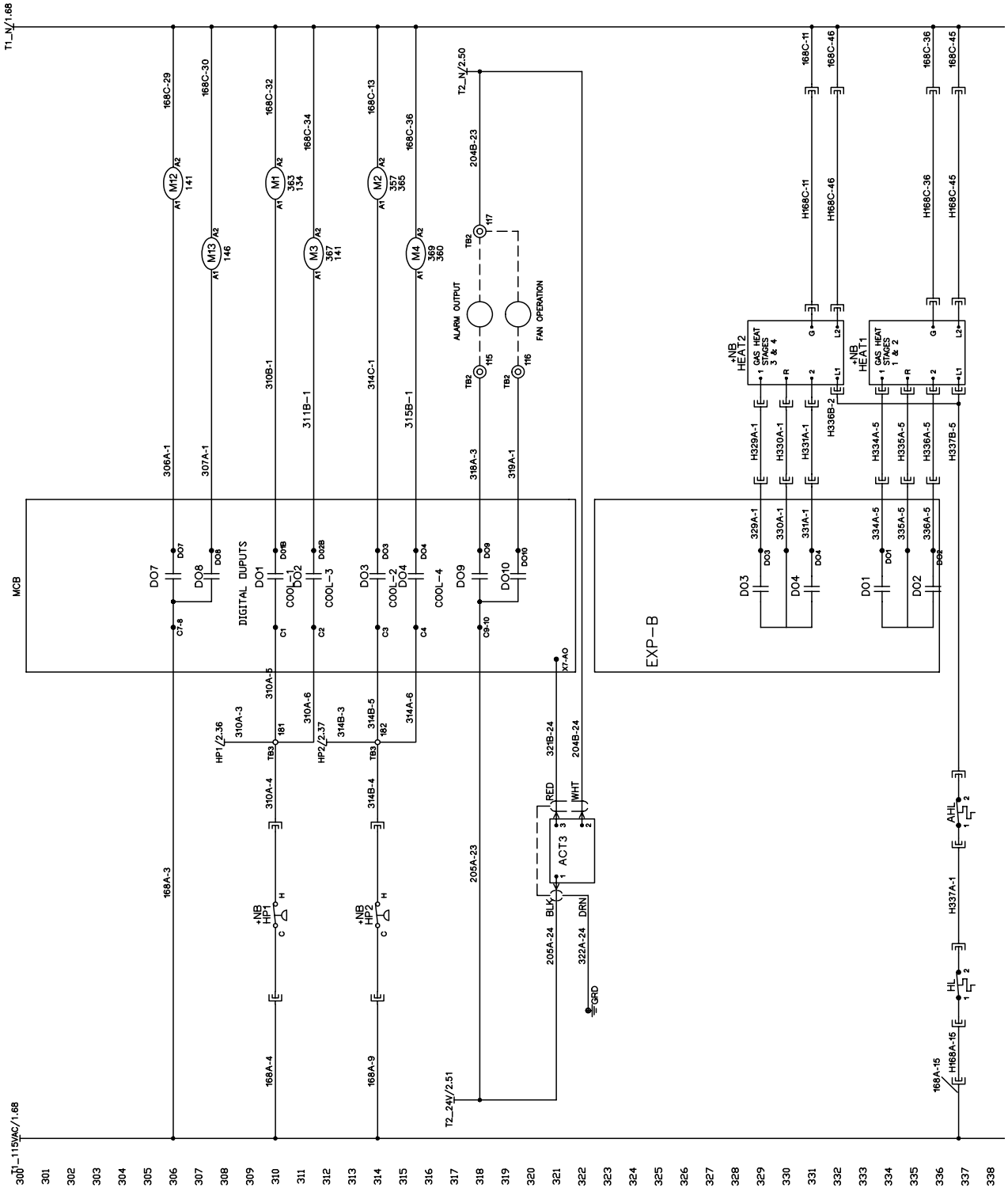


Figure 69 continued: VAV Control – Outputs (Staged Gas Heat)

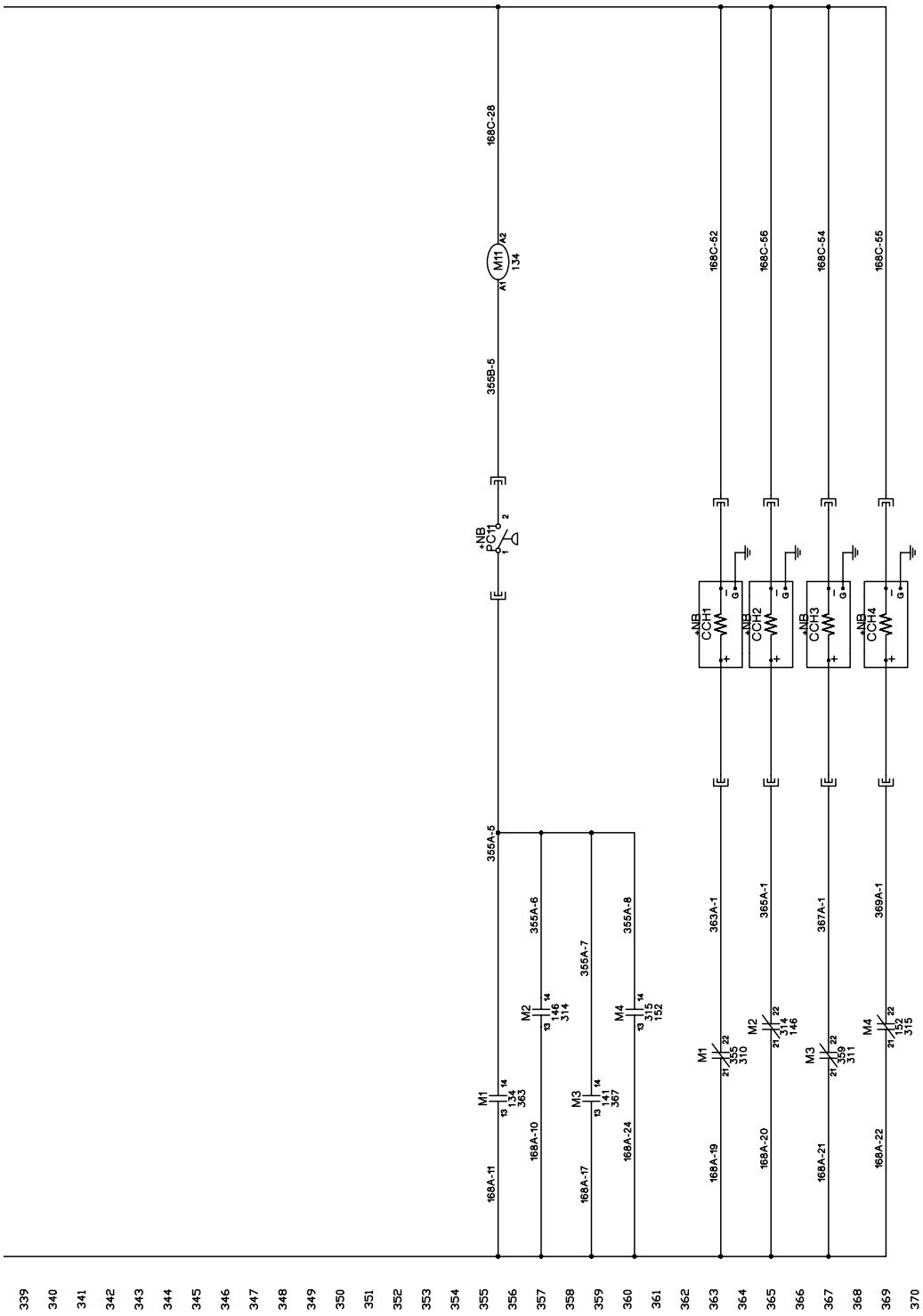


Figure 70: CAV Power

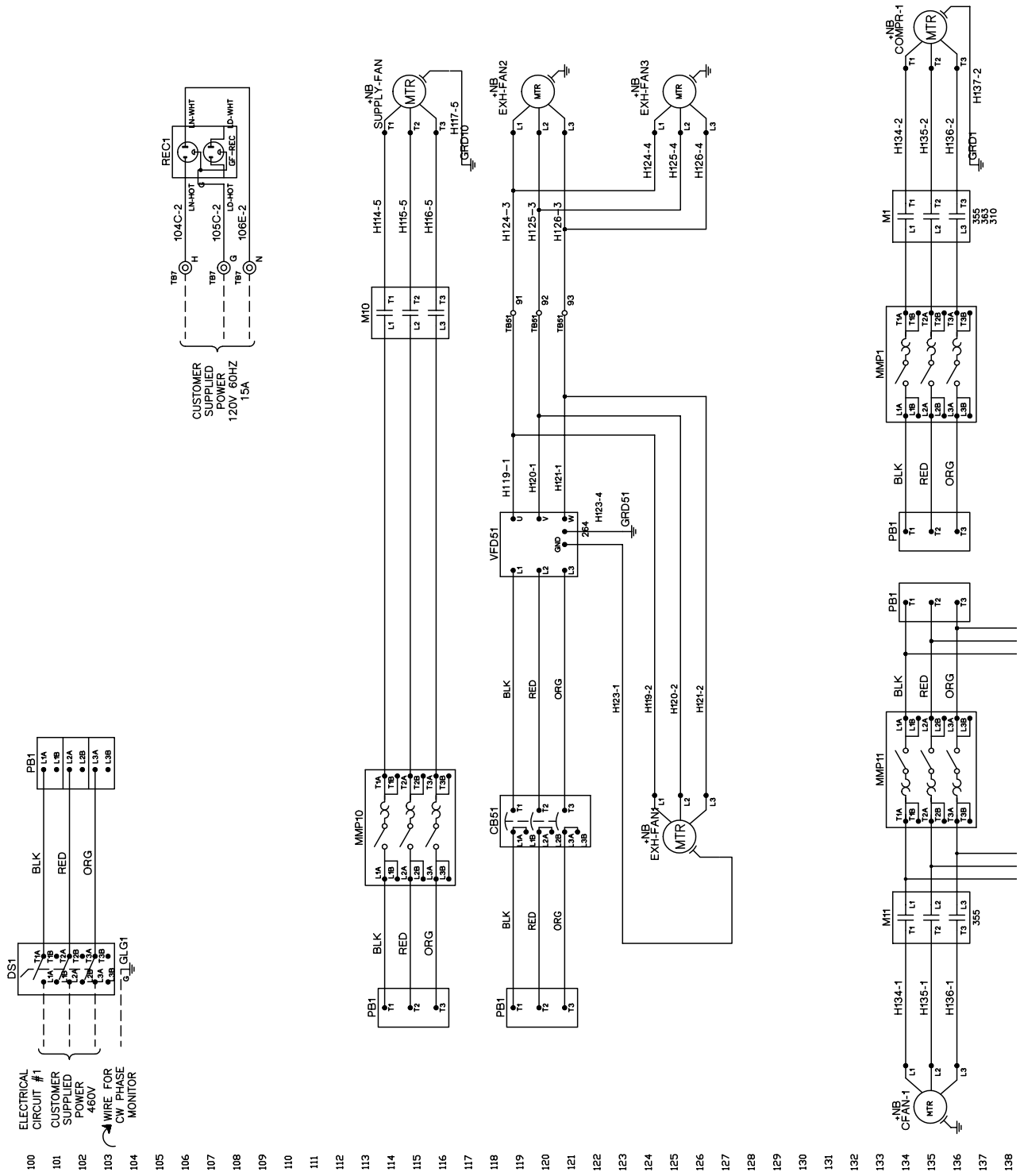


Figure 70 continued: CAV Power

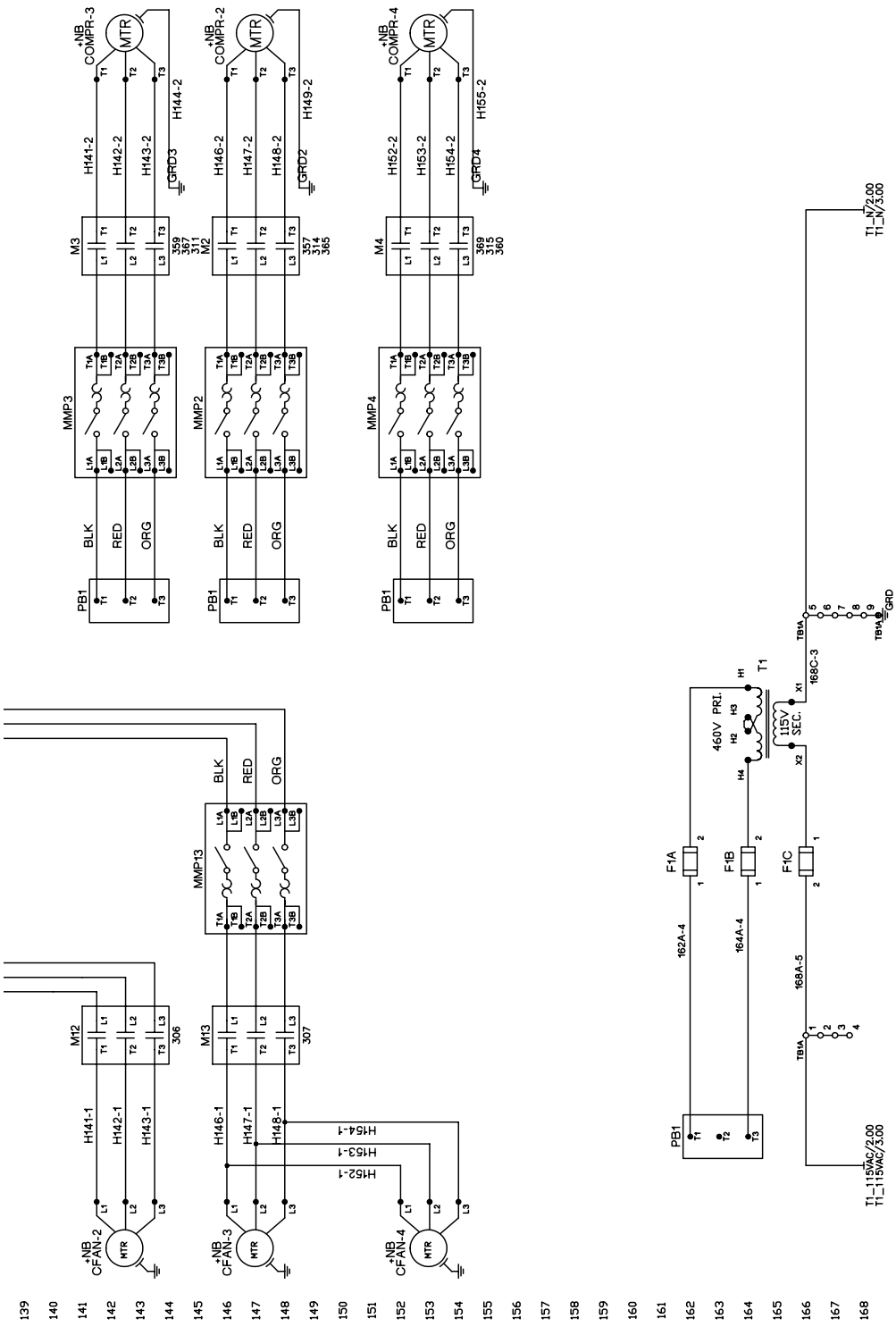


Figure 71: CAV Control – Inputs

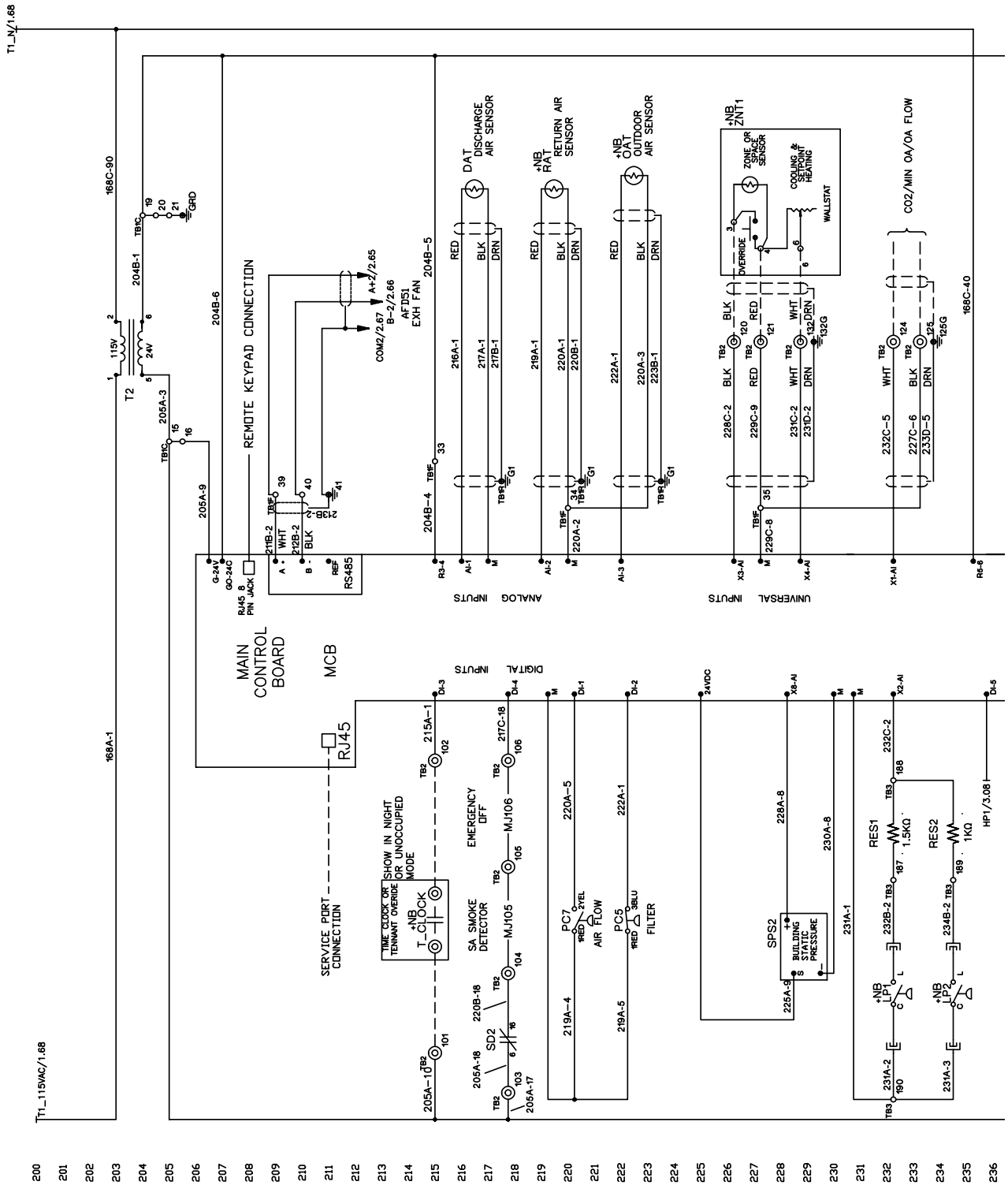


Figure 71 continued: CAV Control – Inputs

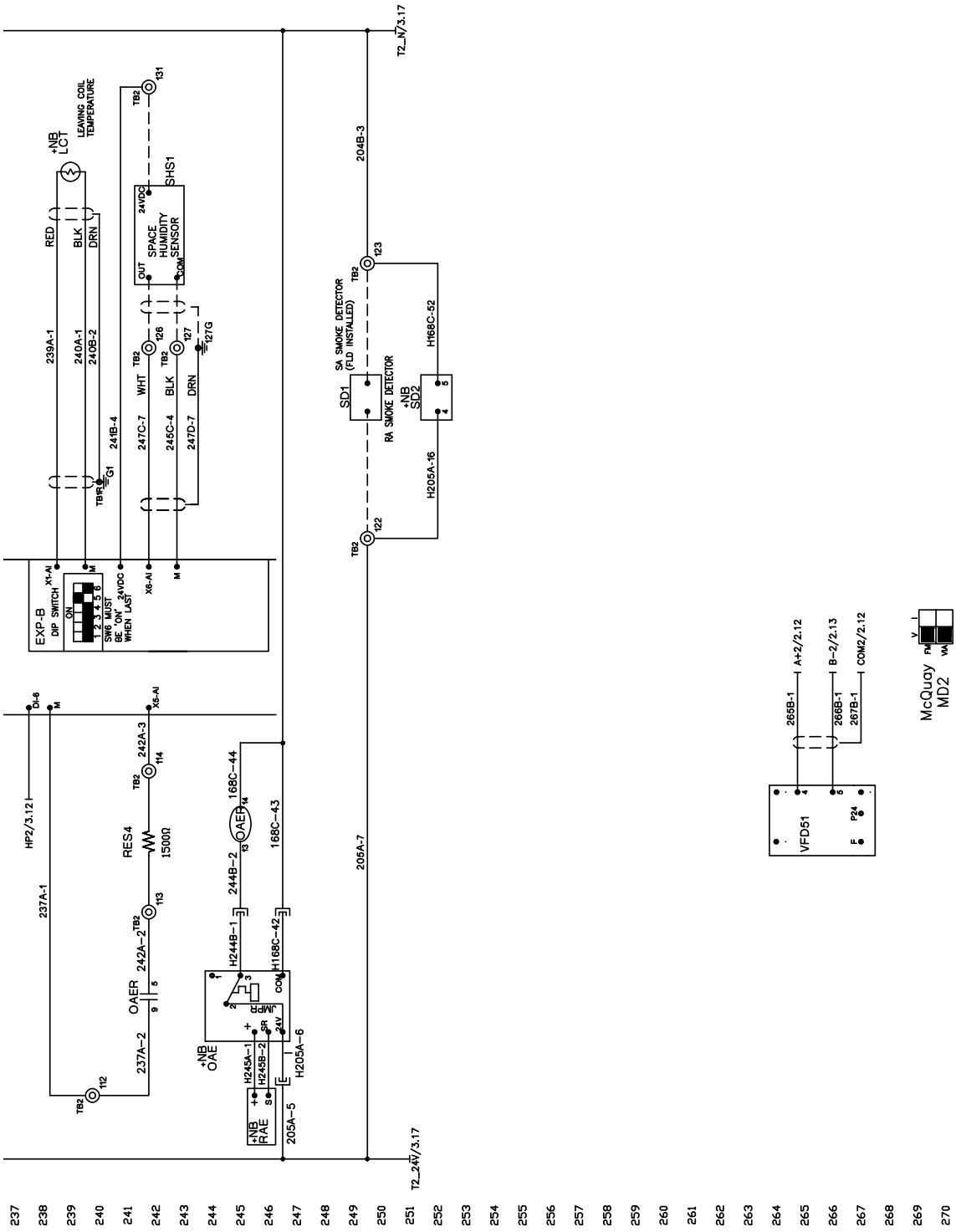


Figure 72: CAV Control – Outputs (Staged Gas Heat)

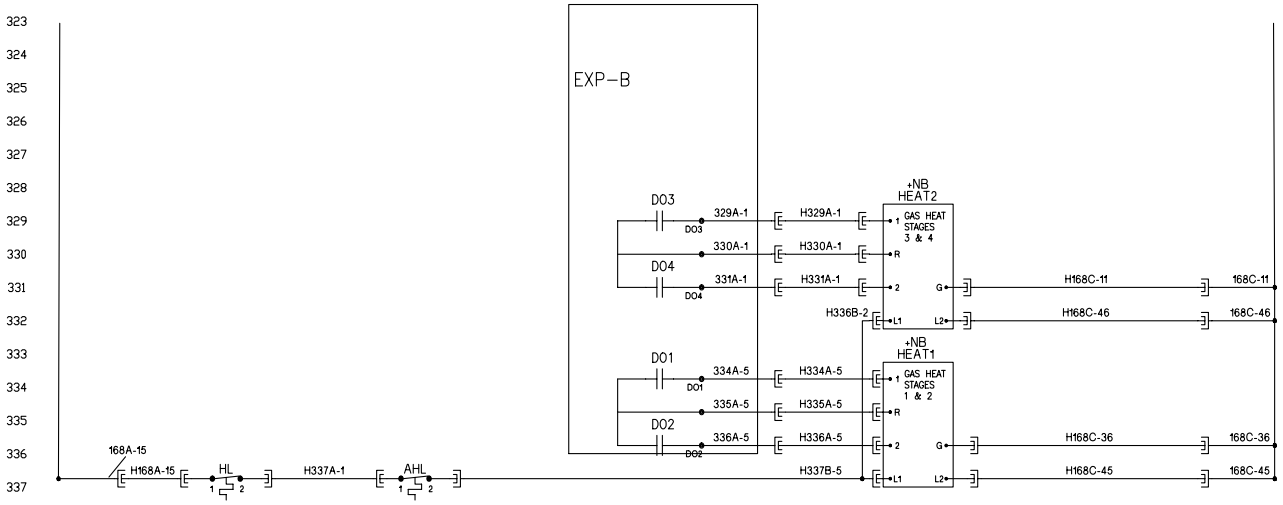


Figure 73: VAV/CAV Control – Outputs (Modulating Gas Heat)

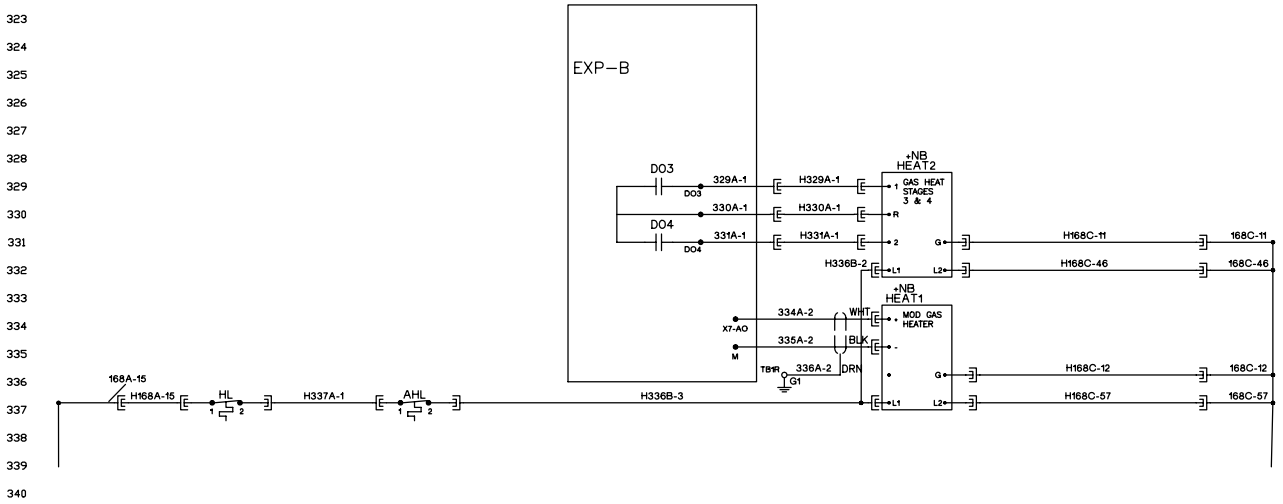


Figure 74: Electric Heat Option Power

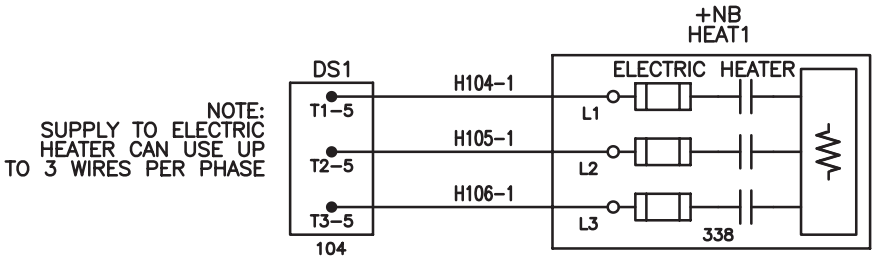


Figure 75: Electric Heat Option – Outputs

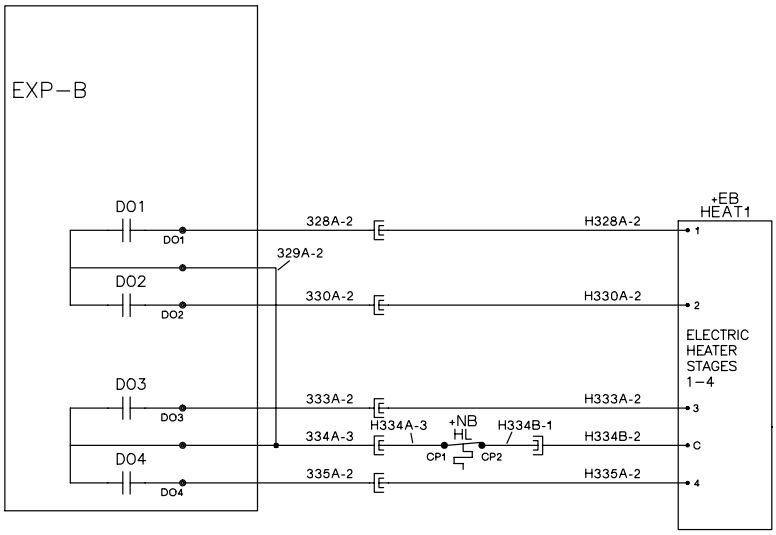


Figure 76: Energy Recovery

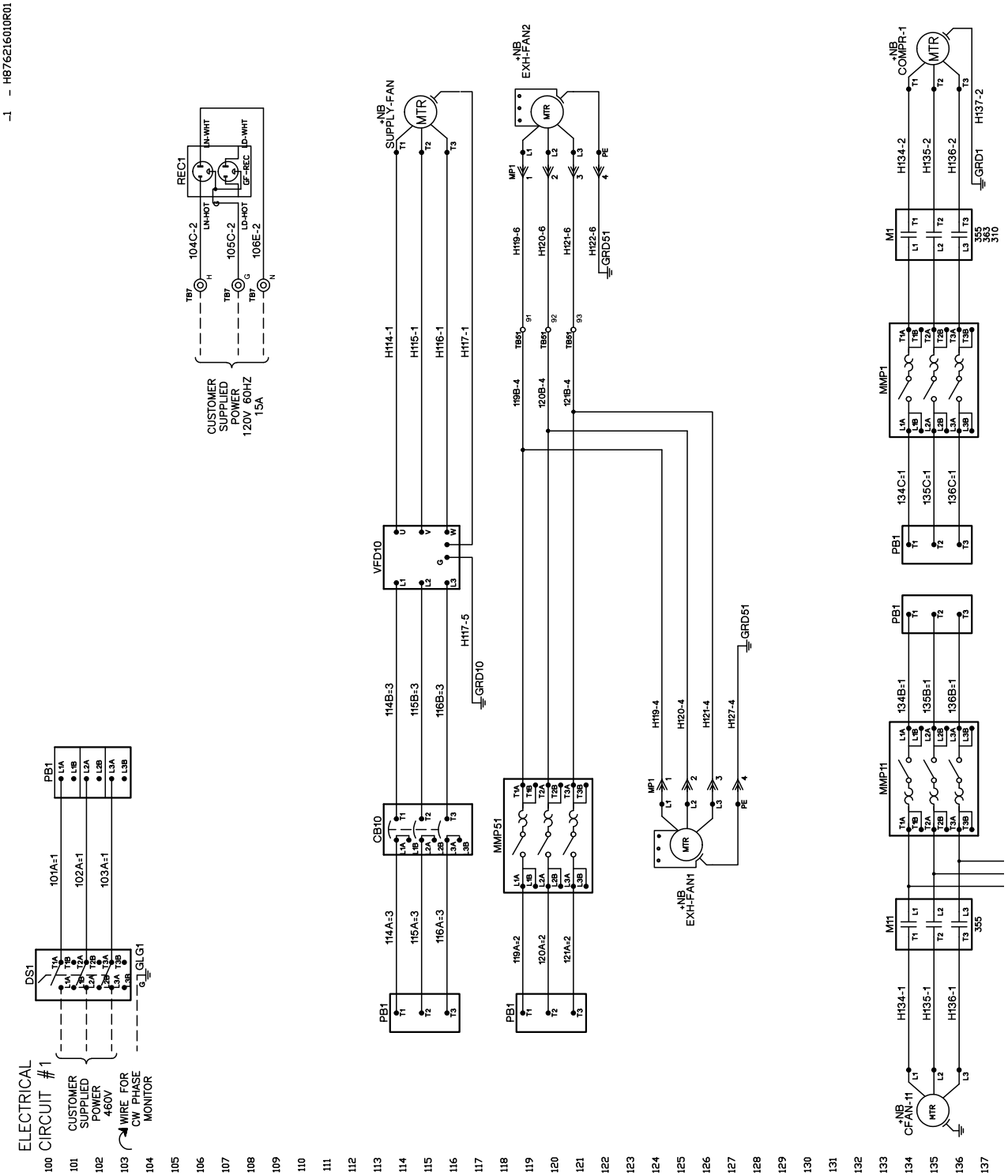


Figure 76 continued: Energy Recovery

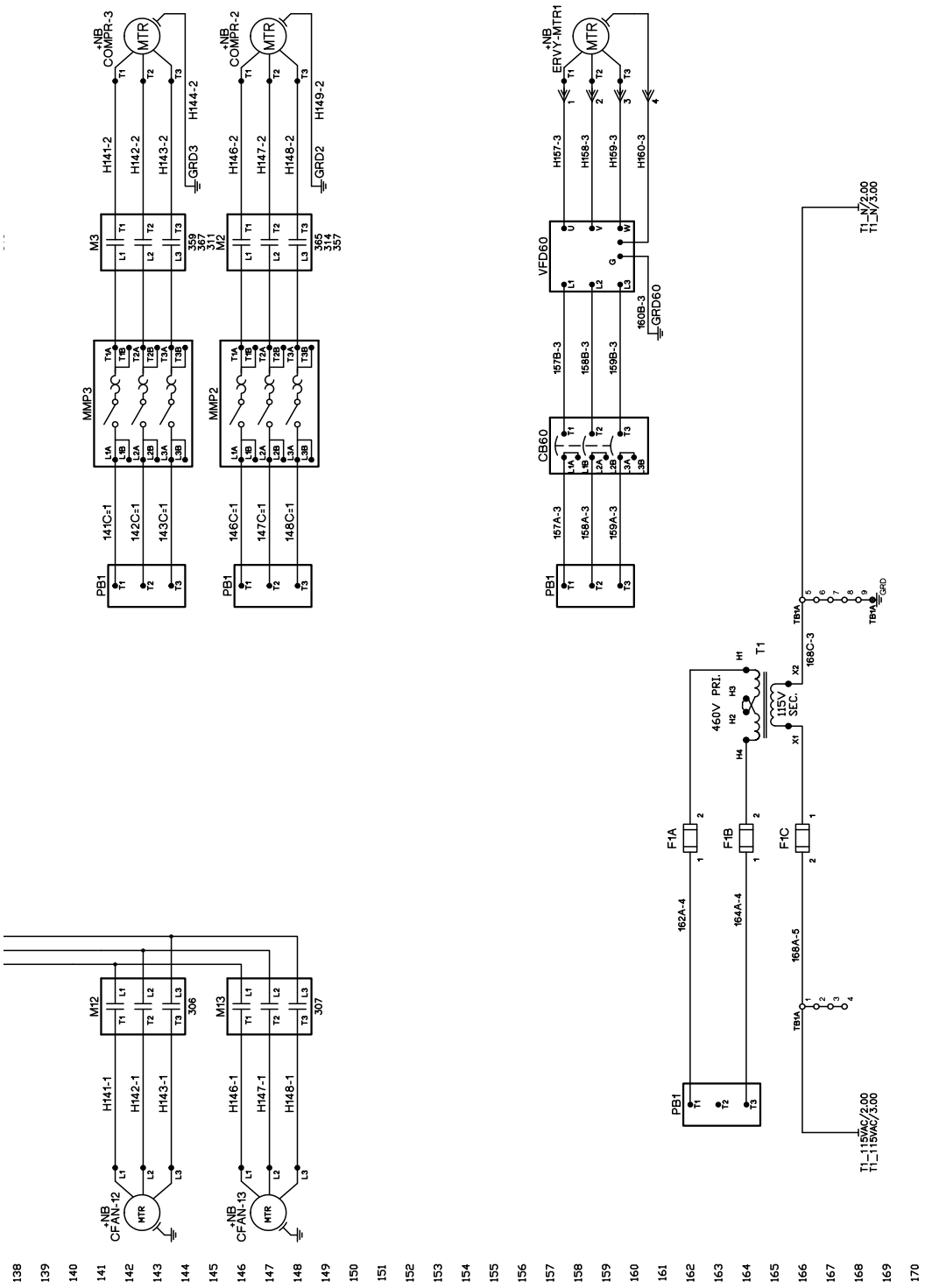


Figure 77: Energy Recovery Main Control Board

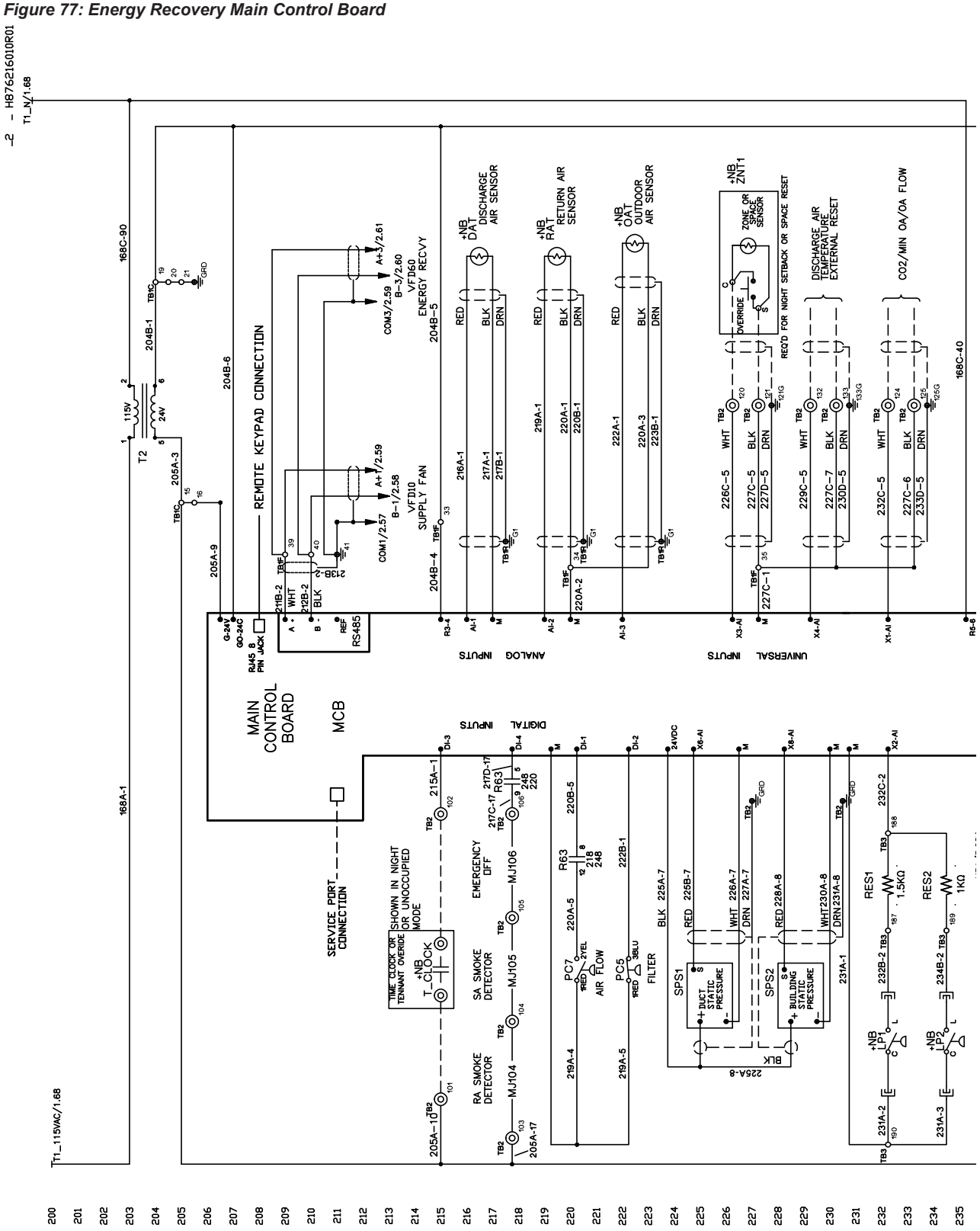
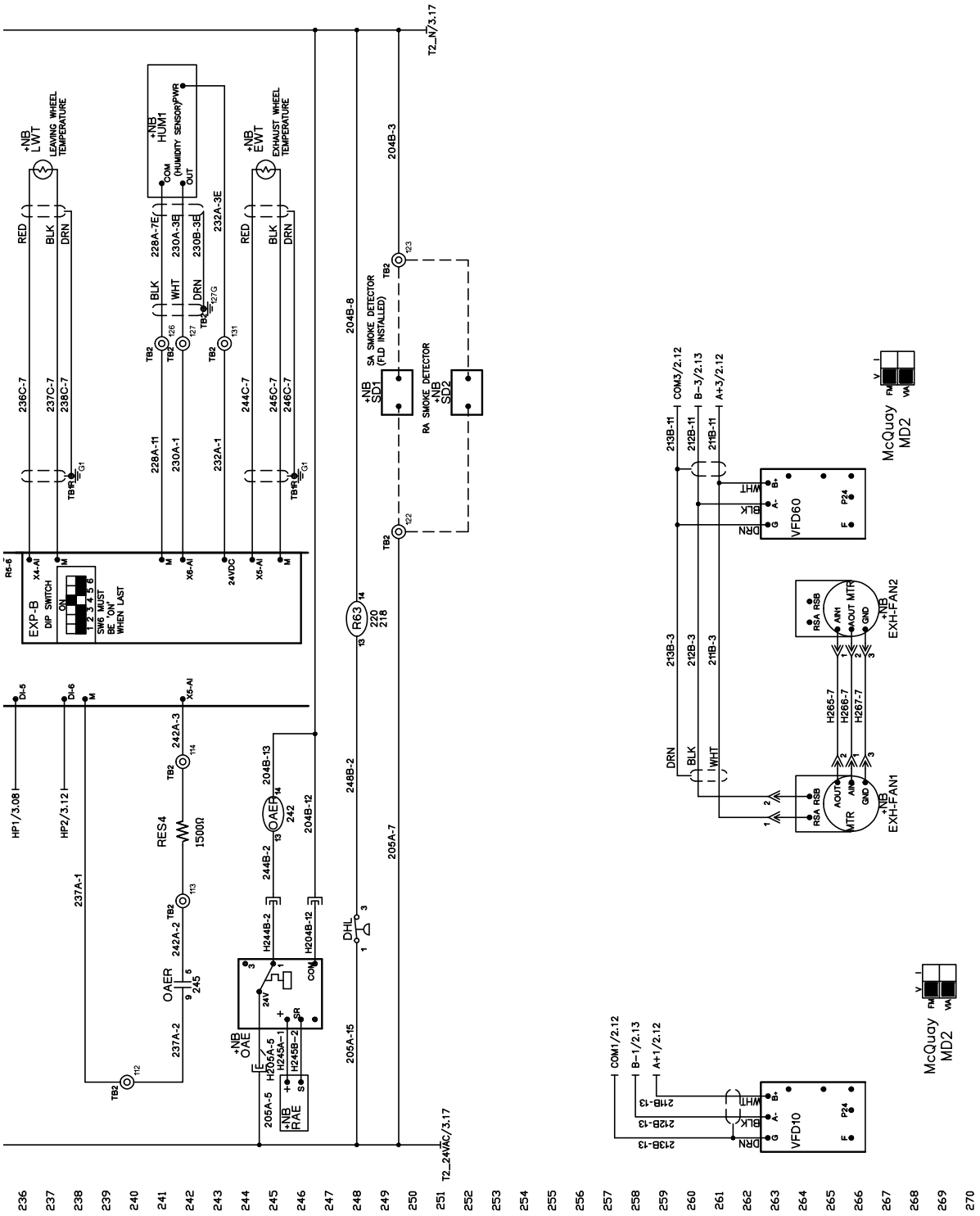


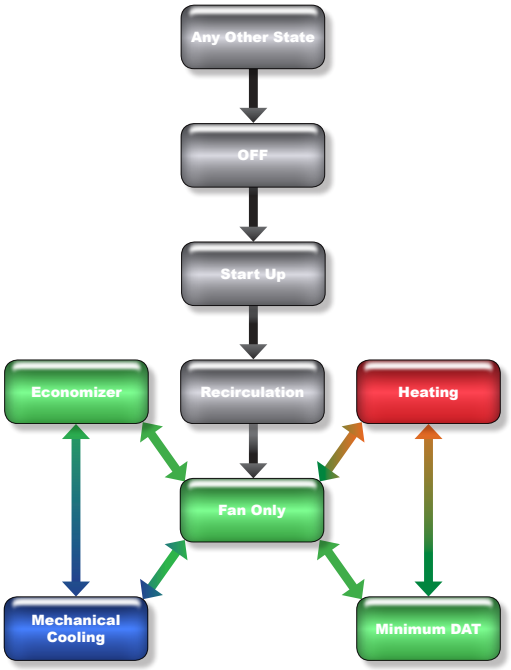
Figure 77 continued: Energy Recovery Main Control Board



Operating States

The transition from any operating state to another is graphically represented in Figure 78.

Figure 78: State Diagram



Start Up

With a “start up” command from the “Off” State the unit will default into the “Start Up” state of operation for 3 minutes. During this time, the fan is off.

Recirculation

Next, the unit will transition into the “Recirculation” state of operation for another 3 minutes. During this time, the outside air damper will close and the fan will turn on, thereby mixing the air in the ductwork and the space.

Fan Only

The outside air damper will modulate to the minimum position and based upon the sensor inputs, the unit will go into one of the four running states - “Heating,” “Cooling,” “Economizing,” or “Minimum DAT.” If the control temperature is between its setpoint and its dead band, the unit will remain in the “Fan Only” state.

Heating

The unit's heating mode of operation is controlled by the control temperature and the heating setpoint temperature. The unit goes into the heating mode of operation by analyzing the control temperature.

The control temperature can be either the return temperature or the space temperature.

The return temperature is typically used for VAV units and the space temperature is typically used for CAV units.

The unit goes into the heating mode of operation when the control temperature (return or space temperature) is below the heating setpoint by more than ½ the deadband.

Example – If the heating setpoint is 68.0°F and the deadband is 1.0°F, the unit will not go into the heating mode of operation until the control temperature reaches 67.4°F.

When this takes place, the heating mode of operation will begin and the 1st stage of heating operation will start. The next stage, up or down, will take place after 4 minutes. This “4 minutes” is called the stage timer. The gas or electric heat module will continue to stage up as long as the control temperature is below the heating setpoint by more than ½ the heating setpoint deadband. The unit will stage down if the maximum discharge air temperature of 120°F is reached. Gas units with one gas valve have 2 stages of heating and units with two gas valves have 4 stages of heating.

Minimum DAT

This control mode is designed to temper the air in the ductwork when in heating mode. When the unit is in the “Fan Only” state and the Discharge Air Temperature is less than the minimum discharge air temperature limit, “Minimum DAT” control is initiated. The unit will turn on minimum heat until the discharge air temperature exceeds the limit.

Mechanical Cooling

Constant Volume (Space Comfort Controller)

The control temperature for a CAV unit is typically the space temperature. A space temperature sensor must be field installed into the occupied space and connected to the unit controller.

The unit goes into the cooling mode of operation when the control temperature (space temperature) is above the cooling setpoint by more than ½ the deadband.

Example – the cooling setpoint is set to 70.0°F and the deadband is 1.0°F, the unit will not go into the cooling mode of operation until the space sensor reaches 70.6°F.

When this takes place, the cooling mode of operation will begin and the 1st stage of compressor operation will start.

The unit controller will turn on the next stage of compressor operation, or turn off a stage of compressor operation, to maintain the cooling setpoint temperature within the deadband. When a compressor stage turns on, the next compressor stage, up or down, will not take place for the next 4 minutes. This “4 minutes” is called the stage time. Reference the “Cooling Setup” menu for the adjustable stage time value.

When a cooling stage is initiated no further operation will take place within the stage timer limit. In the above example, the unit will stage down or turn off the cooling mode of operation when the cooling setpoint reaches 69.4°F.

Variable Air Volume (Discharge Air Controller)

The unit's cooling mode of operation is controlled by the control temperature, the change-over temperature, and the discharge air temperature. The unit goes into the cooling mode of operation by analyzing the control temperature. The control temperature for a VAV system is the return temperature.

The unit goes into the cooling mode of operation when the control temperature (return temperature) is above the changeover setpoint by more than ½ the deadband.

Example – If the change over temperature is 70.0°F and the deadband is 1.0°F, the unit will not go into the cooling mode of operation until the return temperature reaches 70.6°F.

When this takes place, the cooling mode of operation will begin and the 1st stage of compressor operation will start.

The unit controller will turn on the next stage of compressor operation, or turn off a stage of compressor operation, to maintain the discharge air temperature setpoint within the deadband. When a compressor stage turns on, the next compressor stage up or down will not take place for the next 4 minutes. This “4 minutes” is called the stage timer.

When a cooling stage is initiated no further operation will take place within the stage timer limit. Reference the Cooling Setup menu for the adjustable stage time value. In the above example, the unit will stage down or turn off the cooling mode of operation when the return temperature reaches 69.4°F.

Economizer

When the economizer is enabled, the outside air temperature is below the changeover setpoint, and the differential enthalpy switch (if installed) is made, the economizer becomes the first stage of cooling. It will modulate to control to either the discharge air temperature (VAV) or space temperature (CV).

Every 4 minutes, the unit can then either add mechanical cooling if the economizer is at 100% open, continue economizing, or if the control temperature is satisfied, return to minimum position and transition back to “Fan Only” mode.

If the enthalpy switch breaks or the outside air warms, the unit will exit economizing and continue to mechanically cool while returning to the minimum position for ventilation.

⚠ WARNING

Electric shock and moving machinery hazard. Can cause severe equipment damage, personal injury, or death.

Disconnect and tag out all electrical power before servicing this equipment.

All start-up and service work must be performed only by trained, experienced technicians familiar with the hazards of working on this type of equipment

Read and follow this manual: “MicroTech III Unit Controller” (OM 920) before operating or servicing.

Bond the equipment frame to the building electrical ground through grounding terminal or other approved means.

⚠ WARNING

Hazardous voltage. May cause severe injury or death. Disconnect electric power before servicing equipment.

Pre-Start of Unit

All units are completely run tested at the factory to promote proper operation in the field. However, to ensure proper operation once the unit is installed, the following check, test, and start procedures must be performed to properly start the unit. To obtain full warranty coverage, complete and sign the check, test, and start form supplied with the unit and return it to Daikin.

A representative of the owner or the operator of the equipment should be present during start-up to receive instructions in the operation, care, and ma enance of the unit.

Servicing Control Panel Components

Before Start-Up

1. Remove shipping bolt form fan spring.
2. Verify that the unit is completely and properly installed with ductwork connected.
3. Verify that all construction debris is removed, and that the filters are clean.
4. Verify that all electrical work is complete and properly terminated.
5. Verify that all electrical connections in the unit control panel are tight, and that the proper voltage is connected.
6. Verify all nameplate electrical data is compatible with the power supply.
7. Verify the phase voltage imbalance is no greater than 2%.
8. Verify that gas piping is complete and leak tight.
9. Verify that the shutoff cock is installed ahead of the furnace, and that all air has been bled from the gas lines.
10. Verify installation of gas flue and outside air vents.
11. Manually rotate all fans and verify that they rotate freely.
12. Verify that the belts are tight and the sheaves are aligned.
13. Verify that all setscrews and fasteners on the fan assemblies are still tight. See Setscrews on page 111.
14. Verify that the evaporator condensate drain is trapped and that the drain pan is level.
15. If unit is curb mounted, verify that the curb is properly flashed to prevent water leakage.
16. Review the equipment and service literature, the sequences of operation, and the wiring diagrams to become familiar with the functions and purposes of the controls and devices.
17. Determine which optional controls are included with the unit.
18. Inspect the outside and inside of the unit for any signs of damage or rough handling. Excessive air leakage would be one possible, unacceptable consequence. If any problems are found, contact the local Daikin representative for instructions.

Power-Up

1. Close the unit disconnect switch.
2. Power should now be supplied to the control panel.

Fan Start-Up

1. Remove shipping bolt from fan spring if this has not already been done.
2. Verify fan spring adjustment and that the fan assembly is level. Adjust as necessary.
3. Verify all duct isolation dampers are open.
4. Place the unit into the “Fan Only” mode through the keypad.
5. The controller should enter the “Startup Initial” operating state. If the fan does not run, check the manual motor protectors or that the circuit breakers have not tripped.
6. Verify the rotation is correct.

Economizer Start-Up

1. Check whether the outdoor air is suitable for free cooling.
2. At the keypad, set the cooling setpoint low enough so the controller calls for cooling.
3. Place the unit into cooling mode through the keypad menu.
4. Observe the outdoor air dampers:
   a. If the outdoor enthalpy is low, the control algorithm should start to modulate the dampers open to maintain the discharge air setpoint.
   b. If the outdoor enthalpy is high, the dampers should maintain their minimum position.

NOTE: It may not be possible to check the economizer operation in both low and high enthalpy states on the same day. If this is the case, repeat this procedure on another day when the opposite outdoor air enthalpy conditions exist.

Compressor Start-Up

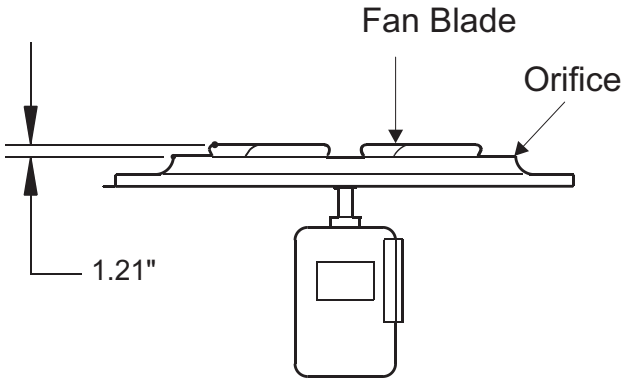
⚠ CAUTION

Low ambient temperature hazard. Can cause compressor damage. Do not attempt to start up and check out the refrigeration system when the outdoor air temperature is below 20°F.

With the supply fan operational, prepare for compressor operation.

1. Inspect all refrigerant piping and look for leaks by looking for refrigerant oil residue. If any problem is found, reclaim any remaining refrigerant, fix the problem and then add the circuit's nameplate charge by weight before proceeding.
2. Connect service gauges and verify that the unit has not lost its refrigerant charge.
3. Verify that the crankcase heaters are operating. These should operate for at least 24 hours before starting the compressors.
4. Verify that the condenser fan blades are positioned properly (see Figure 79) and that the screws are tight. The fan blade must be correctly positioned within its orifice for proper airflow across the condenser coils.
5. Check the fan rotation.

Figure 79: Condenser Fan Blade Positioning



Scroll Compressor Rotational Direction

Scroll compressors only compress in one rotational direction. Three-phase compressors rotate in either direction depending upon phasing of the power to L1, L2, and L3. Since there is a 50/50 chance of connecting power to cause rotation in the reverse direction, verify that the compressor rotates in the proper direction after the system is installed. If the compressor is rotating properly, suction pressure drops and discharge pressure rises when the compressor is energized. If the compressor is rotating in reverse, the sound level is louder and current draw is reduced substantially. After several minutes of operation, the compressor's internal protector trips.

All three-phase compressors are wired the same internally. Therefore, once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the same terminals should maintain proper rotation direction.

Perform the Following Procedure:

1. At the keypad, set the cooling setpoint low enough so that the controller will call for cooling.
2. Verify that compressor #1 starts. If the compressor motor hums but does not run, verify that it is getting three-phase power.
3. The compressor should operate continuously while there is a call for cooling. If the compressor cycles on and off on its low pressure switch, perform the following:
    a. Verify that the circuit is not short of refrigerant.
    b. Check for low airflow across the evaporator coil.
    c. Check for clogged filters.
    d. Check for restricted ductwork.
    e. Check for very low temperature return air entering the unit.
    f. Verify that the liquid line components, expansion valve, and distributor tubes are feeding the evaporator coil.
    g. Verify that all air handling section panels are closed.
4. Verify that the condenser fans are cycling and rotating properly (blowing air upward). When the compressor starts, at least one condenser fan should also start.
5. Check the oil level in the compressor sightglass. If low oil is observed, it is possible that liquid refrigerant is returning to the compressor. Check the suction superheat, see "Expansion Valve Superheat Adjustment" below. It should be between 10°F (5.5°C) and 13°F (7.2°C). See "Expansion Valve Superheat Adjustment" below.
6. Verify that the condenser refrigerant subcooling at full capacity is between 13°F and 20°F.

Checking Subcooling

Following are recommendations for checking subcooling:

1. Run unit until it reaches steady state. Close the unit section doors. Running the unit with its doors open will affect system operation.
2. Measure the discharge gas pressure at the compressor discharge gauge port with an accurate gauge. Use this pressure to determine the saturation temperature of the refrigerant.
3. Measure liquid temperature accurately by attaching a thermocouple to the liquid line tube leaving the condenser coil. Insulate the tube and thermocouple for more accurate results.
4. Subtract the measured liquid temperature from the saturation temperature to determine the subcooling.
5. As a general rule, high subcooling indicates that the circuit is low on charge. Low subcooling generally indicates that the circuit has too much charge.

NOTICE

Venting refrigerant to atmosphere is not allowed per most local laws and/or codes.

Expansion Valve Superheat Adjustment

It is very important that the expansion valve superheat setting be adjusted to be between 10°F (5.5°C) and 13°F (7.2°C). Insufficient superheat will cause liquid floodback to the compressor which may result in slugging. Excessive superheat will reduce system capacity and shorten compressor life.

Turn the adjustment stem clockwise to increase superheat. Not exceeding one turn, adjust the stem and then observe the superheat. Allow up to 30 minutes for the system to rebalance at the final superheat setting.

Checking Superheat

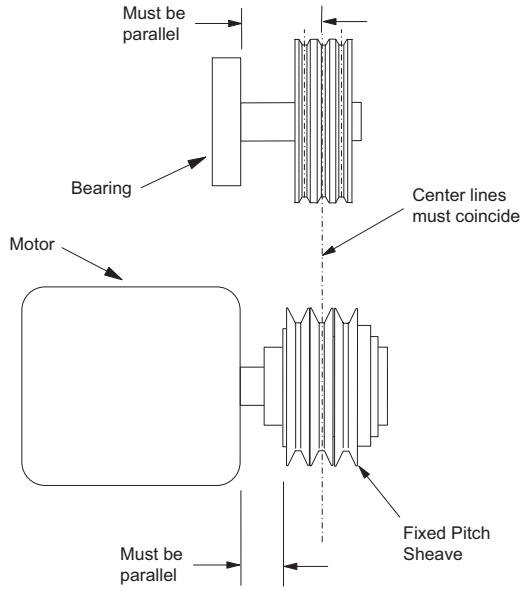
Following are recommendations for checking superheat:

1. Close the unit section doors. Running the unit with its doors open will affect expansion valve and system operation considerably.
2. Check the pressure and temperature at the suction gauge port.

Sheave Alignment

1. Verify both motor and fan sheaves are in alignment and the shafts are parallel. The center line of the motor sheave must be in line with the center line of the fan sheave. See Figure 80.
2. Verify that all setscrews are torqued to the values shown in Table 35 on page 111 before starting drive. Check setscrew torque and belt tension after 24 hours of service.

Figure 80: Sheave Alignment (Adjustable Shown)



Drive Belt Tension Adjustment

1. The ideal tension is the lowest tension at which the belt will not slip under peak load conditions. Over tensioning shortens belt and bearing life.
2. Check tension frequently during the first 24–48 hours of operation.
3. Keep belts free from foreign material which may cause slippage.
4. Make V-drive inspection on a periodic basis. Adjust tension if the belt is slipping. Do not apply belt dressing. This may damage the belt and cause early failure.

Air Balancing

The following should be performed by a qualified air balancing technician:

1. Check the operating balance with the economizer dampers positioned for both full outdoor air and minimum outdoor air.
2. Verify that the total rflow will never be less than that required for operation of the electric heaters or gas furnace.
3. When the final drive adjustments or changes are complete, check the current draw of the supply fan motors. The amperage must not exceed the service factor stamped on the motor nameplate.

⚠ WARNING

Moving machinery hazard. Can cause severe personal injury or death. Do not use a mechanically driven tachometer to measure the speed return fans on this fan arrangement. Use a strobe tachometer.

Rotating parts can cause severe personal injury or death. Replace all belt/fan guards that are removed for service.

Energy Recovery Wheel

Prestartup Checks

1. By hand, turn wheel clockwise (as viewed from the pulley side) to verify wheel turns freely through 360° rotation.
2. During rotation confirm wheel segments are fully engaged in the wheel frame and segment retainers are completely fastened
3. With hands and objects away from moving parts, apply power and confirm wheel rotation. Wheel rotates clockwise as viewed from the pulley side.
4. If wheel has difficulty starting, disconnect power and inspect for excessive interference between the wheel surface and each of the (4) diameter seals.

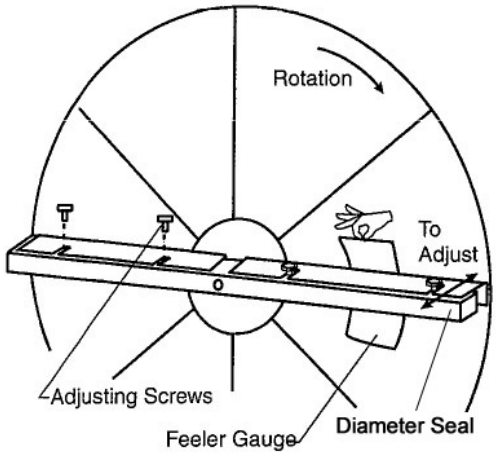
Diameter Seal Adjustment

1. Loosen diameter seal adjusting screws. See Figure 81.
2. Move adjustable diameter seals away from wheel.
3. Using a ¼ inch feeler gauge, adjust the diameter against the wheel. See Figure 81.
4. Tighten diameter seal adjusting screws.
5. Apply power per the start up procedure.

⚠ WARNING

Keep hands away from rotating wheel! Contact with rotating wheel can cause physical injury.

Figure 81: Energy Recovery Wheel



Controller Settings for Normal Operation

When all start-up procedures are completed, set the controls and program the MicroTech III controller for normal operation. Use the following list as a guide; some items may not apply to your unit.

1. Set the heating and cooling parameters as required for normal unit operation:
    a. Temperature \ Zone Cooling \
    b. Temperature \ Zone Heating \
    c. Temperature \ Discharge Cooling \
2. Set the low ambient compressor lockout setpoint as required. Do not set it below 20°F.
3. Set the high ambient heat lockout temperature setpoint.
4. Set the alarm limits as required.
5. Set the duct static pressure control parameters as required.
6. Set the building static pressure control parameters as required.
7. Set the economizer control parameters as required.
8. Set the date and time in keypad menu.
9. Set the operating schedule as required using keypad menus.

NOTE: Unit operation may also be controlled by the building automation system.

Maintaining Control Parameter Records

Daikin recommends that the MicroTech III controller's setpoints and parameters be recorded and saved for future reference. If the microprocessor control board requires replacement, this record facilitates entering the unit's proper

Performing Service Maintenance

Installation and maintenance must be performed only by qualified personnel who are experienced with this type of equipment and familiar with local codes and regulations.

⚠ WARNING

Moving machinery and electrical power hazards. May cause severe personal injury or death. Disconnect and lock off all power before servi ng equipment.

⚠ CAUTION

Sharp edges are inh rent to sheet metal parts, screws, clips, and similar items. May cause personal injury. Exercise caution when servicing equipment.

⚠ IMPORTANT

Chilled Water Piping: A qualified Architect or Systems HVAC Design Engineer familiar with piping design, local codes and regulations, must provide piping design. The following manufacturer recommendations serve as a general guide and should not replace a qualified professional's piping system design.

⚠ IMPORTANT

Refrigerant Piping: A qualified Architect or Systems HVAC Design Engineer familiar with refrigerant piping design, as well as local codes and regulations, must provide refrigerant piping design. The following manufacturer recommendations serve as a general guide and should not replace a qualified professional's refrigerant piping system design.

⚠ WARNING

Hazardous voltage. May cause severe injury or death. Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

Servicing Control Panel Components

Disconnect all electric power to the unit when servicing control panel components. Before servicing, always inspect units for multiple disconnects to ensure all power is removed from the control panel and its components.

Planned Maintenance

Preventive maintenance is the best way to avoid unnecessary expense and inconvenience. Have this system inspected at regular intervals by a qualified service technician. The required frequency of inspections depends upon the total operating time and the indoor and outdoor environmental conditions. Routine maintenance should cover the following items:

- Tighten all belts, wire connections, and setscrews.
- Clean the evaporator and condenser coils mechanically or with cold water, if necessary. Usually any fouling is only matted on the entering air face of the coil and can be removed by brushing or vacuuming.
- Lubricate the motor and fan shaft bearings.
- Align or replace the belts as required.
- Clean or replace the filters as required.

NOTE: A partially full sight glass is not uncommon at part load conditions. A varying amount of bubbles may be noticeable in the sightglass, which is normal.

- Check for proper superheat.
- Check for blockage of the condensate drain. Clean the condensate pan as needed.
- Check the power and control voltages.
- Check the running amperage of all motors.
- Check all operating temperatures and pressures.
- Check and adjust all temperature and pressure controls as needed.
- Check and adjust all damper linkages as needed.
- Check the operation of all safety controls.
- Check the condenser fans and tighten their setscrews.

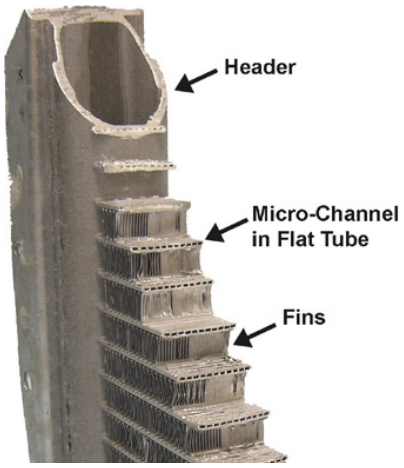
All-Aluminum Condenser Coils

The condenser coils are an all-aluminum design including the connections, micro-channels, fins (an oven brazing process brazes the fins to the micro-channel flat tube), and headers (Figure 82), which eliminates the possibility of corrosion normally found between dissimilar metals of standard coils.

During the condensing process, refrigerant in the coil passes through the micro-channel flat tubes, resulting in higher efficiency heat transfer from the refrigerant to the airstream.

In the unlikely occurence of a coil leak, contact Daikin to receive a replacement coil module.

Figure 82: Micro-Channel Coil Cross-Section



Connecting the Condenser Coil to Copper Tubing

Figure 83 shows the aluminum condenser coil connection to the copper tubing in the unit. Because of the low melting point of aluminum (1220°F compared to 1984°F for copper), this brazed joint is performed with a low temperature brazing process.

⚠ CAUTION

Potential equipment damage. If a standard copper brazing process is performed at this joint, the process will damage the aluminum connection. If a condenser coil ever needs to be replaced, the copper aluminum joint repair should be done with a ProBraze™ repair kit manufactured by OmniTechnologies Corporation. A non-corrosive flux must also be used. The brazing temperature should be between 850°F–900°F. If a coil needs replacing, contact Daikin for a coil and copper connection assembly.

Figure 83: Aluminum/Copper Connection

Cleaning Option E Coated Coils

The following cleaning procedures are recommended as part of the routine maintenance activities for Option E Coated Coils. Documented routine cleaning of Option E Coated Coils is required to maintain warranty coverage.

⚠ WARNING

Prior to cleaning the unit, turn off and lock out the main power switch to the unit and open all access panels.

Remove Surface Loaded Fibers

Surface loaded fibers or dirt should be removed prior to water rinse to prevent further restriction of airflow. If unable to back wash the side of the coil opposite that of the coils entering air side, then surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft non-metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges bent over) if the tool is applied across the fins.

NOTE: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

Periodic Clean Water Rinse

A monthly clean water rinse is recommended for coils that are applied in coastal or industrial environments to help to remove chlorides, dirt and debris. An elevated water temperature (not to exceed 130ºF) will reduce surface tension, increasing the ability to remove chlorides and dirt. Pressure washer PSI must not exceed 900 psig and the nozzel should remain at leat 1 foot from the coil to avoid damaging fin edges.

Routine Quarterly Cleaning of Option E Coated Coil Surfaces

Quarterly cleaning is essential to extend the life of an Option E Coated Coil and is required to maintain warranty coverage. Coil cleaning shall be part of the unit's regularly scheduled maintenance procedures. Failure to clean an Option E Coated Coil will void the warranty and may result in reduced efficiency and durability in the environment.

For routine quarterly cleaning, first clean the coil with the below approved coil cleaner (see approved products list under Recommended Coil Cleaners section, Table 30). After cleaning the coils with the approved cleaning agent, use the approved chloride remover (under the Recommended Chloride Remover section) to remove soluble salts and revitalize the unit.

Recommended Coil Cleaner

The following cleaning agent, assuming it is used in accordance with the manufacturer's directions on the container for proper mixing and cleaning, has been approved for use on Option E Coated Coils to remove mold, mildew, dust, soot, greasy residue, lint and other particulate:

Table 30: Option E Coated Coil Recommended Cleaning Agents

Cleaning Agent	Reseller	Part Number
Enviro-Coil Concentrate	Hydro-Balance Corp P.O. Box 730 Prosper, TX 75078 800-527-5166	H-EC01
Enviro-Coil Concentrate	Home Depot	H-EC01
Chloride Remover	Chlor*Rid Int'l, Inc. P.O. Box 908 Chandler AZ 85244 800-422-3217	Chlor*Rid DTS

CHLOR*RID DTS™ should be used to remove soluble salts from the Option E Coated Coil, but the directions must be followed closely. This product is not intended for use as a degreaser. Any grease or oil film should first be removed with the approved cleaning agent.

1. Remove Barrier - Soluble salts adhere themselves to the substrate. For the effective use of this product, the product must be able to come in contact with the salts. These salts may be beneath any soils, grease or dirt; therefore, these barriers must be removed prior to application of this product. As in all surface preparation, the best work yields the best results.
2. Apply CHLOR*RID DTS - Apply CHLOR*RID DTS directly onto the substrate. Sufficient product must be applied uniformly across the substrate to thoroughly wet out surface, with no areas missed. This may be accomplished by use of a pump-up sprayer or conventional spray gun. The method does not matter, as long as the entire area to be cleaned is wetted. After the substrate has been thoroughly wetted, the salts will be soluble and is now only necessary to rinse them off.
3. Rinse - It is highly recommended that a hose be used, as a pressure washer will damage the fins. The water to be used for the rinse is recommended to be of potable quality, though a lesser quality of water may be used if a small amount of CHLOR*RID DTS is added. Check with CHLOR*RID International, Inc. for recommendations on lesser quality rinse water.

Cautions

Harsh Chemical and Acid Cleaners

Harsh chemicals, household bleach or acid cleaners should not be used to clean outdoor or indoor Option E Coated Coils. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion and attack the Option E coating. If there is dirt below the surface of the coil, use the recommended coil cleaners as described above.

High Velocity Water or Compressed Air

High velocity water from a pressure washer or compressed air should only be used at a very low pressure to prevent fin and/or coil damages. The force of the water or air jet may bend the fin edges and increase airside pressure drop. Reduced unit performance or nuisance unit shutdowns may occur.

Coil Cleaning for Non-Coated Coils

- Clean as needed
- No chemicals or pressure washer use
- Vaccuum and spray with water

Control Panel Components

The following individual motor protection is provided.

Table 31: Maverick Individual Motor Control and Protection

Motor Type	Short Circuit	Overload	ON-OFF
Compressor < 100 Amps	MMP	Internal	Contactor
Condenser Fans	MMP	Internal	Contactor
EAF, no VFD, 208-460V	MMP	MMP	Contactor
EAF, no VFD, 575V	CB	OL	Contactor
EAF with VFD	CB*	VFD	VFD
SAF with VFD	CB*	VFD	VFD
SAF, no VFD	CB	OL	Contactor

MMP = manual motor protector
Internal = vendor motor protector with internal sensors
CB = circuit breaker [* FB with MD4 VFD]
OL = over load relay

Manual Motor Protector (MMP)

The manual motor protector (MMP) provides coordinated branch circuit, short circuit protection, a disconnecting means, a motor controller, and coordinated motor overload protection. A short circuit indicator with manual reset is mounted along side of each MMP as a means to differentiate between a short circuit and overload trip conditions.

The MMP trip points are factory set. Do not change unless the motor ampacity changes or the MMP is replaced with a new device with incorrect setpoint adjustment. Any other non-authorized trip point or setpoint adjustment voids all or portions of the unit's warranty. Authorized setpoint adjustment is accomplished as follows

1. For motors with a 1.15 service factor, rotate the arrow on the dial to correspond to the motor FLA.
2. For motors with a 1.0 service factor, multiply the motor FLA by 0.9; then rotate the arrow on the dial to correspond to that value.

To reset a tripped MMP, clear the trip by rotating the knob counterclockwise to the OFF (O) position; then rotate knob clockwise to the ON (I) position. See Figure 84.

⚠ WARNING

If an overload or a fault current interruption occurs, check circuits to determine the cause of the interruption. If a fault condition exits, examine the controller. If damaged, replace it to reduce the risk of fire or electrical shock.

Other MMP Features:

- Three-position rotary operator: OFF (O)-TRIP-ON (I) (Figure 84).
- Lockout—tagoutable rotary operator: turn the rotary operator to OFF (O), slide out the extension arm, and insert a lockout pin.
- Ambient compensated –20°C to +40°C.
- Single-phase sensitivity: if one phase exceeds setpoint, all three phases open.
- Trip test: insert a 9/64" screw driver in the test slot to simulate a trip.

Figure 84: Manual Motor Protector

Thermal Overload Relay

Designed to provide current-dependent protection for loads with normal starting against impermissibility high temperature rises due to overload, phase asymmetry or phase failure. Increase in motor current beyond set point as a result to overload or phase failure will trip the overload and disconnect the motor.

The Relay trip points are factory set. Do not change unless the motor ampacity changes or the Relay is replaced with a new device with incorrect set point adjustment. Any other non-authorized trip points or set points adjustment voids all or portions of the unit's warranty. Authorized set point adjustment is accomplishment as follows:

1. For motors with 1.15 service factor, rotate the arrow on the dial to correspond to the motor FLA (See Figure 85).
2. For motors with a 1.0 service factor, multiply the motor FLA with 0.9; then rotate the arrow on the dial to correspond to that value.

To reset a tripped Relay, push the blue RESET button. To disconnect, push the Red stop Button.

Other Relay features:

- Three connection systems options, Screw type, spring loaded and ring cable lug connection.
- Switch position indicator to indicate a trip and TEST function for wiring.
- Large rotary button to adjust current to Motor RLA.
- Selector switch for manual/and automatic RESET.

Figure 85: Overload Relay

Circuit Breaker

Circuit breakers are installed upstream of all VFDs to provide short circuit protection. These breakers are not adjustable.

To reset a tripped circuit breaker: Clear the trip by rotating the lever down to the OFF position. Then rotate lever up to the ON position (see Figure 86).

Breakers, like MMPs, have three distinct modes of operation which are clearly indicated by the handle position. The positions are ON (usually up, OFF (usually down), and TRIPPED (midway). Some circuit breakers may have a push-to-test button.

⚠ CAUTION

If a circuit breaker has tripped due to an overload or a fault current (short circuit), prior to resetting, the connected wiring circuits must be checked to determine the cause of the interruption.

Reset After Tripping Information

If a breaker is tripped, the handle/lever will be halfway between the OFF and ON positions. To reset a tripped circuit breaker:

1. Press the handle or rotate the lever to the OFF position.
2. Press the handle or rotate the lever the opposite direction to the ON position.

⚠ WARNING

In certain applications the circuit breaker may be mounted upside down. Therefore, when the handle is in the DOWN position it may not be turned OFF. The handle position corresponds to ON and OFF text clearly printed on the face of the unit. Be sure the mounting orientation and desired handle position is verified prior to performing service on the equipment. Only qualified service personnel should work on this equipment. **Improper position of the breaker handle during service may result in electric shock or death.**

Figure 86: Circuit Breaker

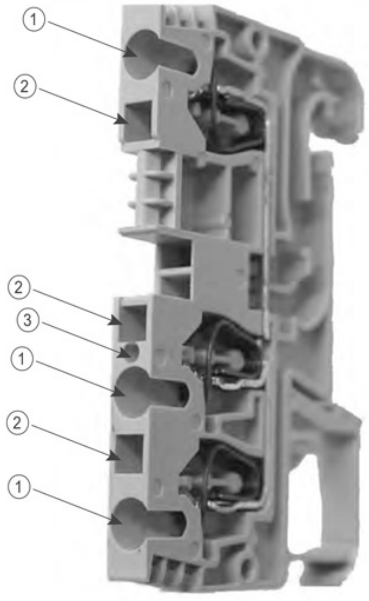
Field Wiring Terminals

All field wiring terminals are spring clamp type, which offer several advantages over traditional screw-type terminals:

- Spring connections do not require torquing
- Spring connections resist failure due to vibration
- Easily identifiable terminal markers
- Combination spring release and square test ports

Wire connections require inserting (“1” in Figure 87) a stripped wire a round port and clamping the stripped wire by inserting a flat-bladed screw driver in the adjacent square port (“2”).

Figure 87: Terminal Connectors



Phase Voltage Monitor (PVM)

The phase voltage monitor (Figure 88) is designed to protect three-phase loads from damaging power conditions. A microprocessor-based voltage and phase sensing circuit constantly monitors the three-phase voltages to detect harmful power line conditions. When a harmful condition is detected, its output relay is deactivated after a specified trip delay (Trip Delay). The output relay reactivates after power line conditions return to an acceptable level for a specified amount of time (Restart Delay). The trip and restart delays prevent nuisance tripping due to rapidly fluctuating power line conditions.

There are two LEDs on the face of the PVM (“1” in Figure 88) to indicate the following items in Table 32.

Figure 88: Phase Voltage Monitor

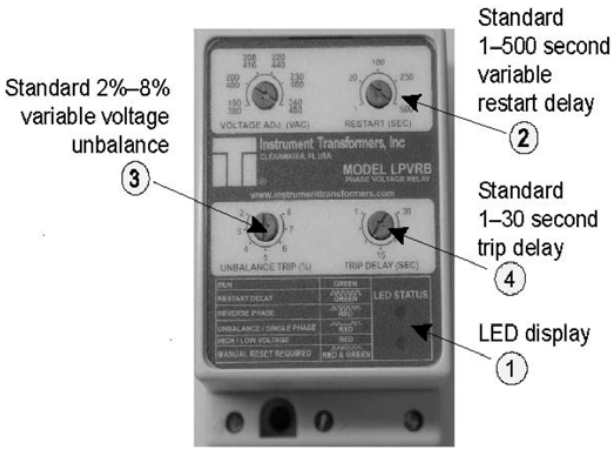


Table 32: LED Indication

Status	LED Indicator
Normal operation, no faults, relay energized	Green LED - steady on
Loss of input phase (relay deenergized)	Red LED - flash twice, off, flash twice, off, etc.
Voltage unbalance (relay deenergized)	Red LED - flash twice, off, flash twice, off, etc.
High or low voltage (relay de-energized)	Red LED - steady on
Phase reversal (relay deenergized)	Red LED - pulse on, off, on, off, etc.
Restart delay (fault cleared, PVM pending restart, relay de-energized)	Green LED - pulse on, off, on, off, etc.

Other features:

- Standard 2% to 8% variable voltage unbalance (“3” in Figure 88).
- Standard 1 to 500 second variable restart delay (“2”).
- Standard 1 to 30 second trip delay (“4”) (except loss of phase, which trips at 1 second non-adjustable).

Through-the-Door Disconnect

Opening the through-the-door disconnect without performing a proper machine shut-down is not recommended except in emergencies.

The optional disconnect provides for locking out power to the unit. To lock out power to the unit, rotate the habdle to the "Reset/Lock" position and insert a padlock or locking device through the base of the handle. **Do not lockout the handle with the Interlock in bypass mode.**

⚠ DANGER

Hazardous voltage. May cause severe injury or death. Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

⚠ CAUTION

Molded case switches do not provide over-current protection. This device may automatically open the circuit at levels above the ampere rating of the switch.

Figure 89: Through-the-Door Handle Disconnect

Unit Storage

Location

The Maverick II is an outdoor unit. However, the construction schedule may dictate storage either on the ground or in its final position at the site. If the unit is stored on the ground, additional precautions should be taken as follows:

- Make sure that the unit is well supported along the length of the base rail.
- Make sure that the unit is level (no twists or uneven ground surface).
- Provide proper drainage around the unit to prevent flooding of the equipment.
- Provide adequate protection from vandalism, mechanical contact, etc.
- Make sure all doors are securely closed and all latches closed.
- Units should be fitted with covers over the supply and return air openings.

Preparation for Storage

Supply Fans

1. Remove the drive belts, tag them with the fan name and unit serial number, and store them in a conditioned space out of direct sunlight.
2. Once every two weeks, rotate the fan and motor shafts. Mark the shaft positions first to make sure they stop in a different position.
3. Depending on local climate conditions, condensate may collect on components inside the units. To prevent surface rust and discoloration, spray all bare metal parts with a rust preventive compound. Pay close attention to fan shafts, sheaves, bearings, and bearing supports.

Cabinet Sections

Once a month, open a door on each section and verify that no moisture or debris is accumulating in the unit.

Control Compartment

1. Daikin recommends that the electronic control equipment in the unit be stored in a 5% to 95% RH (non-condensing) environment.
2. It may be necessary to put a heat source (light bulb) in the main control panel to prevent the accumulation of atmospheric condensate within the panel. The location and wattage of the heat source is dependent on local environmental conditions.
3. Check the control compartment every two weeks to confirm that the heat source is functional and is adequatefor current conditions.

Restart

After extended storage, perform a complete start up. Inevitable accumulations of dirt, insect nests, etc. can contribute to problems if not cleaned out thoroughly prior to start up. In addition, thermal cycling tends to loosen mechanical and electrical connections. Following the startup procedure helps discover these and other issues that may have developed during the storage interval.

Bearing Lubrication

⚠ CAUTION

Bearing overheating potential can damage the equipment. Do not overlubricate bearings. Use only a high grade mineral grease with a 200°F safe operating temperature.

Motor Bearings

Supply Fans

Supply fan motors should have grease added after every 2000 hours of operation. Use one of the greases shown in Table 33. Using the following procedure, relubricate the bearings while the motor is warm, but not running.

1. Remove and clean upper and lower grease plugs.
2. Insert a grease fitting into the upper hole and add a small amount of clean grease with a low pressure gun.
3. Install the lower grease plug.
4. Run the motor for five minutes before installing the upper grease plug.

Condenser Fan and Exhaust Fan

The condenser fan and exhaust fan motors are permanently lubricated and require no periodic lubrication.

Fan Shaft Bearings

Relubricate fan shaft bearings periodically. Relubricate according to the schedule on the fan housing. If the bearings are exposed to wet conditions, wide temperature variations, or other severe atmospheric conditions, relubricate more frequently. Use one of the greases shown in Table 33.

While the bearing is at normal operating temperatures, rotate the fan by hand and add only enough grease to purge the seals. The seals bleed slightly when this occurs. Do not overlubricate.

Table 33: Recommended Greases

Manufacture	Product Name	Temp. Range (°F)
Texaco Lubricants Co.	Premium RB	-30 to 300
Mobil Oil Corporation	Mobilith AW2	-40 to 325
Shell Oil Company	Alvania No. 2	-20 to 240

Vibration Levels

Each unit as shipped is trim balanced to operate smoothly. To provide satisfactory operation after shipping and installation, use accepted industry guidelines for field balancing fans.

NOTE: Excessive vibration from any cause contributes to premature fan and motor bearing failure. Monitor overall vibration levels every six months of operation. An increase in levels is an indication of potential trouble.

Vibration Causes

1. Wheel imbalance.
   a. Dirt or debris on wheel blades.
   b. Loose setscrews in wheel hub or bearing-to-shaft.
   c. Wheel distorted from overspeed.
2. Bent shaft.
3. Faulty drive.
   a. Bad V-belts; lumpy, or mismatched.
   b. Belt tension too tight or too loose.
4. Bad bearings or loose bearing hold-down bolts.
5. Motor imbalance.
6. Fan section not supported evenly on foundation.

Periodic Service and Maintenance

1. Check all moving parts for wear every six months.
2. Check bearing collar, sheave, and wheel hub setscrews, sheave capscrews, and bearing hold-down bolts for tightness every six months.

Energy Recovery Wheel

⚠ CAUTION

Installation and maintenance must be performed only by qualified personnel who are experienced with this type of equipment and familiar w th local codes and regulations.

⚠ WARNING

Moving machinery and electrical power hazards. Can cause severe personal injury or death. Disconnect and lock off all power before servicing equipment.

⚠ CAUTION

Sharp edges are inherent to sheet metal parts, screws, clips, and similar items. Contact with these edges may cause personal injury. Exercise caution when servicing equipment.

⚠ DANGER

Hazardous voltage. Will cause severe injury or death. Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

Servicing Control Panel Components

Disconnect all electric power to the unit when servicingcontrol panel components. Before servicing, always inspectunits for multiple disconnects to ensure all power is removedfrom the control panel and its components.

Bearings

Enthalpy wheels are provided with "no maintenance" inboard bearings, requiring no maintenance during the life of the equipment.

Drive Motor

The drive motor should require no maintenance. The wheel drive motor bearings are pre-lubricated and no further lubrication is necessary. The wheel drive pulley is secured to the drive motor shaft by a combination of either a key or D slot or setscrew. The set screw is secured with removable locktite to prevent loosening. Annually confirm set screw is secure.

Drive Belts

The wheel drive belt is a urethane stretch belt designed to provide constant tension through the life of the belt. No adjustment is required. Inspect the drive belt annually for proper tracking and tension. A properly tensioned belt will turn the wheel immediately after power is applied with no visible slippage during start-up.

Belts are multilink with individual links constructed of a high performance polyurethane elastomer, reinforced with multiple plies of polyester fabric. This belt provides a strong, yet flexible belting. The multilink feature provides easy servicing or replacement.

Seals

The seals are designed to be durable and require no maintenance other than adjustment. If seals become worn or damaged they may easily be replaced. The seals are made to clip onto the cassette or metal post easily.

Variable Frequency Controller

No maintenance should be required on the VFD. Should problems with the VFD develop, consult the VFD service manual that accompanied your order.

Wheel

The enthalpy wheel is designed to last the life of the equipment. It is protected by an ASHRAE 30% filter to keep dust and dirt from the heat transfer surface. The wheel is somewhat self cleaning through its normal action of rotating in and out of countercurrent air flow streams. If the wheel becomes dirty, it may be cleaned by blowing out the unit with compressed air (20 psig maximum). In cases of severe dirt, the wheel may be removed from the cassette and washed with water following wheel removable procedures outlined below.

Routine Maintenance

Cleaning

The need for periodic cleaning of the energy recovery wheel will be a function of operating schedule, climate and contaminants in the indoor air being exhausted and the outdoor air being supplied to the building.

The Daikin wheel is “self-cleaning” with respect tiny particles due to its laminar flow characteristics. Smaller particles pass through; larger particles land on the surface and are blown clear as the flow direction is reversed. Any material that builds up on the face of the wheel can be removed with a brush or vacuum.

The primary need for cleaning is to remove oil based aerosols that have condensed on energy transfer surfaces. A characteristic of all dry desiccants, such films can close off micron sized pores at the surface of the desiccant material, reducing the efficiency by which the desiccant can adsorb and desorbs moisture and also build up so as to reduce airflow.

In a reasonably clean indoor environment such as school or office building, measurable reductions of airflow or loss of sensible (temperature) effectiveness may not occur for several years. Measurable changes in latent energy (water vapor) transfer can occur in shorter periods of time in applications such as moderate occupant smoking or cooking facilities.

In applications experiencing unusually high levels of occupant smoking or oil based aerosols such as industrial applications involving the ventilation of machine shop areas for example, annual washing of energy transfer may be necessary to maintain latent transfer efficiency. Proper cleaning of the energy recovery wheel will restore latent effectiveness to near original performance.

To clean, gain access to the energy recovery wheel and remove segments. Brush foreign material from the face of the wheel. Wash the segments or small wheels in a 5% solution of non-acid based coil cleaner (such as Acti-Klean, available through Daikin, Stock # AK1) or alkaline detergent and warm water. Soak in the solution until grease and tar deposits are loosened (Note: some staining of the desiccant may remain and is not harmful to performance).

Before removing, rapidly run finger across surface of segment to separate polymer strips for better cleaning action. Rinse dirty solution from segment and remove excess water before reinstalling in wheel.

⚠ CAUTION

Do not use acid based cleaners, aromatic solvents, steam or temperatures in excess of 170ºF; damage to the wheel may occur!

Air Seals

Four adjustable diameter seals are provided on each cassette to minimize transfer of air between the counter flowing airstreams.

To adjust diameter seals, loosen diameter seal adjusting screws and back seals away from wheel surface (Figure 90). Rotate wheel clockwise until two opposing spokes are hidden behind the bearing support beam. Using a folded piece of paper as a feeler gauge, position paper between the wheel surface and diameter seals. Adjust seals towards wheel surface until a slight friction on the feeler gauge (paper) is detected when gauge is moved along the length of the spoke. Retighten adjusting screws and recheck clearance with “feeler” gauge.

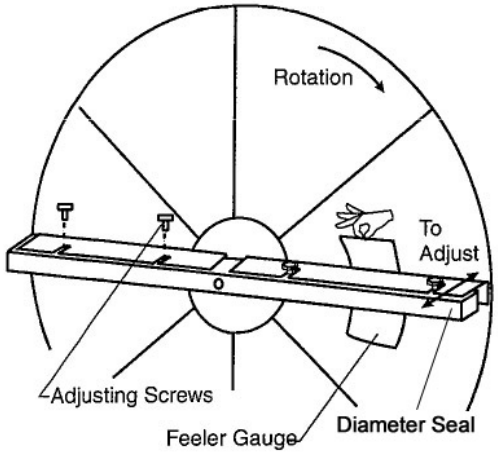
Wheel Drive Components

The wheel drive motor bearings are prelubricated and no further lubrication is necessary.

The wheel drive pulley is secured to the drive motor shaft by a combination of either a key or D slot or setscrew. The set screw is secured with removable locktite to prevent loosening. Annually confirm set screw is secure.

The wheel drive belt is a urethane stretch belt designed to provide constant tension through the life of the belt. No adjustment is required. Inspect the drive belt annually for proper tracking and tension. A properly tensioned belt will turn the wheel immediately after power is applied with no visible slippage during start-up.

Figure 90: Adjusting Diameter Seals



Segment Installation & Replacement

Wheel segments are secured to the wheel frame by a Segment Retainer which pivots on the wheel rim and is held in place by a Segment Retaining Catch (Figure 91).

To install wheel segments follow steps 1 through 5 (Figure 92). Reverse the procedure for segment removal.

1. Disconnect power to the drive motor.
2. Unlock two segment retainers. There is one on each side of the selected segment opening.
3. With the embedded stiffener facing he motor side, insert the node of the segment between hub plates.
4. Holding the segment by the two outer corners, press the segment towards the center of the wheel and inwards against the spoke flanges. If hand pressure does not fully seat the segment, insert the flat tip of a screwdriver between the wheel rim and outer corners of the segment and apply downward force while guiding the segment into place.
5. Close and latch each Segment Retainer under the Segment Retaining Catch.
6. Slowly rotate the wheel 180°. Install the second segment opposite the first for counter balance. Rotate the two installed segments 90° to balance the wheel while the third segment is installed. Rotate the wheel 180° again to install the fourth segment opposite the third. Repeat this sequence with the remaining four segments.

Figure 91: Segment Retaining Clip

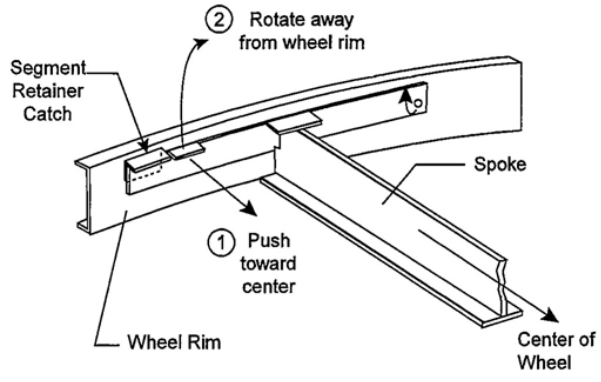
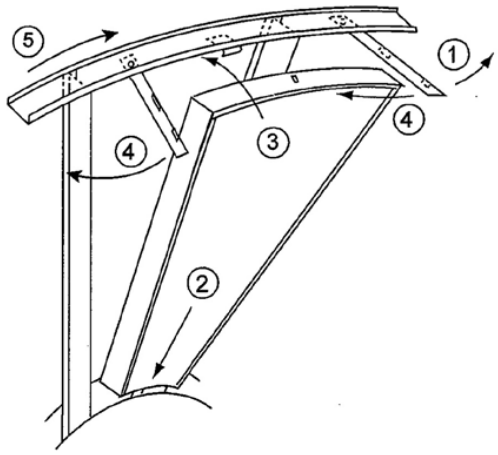


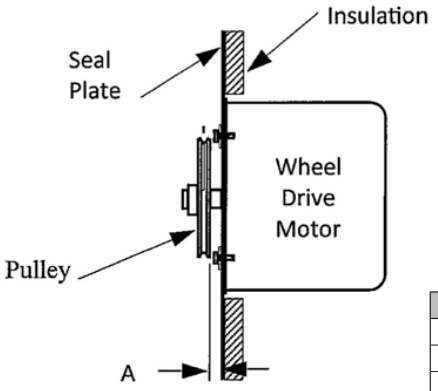
Figure 92: Installing Wheel Segments



Wheel Drive Motor & Pulley Replacement

1. Disconnect power to the drive motor.
2. Remove belt from the pulley and positions temporarily around the wheel rim.
3. Loosen the set screw in wheel drive pulley using Allen wrench and remove pulley from the motor drive shaft.
4. While supporting the weight of the drive motor in one hand, loosen and remove (4) mounting bolts
5. Install the replacement motor with hardware kit supplied.
6. Install the pulley per the dimensions in Figure 93 and secure the set screw to the drive shaft
7. Stretch belt over pulley and engage grove.
8. Follow start up procedure on page 96 (procedure needs to be confirmed).

Figure 93: Pulley Installation

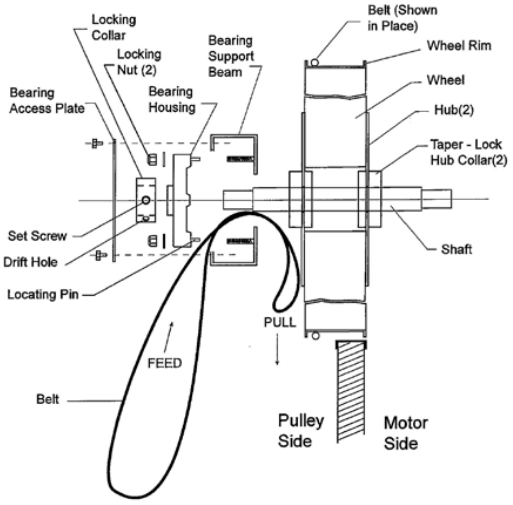


Series	DIM–A
36	1/4"
52	1/4"
64	7/16"
74	7/16"
86	7/16"

Belt Replacement

1. Obtain access to the pulley side bearing access plate and remove two retaining screws.
2. Using a hexagonal wrench, loosen the screw in the bearing lock collar.
3. Using a light hammer and drift, tap collar in the direction of wheel rotation to unlock collar. Remover collar.
4. Using a socket wrench with extension, remove two nuts which secure bearing housing to the bearing support beam.
5. Slide bearing from shaft.
6. Using a wrench, remove the diameter seal retaining screws. Remove diameter seals from bearing beam.
7. Form a small loop on the belt and pass it through the hole in the bearing support beam. Grasp the belt at the wheel hub and pull the entire belt down. Loop the trailing edge of the belt over the shaft.
8. Install the new belt around the wheel and pulley.
9. Reinstall the bearing onto the wheel shaft, being careful to engage the two locating pins into the holes in the bearing support beam. Secure the bearing with two self locking nuts.
10. Reinstall the diameter seals and tighten retaining screws. See Diameter Seal Adjustment on page 96.
11. Reinstall bearing locking collar. Rotate collar by hand in the direction the wheel rotates according to label on wheel casset. Lock in position by tapping pin hole with hammer and drift. Secure in position with set screw
12. Reinstall bearing access cover with two screws
13. Apply power and ensure wheel rotated freely.

Figure 94: Belt Replacement



Troubleshooting

The following table may be used as a quick-reference for identifying common symptoms and possible causes related to the recovery wheel.

Table 34: Energy Recovery Wheel Troubleshooting

Symptom	Cause
Inadequate Wheel Performance	Check wheel rotation speed (see Variable Speed Frequency Control on page 47).
	Check for wheel integrity and adjust seals or replace worn seals (see Energy Recovery Wheel Design on page 45 and Seals on page 107).
	Check entering air conditions and compare to design (see “Energy Recovery Wheel” on page 67).
	Check ducting for leakage and fix any leaks.
	Check media for dirt and clean per cleaning instructions (seeCleaning on page 108 and Segment Installation & Replacement on page 109).
Improper Wheel Rotation	Check drive belts for engagement with sheave.
	Check drive motor.
	Check drive motor wiring for proper voltage.
	Check VFD programming (provided with optional frost protection).
High Pressure Drop	Check air flow and compare to design.
	Check filters and clean/replace as necessary.
	Check media for plugging and clean per cleaning instructions (see Segment Installation & Replacement).
Noise	Check seals and adjust as necessary.
	Check the bearings for source of noise.
	Check the belt for slippage (see Drive Belt Tension Adjustment on page 95).
Wheel Will Not Operate	Check all electrical connections. If MicroTech II controls are provided, make sure the building pressure is above setpoint such that the EAF turns on. The wheel does not operate unless the EAF is on (see Exhaust Fan Option on page 53).

Supply Fan

Setscrews

Setscrews are used to lock bearings, sheaves, locking collars, and fan wheels to their shafts. They must be checked periodically to see that they have not loosened. If this is not done, severe equipment damage could occur.

Refer to the values in Table 35 and check the tightness of all setscrews with a torque wrench.

Table 35: Setscrew Minimum Torque Specifications

Setscrew Diameter (in.)	Minimum Torque (ft.lb)
1/4	5.5
5/16	10.5
3/8	19.0
7/16	29.0
1/2	42.0
5/8	92.0

Supply Fan Wheel-to-Funnel Alignment

The fan wheel-to-funnel alignment must be as shown in Figure 95 to obtain proper air delivery and operating clearance. If necessary, adjustments are made as follows:

1. Verify that the fan shaft has not moved in its bearings.
2. Loosen the fan hub setscrews and move the wheel(s) along the shaft as necessary to obtain the correct dimension shown in Table 36.
3. Retighten the setscrews to the torque specification given in Table 35. Tighten the setscrews over the keyway first; tighten those at 90 degrees to the keyway last.
4. Verify that the radial clearance around the fan is uniform.

Figure 95: SWSI Airfoil Wheel-to-Funnel Alignment

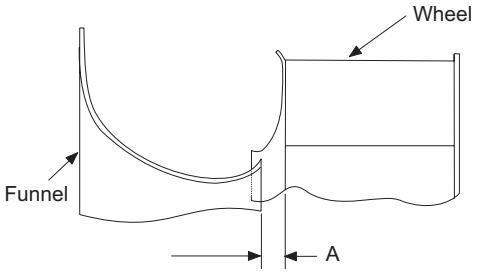


Table 36: SWSI Airfoil Wheel-to-Funnel Relationship

Wheel-to-Funnel Relationship (in inches)	
Wheel Diameter	**A**
15	0.44
18	0.44
20	0.44
22	0.44
24	0.44
30	0.56

Refrigerant Charge

The unit nameplate references proper charge for each refrigerant circuit in case a full charge must be added to the unit.

⚠ CAUTION

Severe loss of charge may occur if the high refrigerant pressure switch is replaced before reclaiming the refrigerant. Replace pressure switch after reclaiming refrigerant. Venting refrigerant to atmosphere is not allowed per most local laws and/or codes.

Servicing Refrigerant Sensors or Switches

The Maverick II includes the following refrigerant sensors or switches.

1. Low refrigerant pressure sensing, operating switch, automatic reset.
    a. Disables associated compressors on a drop in suction pressure to approximately 35 psig.
    b. Enables associated compressors on a rise in suction pressure to approximately 60 psig.
2. High refrigerant pressure, protective switch, manual reset at keypad.

The low pressure switch senses refrigerant pressure through shrader fittings that contain cores. The cores are stop valves that do not allow refrigerant to flow through the Shrader unless the device is in place. Therefore, the low pressure switch can be replaced without reclaiming the refrigerant.

The Shrader that serves the high pressure switch does not contain a core in order to maximize the functionality of the safety. Therefore it cannot be replaced unless the refrigerant has already been reclaimed.

Servicing Optional Electric Heater

⚠ WARNING

Hazardous voltage. May cause severe injury or death. Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

If the electric heater is not operating properly, a qualified electrician should perform the following to check if the heater is damaged:

1. Measure continuity through all fuses.
2. Check that all electrical connections are tight. Look for signs of arcing.
3. Check the resistance to ground for each circuit. It should be infinite.
4. Check the resistance phase to phase for each circuit.
5. Check all contactors.

Replacement Parts

Replacement parts can be obtained by contacting Daikin at 1-800-37-PARTS or at www.DaikinMcQuay.com. When contacting Daikin for service or replacement parts, refer to the model number and serial number of the unit as stamped on the nameplate attached to the unit.

When contacting Daikin for service or replacement parts, provide the model number, serial number, and unit part number of the unit as stamped on the serial plate attached to the unit. For questions regarding wiring diagrams, provide the number on the specific diagram. If replacement parts are required, include the date of unit installation, the date of failure, an explanation of the malfunction, and a description of the replacement parts required.

Compressors

Scroll Compressor

All Daikin Rooftop products include a first-year parts only warranty. The warranty period extends 12 months from startup or 18 months from date of shipment, whichever comes first. Labor to install these parts is not included with this warranty. Compressors are considered a part and are included in this standard warranty.

All Compressors

Replacement compressors for Daikin Rooftop Units can be obtained from the Daikin Service Parts department.

The decision to replace the failed portion of the compressor tandem, as opposed to replacing the entire tandem, must be decided based on the following.

1. In warranty: Warranty only covers replacement of the failed portion of the tandem.
2. Out of warranty: The customer decides whether to replace the entire tandem or just a portion.
3. Some equipment may include the extended 2nd - 5th year compressor warranty option.

Order the replacement compressor through the Daikin Parts Department (Minneapolis).

1. Contact the Daikin Parts Department for compressor availability.
2. Send a completed parts order form to the Daikin Parts Department.
3. The Parts Department processes the order and the compressors are shipped from our Dayton, OH warehouse via ground transportation. If next-day air is required, indicate this on the parts order form and a freight charge will be billed to your account. Air freight costs are not covered under the Daikin warranty.
4. After the failed compressor is replaced, return it to Daikin with a Return Goods Tag attached, which you will receive in the mail. It must be attached to the compressor. The Return Goods Tag has instructions on where to send the compressor. If the compressor is not returned, you will be billed for the replacement compressor.
5. Consideration may be given at this time to a compressor teardown analysis, depending on the history of failures.

In-Warranty Return Material Procedure

Material other than compressors may not be returned except by permission of authorized factory service personnel of Daikin at Minneapolis, Minnesota.

A “return goods” tag will be sent to be included with the returned material. Enter the information as called for on the tag in order to expedite handling at out factories and issuance of credits. All parts shall be returned to the factory designated on the return goods tag, transportation charges prepaid.

The return of the part does not constitute an order for replacement. A purchase order for the replacement part must be entered through your nearest Daikin representative. The order should include the component's part number and description and the model and serial numbers of the unit involved.

If it is determined that the failure of the returned part is due to faulty material or workmanship within the standard warranty period, credit will be issued on the customer's purchase order.

Rooftop
Equipment Warranty Registration Form

To comply with the terms of Daikin Applied Warranty, complete and return this form within 10 days to the Warranty Department of Daikin Applied.

Check, test, and start procedure for Rooftop roof mounted air conditioners with or without heat recovery and roof mounted air handlers.

GENERAL INFORMATION

Job Name: _____ **Unit No.:** _____

SOI No.: _____

Installation address: _____

City: _____ **State:** _____

Purchasing contractor: _____

City: _____ **State:** _____

Name of person doing start-up: _____

Company name: _____

Address: _____

City/State/Zip: _____

UNIT INFORMATION

Unit model number: _____ **Unit serial number:** _____

Compressor 1 model number: _____ **Serial number:** _____

Compressor 2 model number: _____ **Serial number:** _____

Compressor 3 model number: _____ **Serial number:** _____

Compressor 4 model number: _____ **Serial number:** _____

Compressor 5 model number: _____ **Serial number:** _____

Compressor 6 model number: _____ **Serial number:** _____

DAIKIN **Rooftop Equipment Warranty Registration Form (continued)**

Select Yes or No. If not applicable to the type of unit, select N/A.

I. INITIAL CHECK

A. Is any shipping damage visible? . . . . . Yes No N/A

B. Are fan drives properly aligned and belts properly adjusted? . . . . . Yes No N/A

C. Tightened all setscrews on pulleys, bearings and fans? . . . . . Yes No N/A

D. Have the hold-down bolts been backed off on spring mounted fan isolators? . . . . . Yes No N/A

E. Do fans turn freely? . . . . . Yes No N/A

F. Has the discharge static pressure reference line been properly located within the building? . . . . . Yes No N/A

G. Electrical service corresponds to unit nameplate? . . . . . Yes No N/A

G1. Voltage at Terminal Block | Disconnect 1–2_____ V 2–3 _____ V 1–3 _____ V

H. Is the main disconnect adequately fused and are fuses installed? . . . . . Yes No N/A

I. Are crankcase heaters operating, and have they been operating 24 hours prior to start-up? . . . . . Yes No N/A

J. Are all electrical power connections tight? (Check compressorelectrical box.) . . . . . Yes No N/A

K. Is the condensate drain trapped? . . . . . Yes No N/A

II. FAN DATA

A. Check rotation of supply fan? . . . . . Yes No N/A

B. Voltage at supply fan motor: . . . . . 1–2_____ V 2–3 _____ V 1–3 _____ V

C. Supply fan motor amp draw per phase: . . . . . L1 _____ L2 _____ L3 _____

D. Fuse sizes: . . . . . _____

E. What is the supply fan rpm? . . . . . _____

F. Check rotation of return fan? . . . . . Yes No N/A

G. Voltage at return fan motor: . . . . . 1–2_____ V 2–3 _____ V 1–3 _____ V

H. Return fan motor amp draw per phase: . . . . . L1 _____ L2 _____ L3 _____

I. Fuse sizes: . . . . . _____

J. What is the return fan rpm? . . . . . _____

K. Record supply static pressure at unit in inches of H_20: . . . . . _____

L. Record return static pressure at unit (with outside air dampers closed) in inches of H_20: . . . . . _____

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DAIKIN **Rooftop Equipment Warranty Registration Form (continued)**

Select Yes or No. If not applicable to the type of unit, select N/A.

III. START-UP COMPRESSOR OPERATION

A. Do compressors have holding charges?

Circuit #1 . . . . . Yes No N/A

Circuit #2 . . . . . Yes No N/A

B. Are compressors rotating in the right direction? . . . . . Yes No N/A

C. Do condenser fans rotate in the right direction? . . . . . Yes No N/A

D. Ambient temperature (°F): . . . . . _____

E. Does unit start up and perform per sequence of operation? . . . . . Yes No N/A

IV. PERFORMANCE DATA

A. Compressor voltage across each phase: . . . . . 1–2_____ V 2–3 _____ V 1–3 _____ V

B. Compressor amperage of fully loaded compressor: Compressor #1 — Phase 1_____ Phase 2 _____ Phase 3 _____

Compressor #2 — Phase 1_____ Phase 2 _____ Phase 3 _____

Compressor #3 — Phase 1_____ Phase 2 _____ Phase 3 _____

Compressor #4 — Phase 1_____ Phase 2 _____ Phase 3 _____

Compressor #5 — Phase 1_____ Phase 2 _____ Phase 3 _____

Compressor #6 — Phase 1_____ Phase 2 _____ Phase 3 _____

C. Low pressure cut-out: . . . . . Circuit 1 _____ psig Circuit 2 _____ psig

D. Low pressure cut-in: . . . . . Circuit 1 _____ psig Circuit 2 _____ psig

E. High pressure cut-out: . . . . . Circuit 1 _____ psig Circuit 2 _____ psig

F. Discharge pressure, one compressor: . . . . . Circuit 1 _____ psig Circuit 2 _____ psig

G. Discharge pressure, fully loaded, 2–3 compressors: . . . . . Circuit 1 _____ psig Circuit 2 _____ psig

H. Suction pressure, one compressor: . . . . . Circuit 1 _____ psig Circuit 2 _____ psig

I. Suction pressure, fully loaded, 2–3 compressors: . . . . . Circuit 1 _____ psig Circuit 2 _____ psig

J. Liquid press, fully loaded, 2–3 compressors (at liquid line shutoff valve): . . . Circuit 1 _____ psig Circuit 2 _____ psig

K. Liquid temperature, fully loaded, 2–3 compressors: . . . . . Circuit 1 _____ psig Circuit 2 _____ psig

L. Suction line temperature: . . . . . _____ °F _____ °F

M. Superheat: . . . . . _____ °F _____ °F

N. Subcooling: . . . . . _____ °F _____ °F

O. Is the liquid in the line sightglass clear and dry? . . . . . Yes No N/A

P. Does the hot gas bypass valve function properly? . . . . . Yes No N/A

DAIKIN **Rooftop Equipment Warranty Registration Form (continued)**

Select Yes or No. If not applicable to the type of unit, select N/A.

Q. At what suction pressure does the hot gas bypass valve open? . . . . . Circuit 1 _____ psig Circuit 2 _____ psig

R. Record discharge air temperature at discharge of unit: _____ °F

S. Are all control lines secure to prevent excessive vibration and wear? . . . . . Yes No N/A

T. Are all gauges shut off and valve caps and packings tight after start-up? . . . . . Yes No N/A

V. ELECTRIC HEAT CHECK, TEST & START

A. Electrical heat service corresponds to unit nameplate? . . . . . Yes No N/A

Volts _____ Hertz _____ Phase _____

B. Are there any signs of physical damage to the electric heat coils? . . . . . Yes No N/A

C. Have all electrical terminals been tightened? . . . . . Yes No N/A

D. Does sequence controller stage contactors properly? . . . . . Yes No N/A

E. Electric heater voltage across each phase: . . . . . _____ L1 _____ L2 _____ L3

F. Amp draw across each phase at each heating stage:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Phase L1:						
Phase L2:						
Phase L3						

G. FLA: . . . . . L1 _____ L2_____ L3 _____

H. Operate electric heat with fans off. Electric heat must cycle on high limit control . . . . . Yes No N/A

VI. GAS BURNER CHECK, TEST, & START

Specifications:
For gas, see Forced Draft Gas Burner Installation and Maintenance Bulletin. (IM 684 and IM 685)

A. Gas Furnace: . . . . . Model no. _____

B. Gas Burner: . . . . . .Model no._____ Serial no. _____

C. Gas Rated firing rate (MBH input): . . . . . ._____

D. Gas Altitude (ft. above sea level): . . . . . ._____

E. Input (CFH): . . . . . _____

F. Gas pressure at burner (inches w.c.): . . . . . _____

G. CO_2 (%) . . . . . _____

H. CO_2 (%): . . . . . _____

I. Pilot flame only in microamps (steady at low fire): . . . . . _____

J. Pilot Tap-gas pressure (inches w.c.): . . . . . _____

K. Motor only/burner FLA running amps: . . . . . _____

L. High limit control OK? . . . . . Yes No N/A

M. Flame safeguard (microamps): . . . . . _____

DAIKIN **Rooftop Equipment Warranty Registration Form (continued)**

Select Yes or No. If not applicable to the type of unit, select N/A.

N. Flame failure shutoff (seconds): _____

O. Airswitch OK? . . . Yes No N/A

P. High Gas Pressure Switch OK? . . . Yes No N/A

Q. Low Gas Pressure Switch OK? . . . Yes No N/A

R. Main Gas Valve Close-off OK? . . . Yes No N/A

S. Modulation Gas Heat Performance

Gas Pressure	
Mod. Valve	**Reg. Valve**
25% _____ in Wc.	25% _____ in Wc.
50% _____ in Wc.	50% _____ in Wc.
75% _____ in Wc.	75% _____ in Wc.
100% _____ in Wc.	100% _____ in Wc.

VII. Hot Water Coil

A. Pressure test OK? . . . Yes No N/A

VIII. Heat Recovery

A. Heat wheel rotates freely? . . . Yes No N/A

B. Heat wheel VFD operates properly? . . . Yes No N/A

C. Heat wheel VFD . . . Model No. _____ Serial No. _____

D. Check for air bypass around heat wheel . . . Yes No N/A

IX. Design Flow Calibration

A. Verify power is supplied to the MicroTech III unit controller . . . Yes No N/A

B. Verify that the shipping screws have been removed from the measuring station vane . . . Yes No N/A

C. Examine station for damage . . . Yes No N/A

D. Record Level Position after calibration

- LH Level Position . . . _____
- RH Level Position . . . _____

NOTE: This is viewed in the MicroTech III controller, in the Min OA setup menu.

DAIKIN

Rooftop Equipment Warranty Registration Form (continued)

Select Yes or No. If not applicable to the type of unit, select N/A.

X. Have all electronic or electrical controls been checked, adjusted, and tested for proper operation per the installation and maintenance bulletins?

. . . . . Yes No N/A

XI. MAINTAINING MICROTECH CONTROL PARAMETER RECORDS

After the unit is checked, tested, and started and the final control parameters are set, record the final settings. Keep these records on file and update whenever changes to the control parameters are made. Keeping a record facilitates any required analysis and troubleshooting of the system operation and facilitates restoration after a controller replacement.

Thank you for completing this form. Please sign and date below.

Signature _____ **Startup date:** _____

Return completed form by mail to:

Daikin Warranty Department, 13600 Industrial Park Boulevard, Minneapolis, MN 55441

or by email to: AAH.Wty_WAR_forms@daikinapplied.com

Please fill out the Daikin Applied "Quality Assurance Survey Report" and list any additional comments that could affect the operation of this unit; e.g., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach it to the Survey Report and return it to the Warranty Department of Daikin Applied with the completed Equipment Warranty Registration form.

DAIKIN

Quality Assurance Survey Report

To whom it may concern:
Please review the items below upon receiving and installing our product. Select N/A on any item that does not apply to the product.

Job Name: _____ **Daikin Applied S.O. No.** _____

Installation address: _____

City: _____ State: _____

Purchasing contractor: _____

City: _____ State: _____

Name of person doing start-up (print): _____

Company name: _____

Address: _____

City/State/Zip: _____

Unit model number: _____ **Unit serial number:** _____

1. Is there any shipping damage visible? . . . . . Yes No N/A
   Location on unit _____
2. How would you rate the overall appearance of the product; i.e., paint, fin damage, etc.?
   Excellent Good Fair Poor
3. Did all sections of the unit fit together properly? . . . . . Yes No N/A
4. Did the cabinet have any air leakage? . . . . . Yes No N/A
   Location on unit _____
5. Were there any refrigerant leaks? . . . . . Yes No N/A
   From where did it occur? . . . . . Shipping Workmanship Design
6. Does the refrigerant piping have excessive vibration? . . . . . Yes No N/A
   Location on unit _____
7. Did all of the electrical controls function at start-up? . . . . . Yes No N/A
   Comments _____
8. Did the labeling and schematics provide adequate information? . . . . . Yes No N/A
9. How would you rate the serviceability of the product?
   Excellent Good Fair Poor
10. How would you rate the overall quality of the product?
    Excellent Good Fair Poor
11. How does the quality of Daikin Applied products rank in relation to competitive products?
    Excellent Good Fair Poor

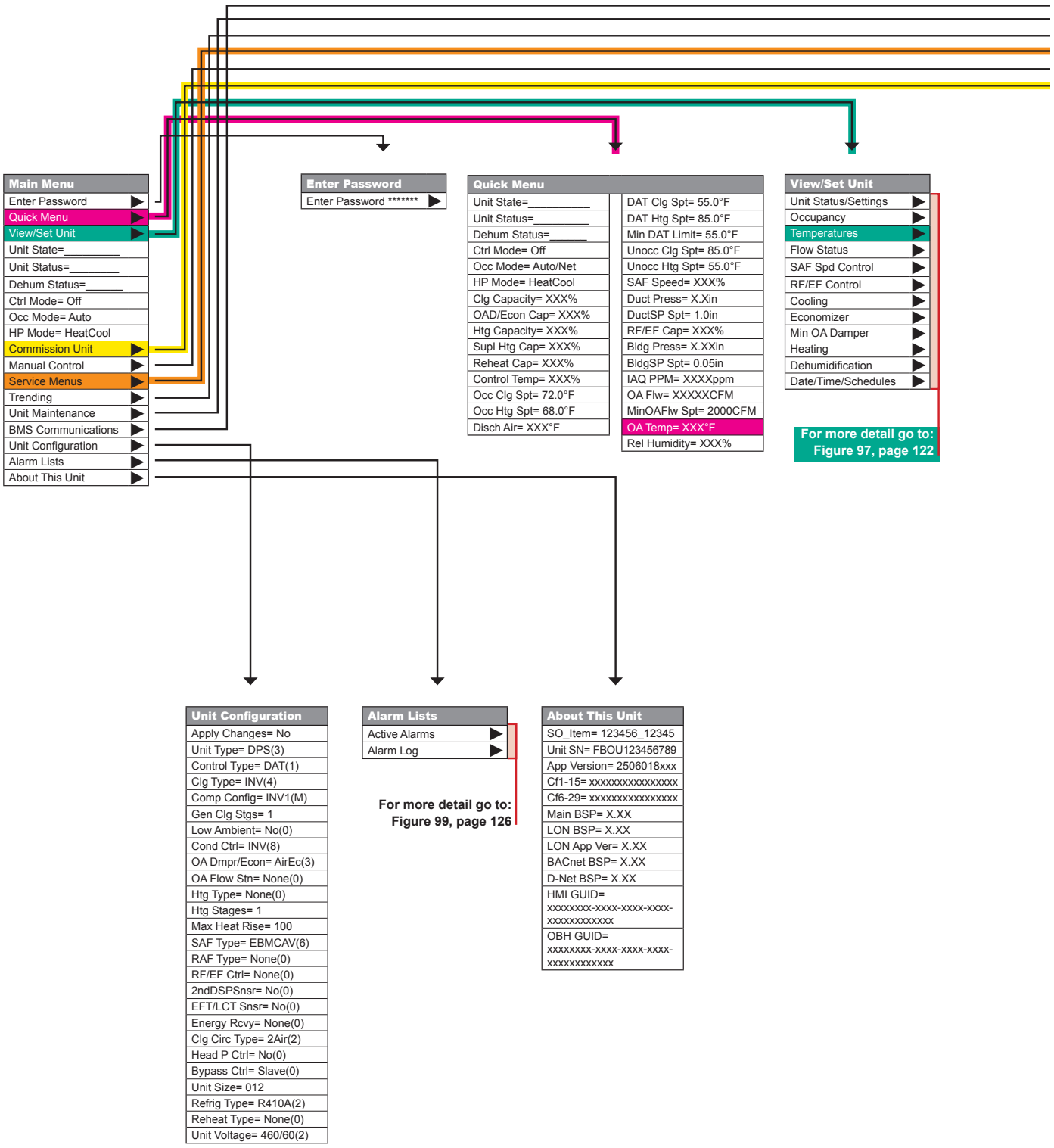
    Comments _____

Please list any additional comments which could affect the operation of this unit; i.e., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach the sheet to this completed Quality Assurance Survey Report, and return it to the Warranty Department with the completed preceding "Equipment Warranty Registration Form".

13F-4160 (02/16)

The following is a description of the MicroTech III menu structure. These menus and items can all be displayed with the keypad/display. Menu items displayed will change based on the selected unit configuration.

Figure 96: Main Menu *– Keypad/Display Menu Structure*



APPENDIX – KEYPAD/DISPLAY MENU STRUCTURE

Commission Unit
Unit Set-Up ▶
Timer Settings ▶
SAF Set-Up ▶
RF/EF Set-Up ▶
Htg/Clg ChgOvr Set-Up ▶
Cooling Set-Up ▶
INV Cmp Set-Up ▶
Econo Set-Up ▶
Min OA Set-Up ▶
Heating Set-Up ▶
OA Fan Set-Up ▶
Exp Valve Set-Up ▶
Defrost Set-Up ▶
Dehum Set-Up ▶
Energy Rec Set-Up ▶
D3 Set-Up ▶
Alarm Configuration ▶

For more detail go to: Figure 98, page 124

Manual Control
Manual Control= Normal
Supply Fan= Off
SAF Spd Cmd= 0%
INV/OF Ena= Off
INV Comp= Off
INV Spd Cmd= 0%
Comp 3= Off
OA Fan= Off
OA Fan Cmd= 0%
4 Way Valve= Cool
RcvrSol Valve= Closed
BP Sol Valve= Closed
EVI Cmd= 0%
EVO Cmd= 0%
RF/EF VFD= Off
RF/EF Spd Cmd= 0%
OAD/Econo= 0%
Gas Htg On/Off
Htg Valve= 0%
SCR Out= 0%
Htg Stg 1= Off
SCR Ena 1= Off
Htg Stg 2= Off
Htg Stg 3= Off
Htg Stg 4= Off
Reheat Valve= 0%
ERec Wheel= Off
ER Whl Cmd= 0%
ER BP Dmpr Cl= Off
ER BP Dmpr Op= Off
Alm Output= Off
Fan Op Out= Off

Service Menus
Timer Settings ▶
Operating Hours ▶
Save/Restore Settings ▶
Active Alarms ▶
Alarm Log ▶
Alarm Configuration ▶
Analog Input Status ▶
Universal I/O Status ▶
Digital Input Status ▶
Digital Output Status ▶
Network Input Status ▶
Modbus Status ▶
D3 Status ▶
Sensor Offsets ▶
Reset Counte= XXXX

For more detail go to: Figure 99, page 126

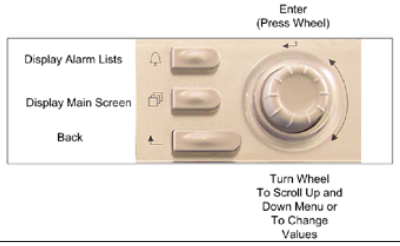
Trending
Trending Ena= No
Apply Chgs= No
Sample Time= 300s
TrendOnOff= Off
Export Data= No
Clear Trend= Done
Points 1–8 (Fixed) ▶
Points 9–24 (from List) ▶
Points 25–27 (with IDs) ▶
Points 28–30 (with IDs) ▶

For more detail go to: Figure 101, page 128

Unit Maintenance
Operating Hours

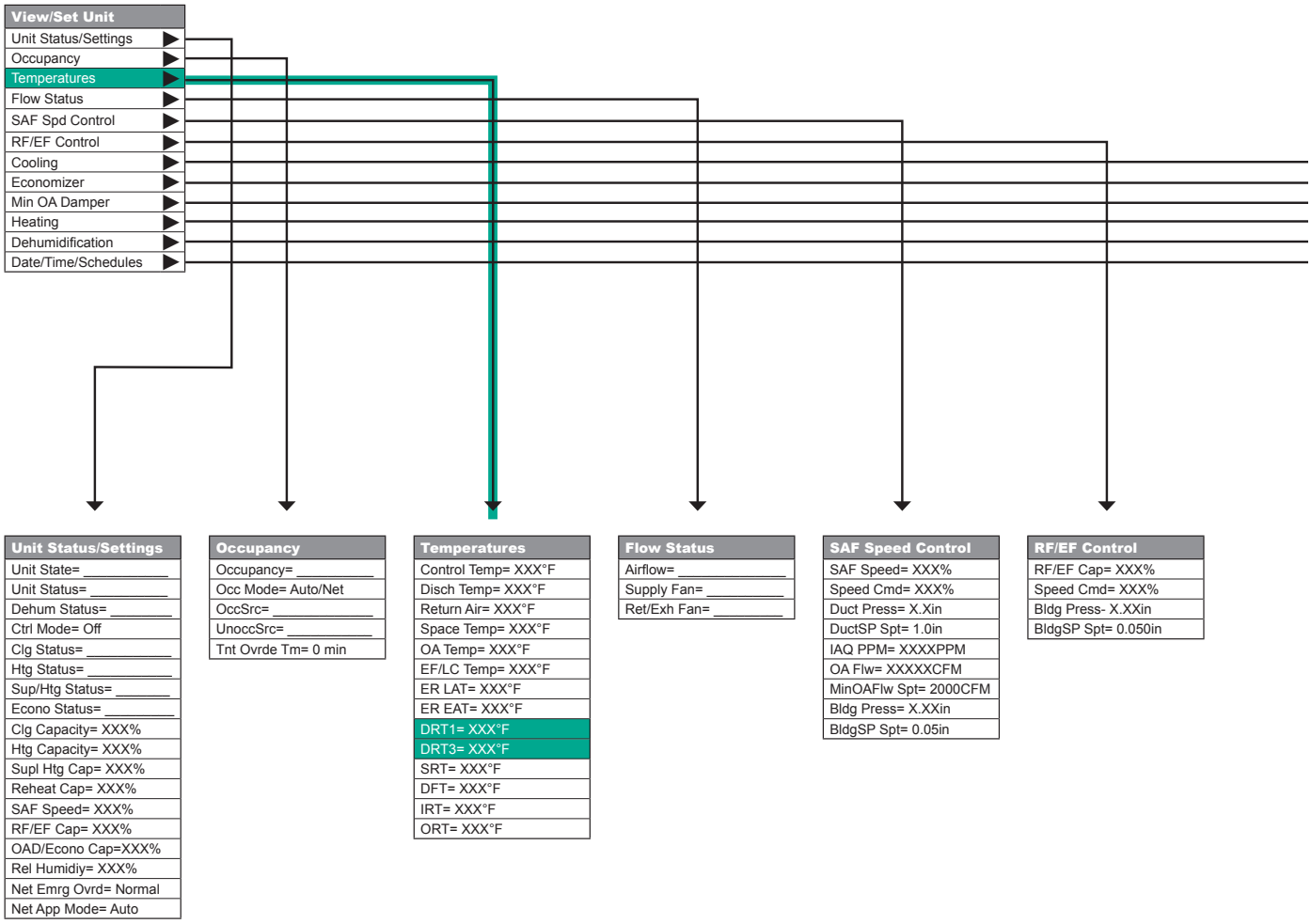
BMS Communications
LON Set-Up ▶
BACnet MSTP Set-Up ▶
BACnet IP Set-Up ▶
D-Net Set-Up ▶
Network Unit Set-Up ▶

For more detail go to: Figure 100, page 128



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

***Figure 97: View/Set Unit** – Keypad/Display Menu Structure*



APPENDIX – KEYPAD/DISPLAY MENU STRUCTURE

Cooling
Occ Clg Spt= 72.0°F
Unocc Clg Spt= 85.0°F
DAT Clg Spt= 55.0°F

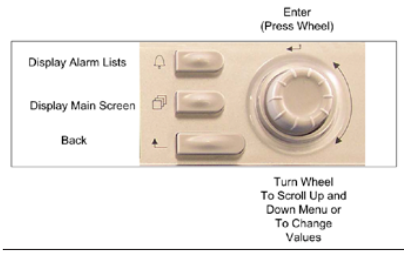
Economizer
OAD/Econo Pos= XXX%
DAT Clg Spt= 55.0°F
Min OA Pos= XXX%
Occ Clg Spt= 72.0°F
Unocc Clg Spt= 85.0°F

Min OA Damper
Min OA Pos= XXX%
Vent Limit= 20%
LoFlo V Lmt= 30%
DCV Limit= 10%
Min OA Src= _____

Heating
Occ Htg Spt= 68.0°F
Unocc Htg Spt= 55.0°F
MWU Spt= 70.0°F
DAT Htg Spt= 85.0°F

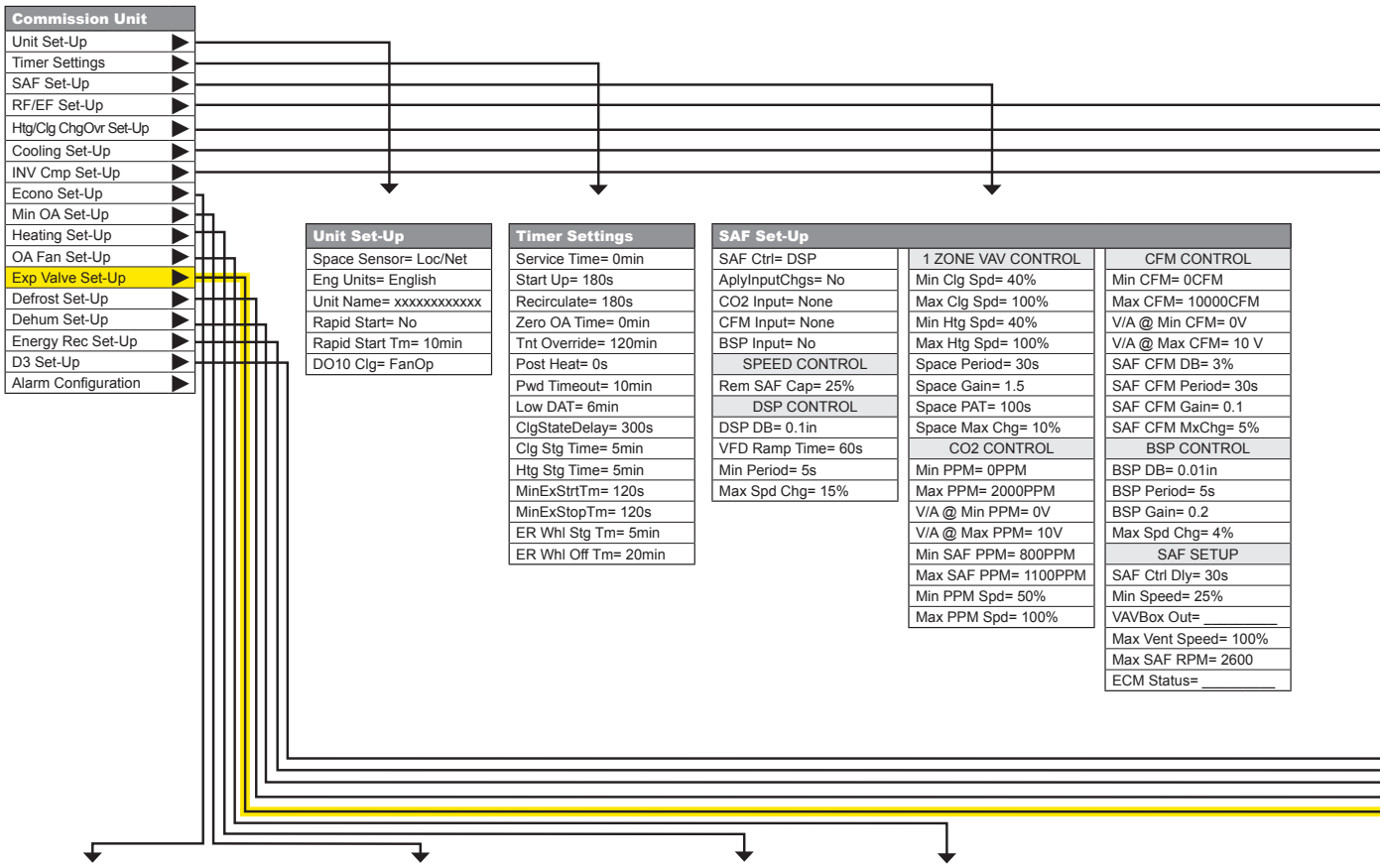
Dehumidification
Dehum Status= _____
Rel Humidity= XXX%
Dewpoint= XXX°F
Dehum Method= None
RH Setpoint= 50%
Dewpoint Spt= 50°F
Reheat Spt= XXX°F
Reheat Cap= XXX%

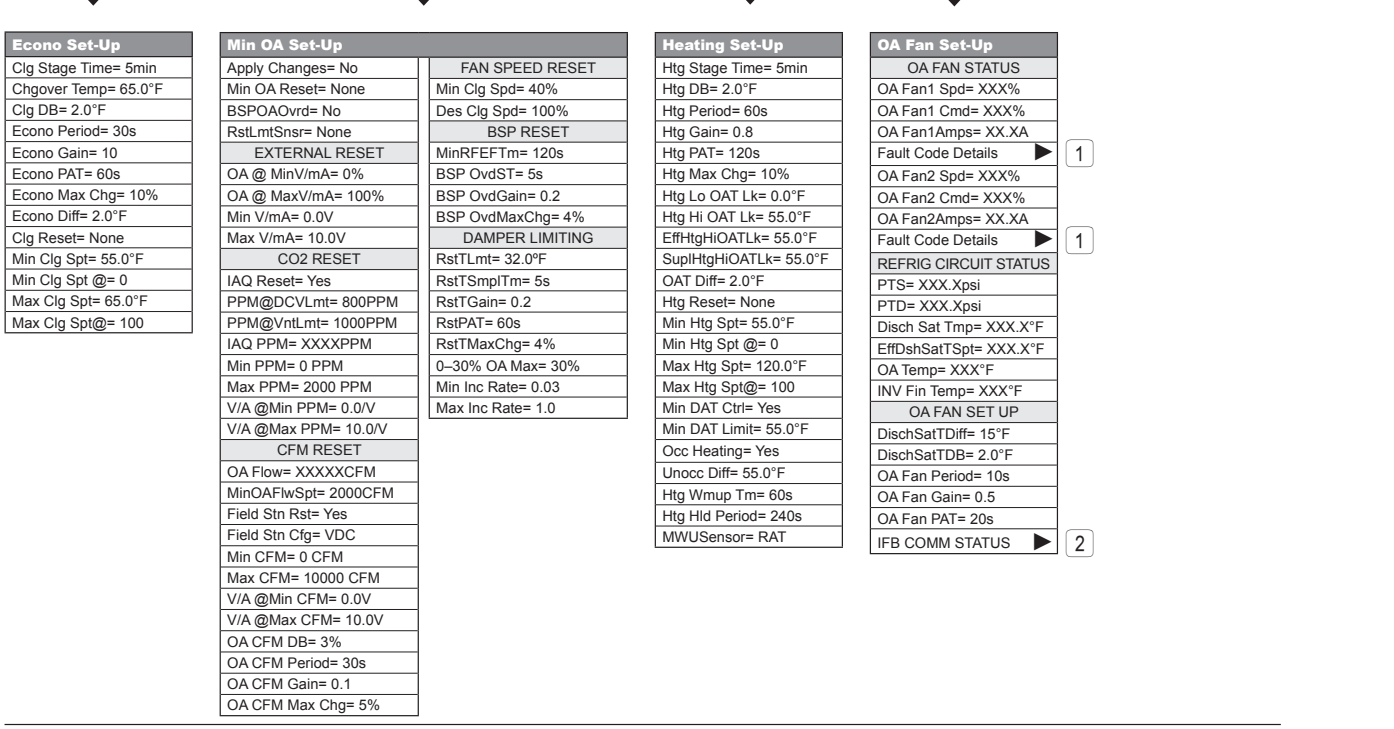
Date/Time/Schedules
Time= hh:mm:ss
Date= MM/DD/YY
UTC Diff= -60min
DAILY SCHEDULE
Mon= HH:MM-HH:MM
Tue= HH:MM-HH:MM
Wed= HH:MM-HH:MM
Thu= HH:MM-HH:MM
Fri= HH:MM-HH:MM
Sat= HH:MM-HH:MM
Sun= HH:MM-HH:MM
Hol= HH:MM-HH:MM
HOLIDAY DATES
Hol 1=MMMDD/YY-MMMDD/YY
Hol 2=MMMDD/YY-MMMDD/YY
Hol 3=MMMDD/YY-MMMDD/YY
Hol 4=MMMDD/YY-MMMDD/YY
Hol 5=MMMDD/YY-MMMDD/YY
Hol 6=MMMDD/YY-MMMDD/YY
Hol 7=MMMDD/YY-MMMDD/YY
Hol 8=MMMDD/YY-MMMDD/YY
Hol 9=MMMDD/YY-MMMDD/YY
Hol 10=MMMDD/YY-MMMDD/YY
ONE EVENT SCHEDULE
Beg= MMMDD/YY@HH:MM
End= MMMDD/YY@HH:MM
OPTIMAL START
Enable= No
Htg Range= 0.4 °F/min
Htg OAT= 35 °F
Des Htg OAT= 0 °F
Clg Rate= 0.4 °F/min
Clg OAT= 85 °F
Des Clg OAT= 95 °F
DAYLIGHT SAVINGS
DLS Strt Mon= Mar
DLS Strt Wk= 2nd Week
DLS End Mon= Nov
DLS End Wk= 1st Week
DLS Active= Yes



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

***Figure 98: Commission Unit** – Keypad/Display Menu Structure*





APPENDIX – KEYPAD/DISPLAY MENU STRUCTURE

1, 2 See Figure 99, page 127 for the expansion information

RF/EF Set-Up
RF/EF Ctrl= None
Rem ExhF Cap= 5%
BSP DB= 0.010in
BSP Period= 5s
BSP Gain= 0.2s
Max Spd Chg= 4%
RFEF Ctrl Dly= 30s
Min Speed= 5%
MinExStrtTm= 120s
MinExStopTm= 120s
MinExOAPos= 5%
MinExSAFCap= 10%
ExhOnOAPos= 40%
ExhMxOAPos= 100%
Max Vent Spd= 100%
Max RFEF RPM= 2600
ECM Status=_____

Htg/Clg ChgOvr Set-Up
Ctlr Temp Src= RAT
Use Tstat Spt= No
Occ Clg DB= 2.0°F
Clg Period= 60s
Clg Gain= 0.1
Clg PAT= 600s
Max Clg Chg= 5.0°F
Occ Htg DB= 2.0°F
Htg Period= 60s
Htg Gain= 0.1
Htg PAT= 600s
Max Htg Chg= 5.0°F

Cooling Set-Up
Clg Stage Time= 5min
Clg DB= 2.0°F
Clg Lo OAT Lk= 55ºF
OAT Diff= 2.0°F
Clg Reset= None
Min Clg Spt= 55.0°F
Min Clg Spt @= 0
Max Clg Spt= 65.0°F
Max Clg Spt@= 100
Unocc Diff= 3°F

INV Cmp Set-Up
COMPRESSOR STATUS
Clg State=_____
Htg State=_____
INV Cmp Spd= XXX.X%
INV Spd Cmd= XXX.X%
Comp 3=_____
Prev Standby=_____ ▶
Compressor Limiting ▶
Fault Code Details ▶ 1
INV Port Temp= XXX.XºF
INV Fin Temp= XXX.XºF
INV Cmp Amps= XX.XA
REFRIG CIRCUIT STATUS
PTS= XXX.Xpsi
PTD= XXX.Xpsi
4 Way Valve=_____
RcvrSol Valve=_____
BP Sol Valve=_____

COMPRESSOR SETUP
Clg Lo OAT Lk= 55°F
Htg Lo OAT Lk= 0.0ºF
Htg Hi OAT Lk= 55.0ºF
EffHtgOATLk= 55.0ºF
OAT Diff= 2ºF
INV Period= 20s
INV Gain= 2.5
INV PAT= 10s
INV Max Chg= 15%
IFB COMM STATUS ▶ 2

Date/Time
MM/DD/YYYY HH:MM:SS

Compressor Limiting
Clg Press Lmtg=_____
Htg Press Lmtg=_____
C Ratio Lmtg=_____
Ref DLT Lmtg=_____
INV Brd Lmtg=_____
INV Man Dsbl= Enable
Comp3 ManDsbl= Enable

Exp Valve Set-Up
EXP VALVE STATUS
EVI Pos= XXX%
EVO Pos= XXX%
EVStatus=_____
REFRIG CIRCUIT STATUS
PTS= XXX.Xpsi
PTD= XXX.Xpsi
Suction SH= XX.XºF
Discharge SH= XX.XºF
Subcooling= XX.X°F
Eff SSH Spt= XX.X°F
EffSH Base= XX.X°F
Eff SC Spt= XX.X°F
Eff SC Lo Lmt= XXX%
SRT= XXX°F
Disch Sat Tmp= XXX.X°F
Sucn Sat Tmp= XXX.X°F
IRT= XXX°F
ORT= XXX°F

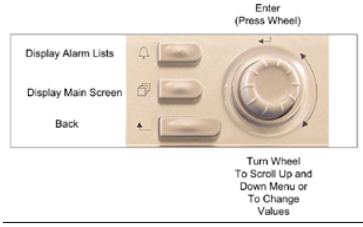
EXP VALVE SETUP
SSH DB= 2.0ºF
SH Lo Base= 5.0ºF
SH Hi Base= 9.0ºF
Htg EVI Meth= SbC
IC SC Spt= 9.0ºF
IC SC DB= 2.0ºF
HtgSC EVI Min= 0%
Clg EVO Meth= SbC
OC SC Spt= 9.0ºF
OC SC DB= 2.0ºF
ClgSC EVO Min= 0%
ManCtrl EV Op= Auto

Defrost Set-Up
Defrost State=_____
Manual DF= No
MinCmpOpTm= 10min
MinAccCmpTm= 40min
MaxFrostTm= 120min
Defrost Temp= XXºF
Tdef Adj= 0.0ºF
CmpOpTime= XXXmin
AccCmpOpTm= XXXmin
LoFrstAccTm= XXXmin
HiFrstAccTm= XXXmin

Dehum Set-Up
Dehum Method= None
RH DB= 2%
Dewpoint DB= 2°F
RH Period= 30s
RH Gain= 1
RH PAT= 30s
RH Max Chg= 10%
Dehum Ctrl= Occupied
Sensor Loc= Return
Mn Lvg Coil T= 45.0°F
Mx Lvg Coil T= 52.0°F
Min Rheat Spt= 55.0°F
Max Rheat Spt= 65.0°F
RH Sens Type= VDC
RH Min Sig= 0V
RH Max Sig= 10V
Min Dehum Spd= 33%
Max Dehum Spd= 100%
RH Min Pos= 15%
RH Dec Rate= 1.0%/s

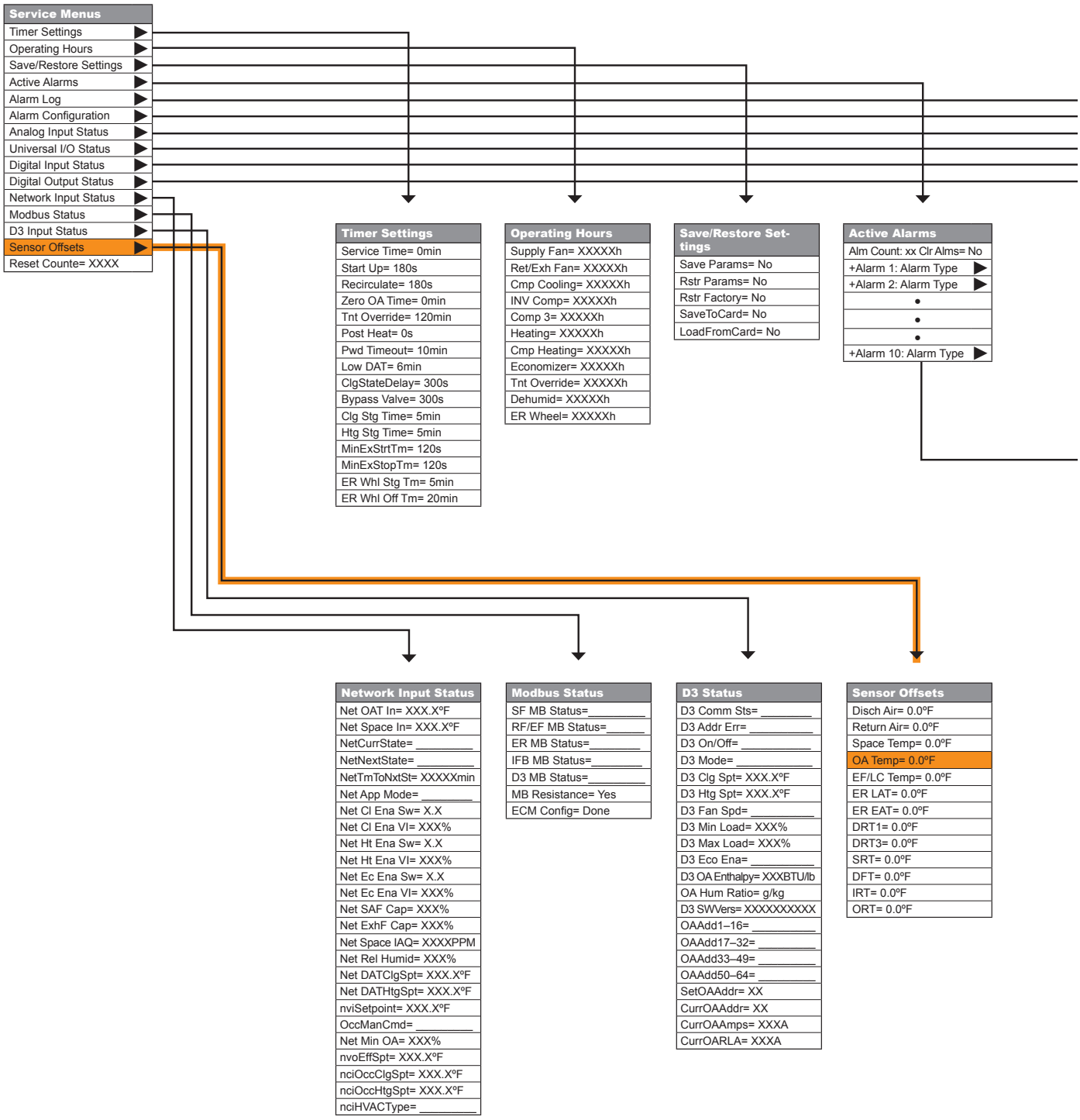
Energy Rec Set-Up
Energy Rcvy= Yes
ER Wheel=_____
Wheel Speed= XXX%
Whl Spd Cmd= XXX%
ER LAT= XXX°F
ER EAT= XXX°F
Min ExhT Diff= 2.0°F
Max ExhT Diff= 6.0°F
ER Whl Stg Tm= 5min
ER Whl Off Tm= 20min
Rel Humidity= XXX%
Min Whl Spd= 5%
Intersect Pt= XXX.XºF
Fst Mgnt Meth= Timed
OA Frst Temp= -5.0°F
Defrost Time= 5min
Defrost Period= 60min
Defrst On Tm= 1s
Defrst Off Tm= 24s
ER Whl Period= 30s
ER Whl Gain= 1.0
ER Whl PAT= 30s
ER Whl Chg= 10%

D3 Set-Up
Itouch Vers=_____
Unit D3 Addr= 1–00
Set D3 Addr= No
OA Unit Num= 0
OA Unit Amps= 0
OA Unit Addr= 0
Set OA Unit= No
Rst All OA= No
Min Load= 20%
Max Load= 50%
HiCapReset= No
DATLoDiff= 10.0ºF
Eco Method= None
DATHiDiff= 10.0ºF
OA Enth Max= 25.5 BTU/lb
OA Hum Max= 0.0107lb/lb
OAT Max= 84ºF
Temp Display= DAT
Low Speed= 33%
Med Speed= 66%
Hi Speed= 100%



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

***Figure 99: Service Menu** – Keypad/Display Menu Structure*



APPENDIX – KEYPAD/DISPLAY MENU STRUCTURE

Alarm Log
Log Count: xx Clr Log= No ▶
+/-Alarm 1: Alarm Type ▶
+/-Alarm 2: Alarm Type ▶
•
•
•
+/-Alarm 10: Alarm Type ▶

Alarm Configuration
ALARM LIMITS
Hi Disch Temp= 170°F
Lo Disch Temp= 40°F
Hi Return Temp= 120°F
ALARM OUT CONFIG
Faults= Fast
Problems= Slow
Warnings= Off
ALARM DELAYS
Frz Delay Time= 30s
Air Flw Ing=120s
Sens Alm Dly= 30s
Temp AlmDly= 30s
ALARM CONFIG
Emerg Stop= ManClr

Analog Input Status
MCB AI1= XXXXXXXX
MCB AI2= XXXXXXXX
MCB AI3= XXXXXXXX

Universal I/O Status
MCB X1= XXXXXXXX
MCB X2= XXXXXXXX
MCB X3= XXXXXXXX
MCB X4= XXXXXXXX
MCB X5= XXXXXXXX
MCB X6= XXXXXXXX
MCB X7= XXXXXXXX
MCB X8= XXXXXXXX
EMB X1= XXXXXXXX
EMB X2= XXXXXXXX
EMB X3= XXXXXXXX
EMB X4= XXXXXXXX
EMB X5= XXXXXXXX
EMB X6= XXXXXXXX
EMB X7= XXXXXXXX
EMB X8= XXXXXXXX
EMD X1= XXXXXXXX
EMD X2= XXXXXXXX
EMD X3= XXXXXXXX
EMD X4= XXXXXXXX
EMD X5= XXXXXXXX
EMD X6= XXXXXXXX
EMD X7= XXXXXXXX
EMD X8= XXXXXXXX

Digital Input Status
MCB DI1= _____
MCB DI2= _____
MCB DI3= _____
MCB DI4= _____
MCB DI5= _____
MCB DI6= _____
EMD DI1= _____

Digital Output Status
MCB DO1= _____
MCB DO2= _____
MCB DO3= _____
MCB DO4= _____
MCB DO5= _____
MCB DO6= _____
MCB DO7= _____
MCB DO8= _____
MCB DO9= _____
MCB DO10= _____
EMB DO1= _____
EMB DO2= _____
EMB DO3= _____
EMB DO4= _____
EMB DO5= _____
EMB DO6= _____
EMD DO1= _____
EMD DO2= _____
EMD DO3= _____
EMD DO4= _____
EMD DO5= _____
EMD DO6= _____

Alarm Lists
Active Alarms ▶
Alarm Log ▶

Active Alarms
Alm Count: xx Clr Alms= No
+Alarm 1: Alarm Type ▶
+Alarm 2: Alarm Type ▶
•
•
•
+Alarm 10: Alarm Type ▶

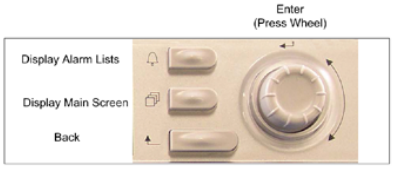
Alarm Log
Log Count: xx Clr Log= No ▶
+/-Alarm 1: Alarm Type ▶
+/-Alarm 2: Alarm Type ▶
•
•
•
+/-Alarm 10: Alarm Type ▶

Alarm Details
+/-Alarm 1: Alarm Type
MM/DD/YYYY HH:MM:SS
INV/OF Flt Code Details ▶
IFB Comm Status ▶

1
2

IFB Comm Status
IFB SW Vers= VP0329008
IFBCommStatus=____
PrvCommStatus=_____
MM/DD/YYYY HH:MM:SS
ACS1 DataRcvd=_____
ACS3 DataRcvd=_____

Fault Code Details
ACTIVE FAULT CODES
INVAlarmCode=_____
Code Text
OF1AlarmCode=_____
Code Text
OF2AlarmCode=_____
Code Text
PREVIOUS FAULT CODES
PrvINVAlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS
PrvOF1AlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS
PrvOF2AlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

Figure 100: BMS Communications – *Keypad/Display Menu Structure*

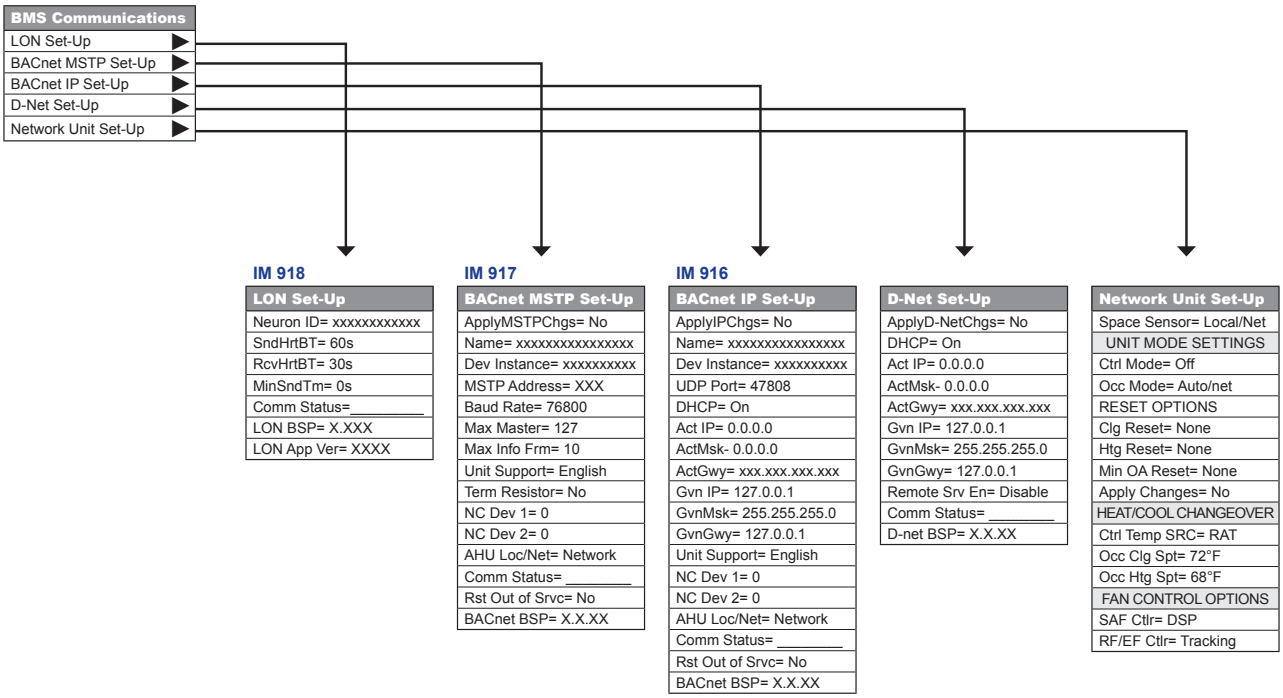


Figure 101: Trending – *Keypad/Display Menu Structure*

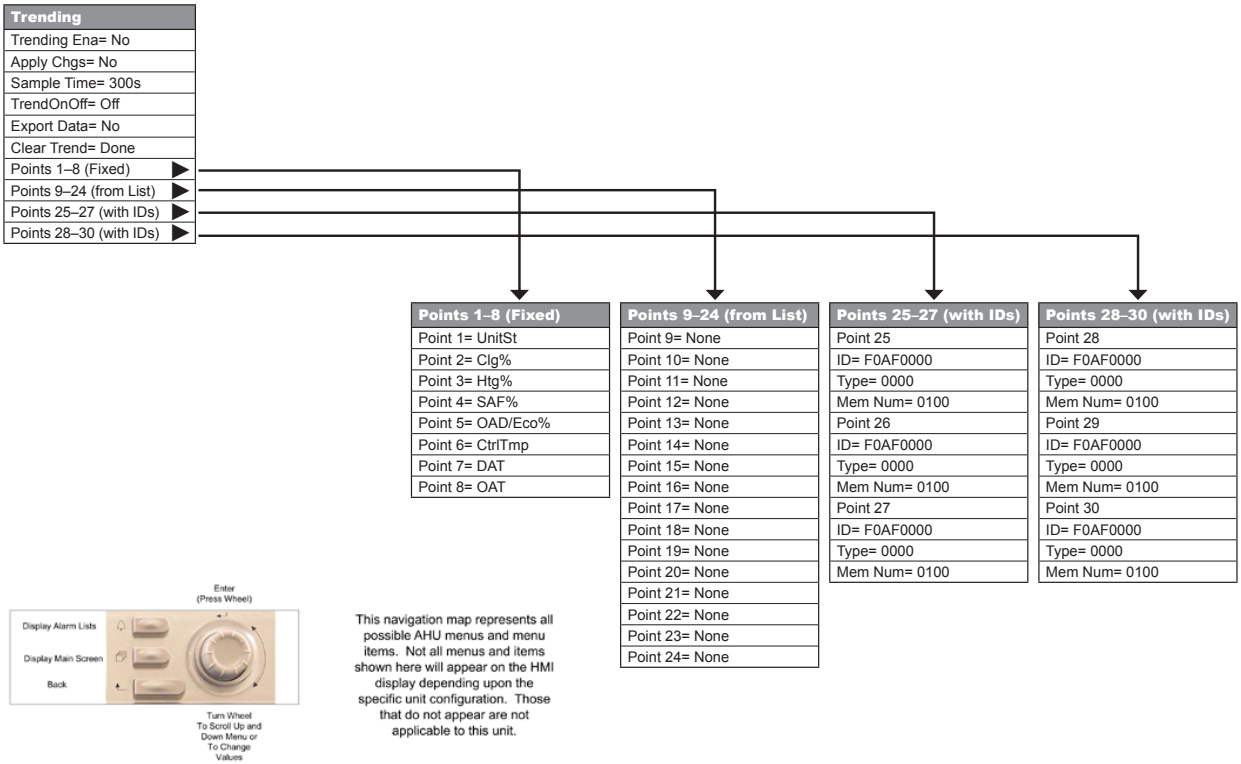
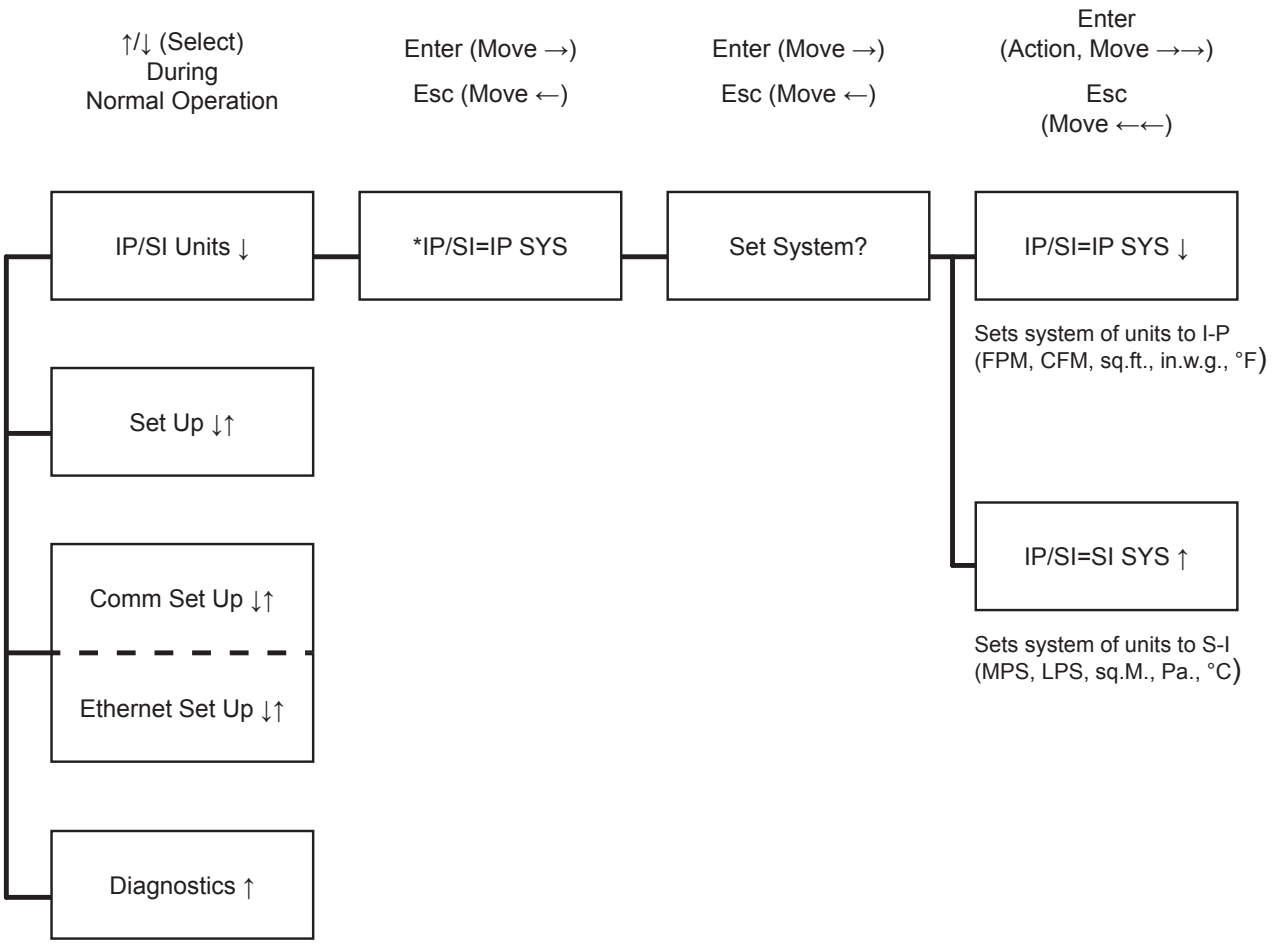


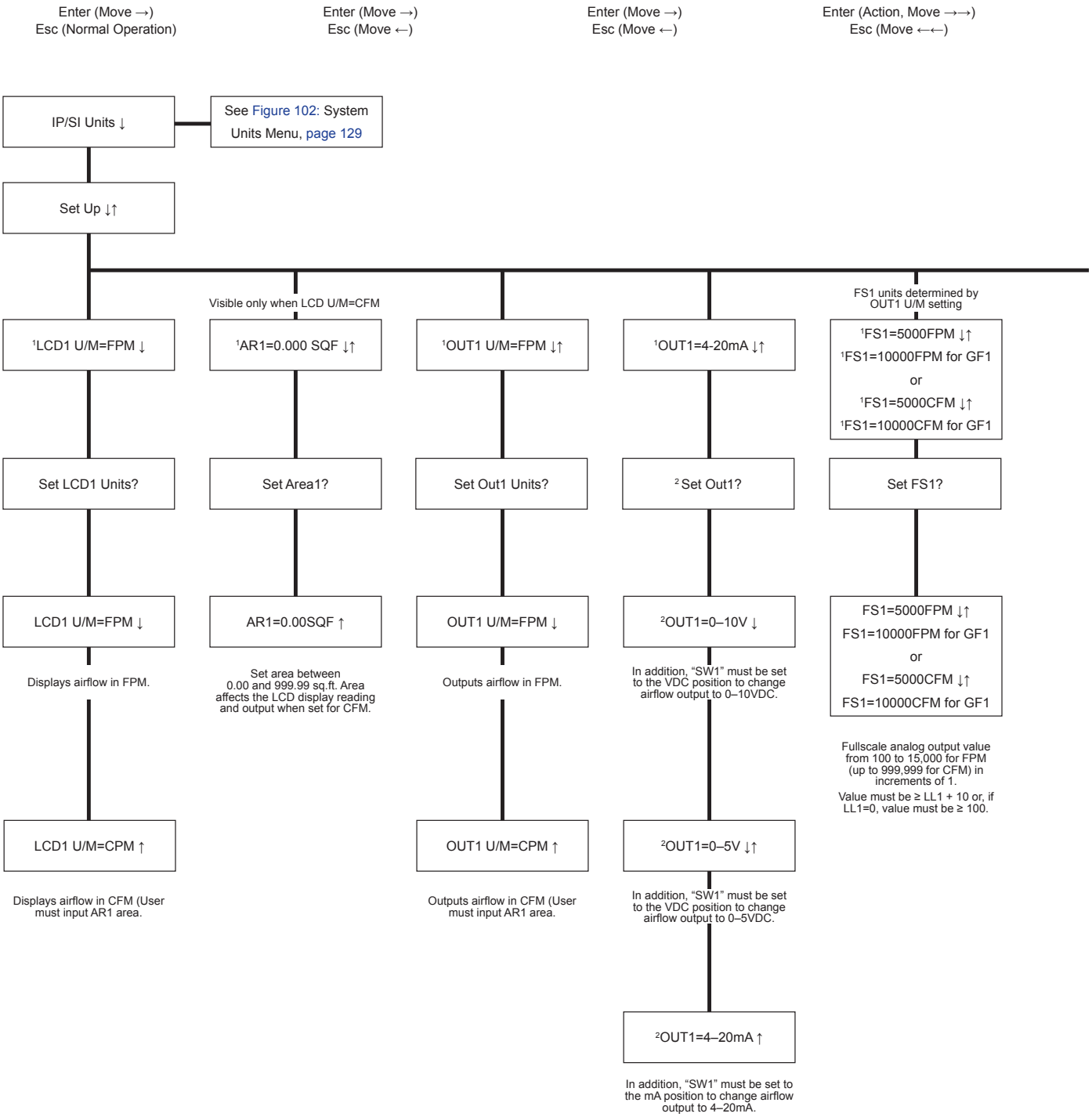
Figure 102: Optional Outdoor Air Monitor *– Changing the System of Units*



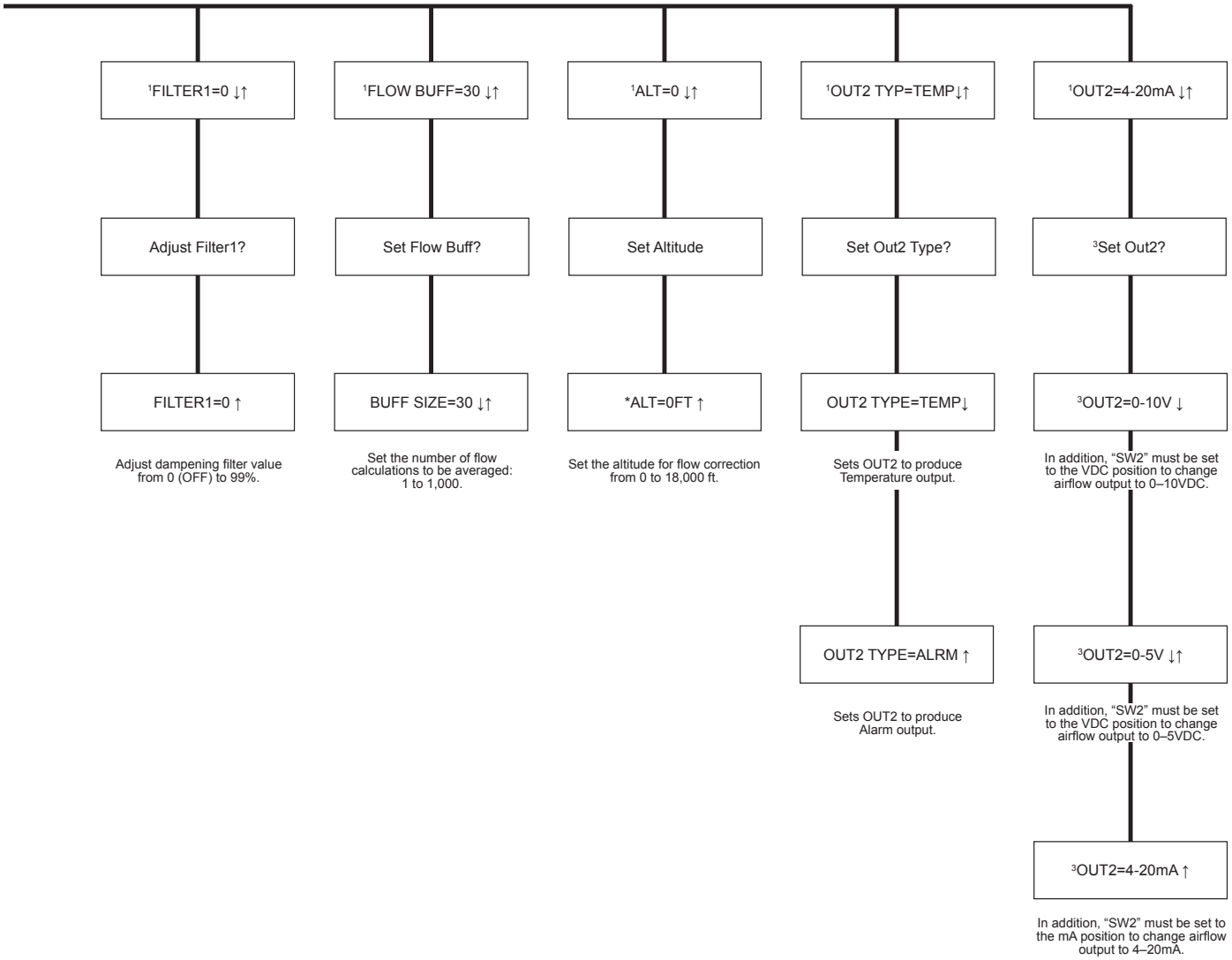
* Factory Default/Current Setting

Figure 103: Optional Outdoor Air Monitor *– Set Up Menu*

Press and release ↑/↓ during normal operation to select



1. Factory default/current setting
2. If a selection is made that requires SW1 to be set, the LCD displays “Set SW1 on Board”.
3. If a selection is made that requires SW2 to be set, the LCD displays “Set SW2 on Board”.



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IM 1058-8 (07/17)

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English
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DAIKIN ROOM AIR CONDITIONER

INSTALLATION MANUAL

R410A Split Series

INVERTER

Installation manual
Manuel d'installation
Manual de instalación

MODELS

FTX09NMVJU	**FTK09NMVJU**
FTX12NMVJU	**FTK12NMVJU**
FTX15NMVJU	**FTK18NMVJU**
FTX18NMVJU	**FTK24NMVJU**
FTX24NMVJU	**FTKN09NMVJU**
FTXN09NMVJU	**FTKN12NMVJU**
FTXN12NMVJU	**FTKN18NMVJU**
FTXN18NMVJU	**FTKN24NMVJU**
FTXN24NMVJU	

Contents

Safety Considerations

Read these **Safety Considerations for Installation** carefully before installing an air conditioner or heat pump. After completing the installation, make sure that the unit operates properly during the startup operation.
Instruct the user on how to operate and maintain the unit.
Inform users that they should store this installation manual with the operation manual for future reference.
Always use a licensed installer or contractor to install this product. Improper installation can result in water or refrigerant leakage, electric shock, fire, or explosion.
Meanings of **DANGER**, **WARNING**, **CAUTION**, and **NOTE** Symbols:

⚠ **DANGER** ..... Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING** ..... Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION** ..... Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

⚠ **NOTE** ..... Indicates situations that may result in equipment or property-damage accidents only.

⚠ DANGER

- Refrigerant gas is heavier than air and replaces oxygen. A massive leak can lead to oxygen depletion, especially in basements, and an asphyxiation hazard could occur leading to serious injury or death.
- Do not ground units to water pipes, gas pipes, telephone wires, or lightning rods as incomplete grounding can cause a severe shock hazard resulting in severe injury or death. Additionally, grounding to gas pipes could cause a gas leak and potential explosion causing severe injury or death.
- If refrigerant gas leaks during installation, ventilate the area immediately. Refrigerant gas may produce toxic gas if it comes into contact with fire. Exposure to this gas could cause severe injury or death.
- After completing the installation work, check that the refrigerant gas does not leak throughout the system.
- Do not install unit in an area where flammable materials are present due to risk of explosions that can cause serious injury or death.
- Safely dispose all packing and transportation materials in accordance with federal/state/local laws or ordinances. Packing materials such as nails and other metal or wood parts, including plastic packing materials used for transportation may cause injuries or death by suffocation.

⚠ WARNING

- Only qualified personnel must carry out the installation work. Installation must be done in accordance with this installation manual. Improper installation may result in water leakage, electric shock, or fire.
- When installing the unit in a small room, take measures to keep the refrigerant concentration from exceeding allowable safety limits. Excessive refrigerant leaks, in the event of an accident in a closed ambient space, can lead to oxygen deficiency.
- Use only specified accessories and parts for installation work. Failure to use specified parts may result in water leakage, electric shock, fire, or the unit falling.
- Install the air conditioner or heat pump on a foundation strong enough that it can withstand the weight of the unit. A foundation of insufficient strength may result in the unit falling and causing injuries.
- Take into account strong winds, typhoons, or earthquakes when installing. Improper installation may result in the unit falling and causing accidents.

- Make sure that a separate power supply circuit is provided for this unit and that all electrical work is carried out by qualified personnel according to local, state, and national regulations. An insufficient power supply capacity or improper electrical construction may lead to electric shock or fire.
- Make sure that all wiring is secured, that specified wires are used, and that no external forces act on the terminal connections or wires. Improper connections or installation may result in fire.
- When wiring, position the wires so that the electrical wiring box cover can be securely fastened. Improper positioning of the electrical wiring box cover may result in electric shock, fire, or the terminals overheating.
- Before touching electrical parts, turn off the unit.
- It is recommended to install a ground fault circuit interrupter if one is not already available. This helps prevent electric shock or fire.
- Securely fasten the outdoor unit terminal cover (panel). If the terminal cover/panel is not installed properly, dust or water may enter the outdoor unit causing fire or electric shock.
- When installing or relocating the system, keep the refrigerant circuit free from substances other than the specified refrigerant (R410A) such as air. Any presence of air or other foreign substance in the refrigerant circuit can cause an abnormal pressure rise or rupture, resulting in injury.
- Do not change the setting of the protection devices. If the pressure switch, thermal switch, or other protection device is shorted and operated forcibly, or parts other than those specified by Daikin are used, fire or explosion may occur.

⚠ CAUTION

- Do not touch the switch with wet fingers. Touching a switch with wet fingers can cause electric shock.
- Do not allow children to play on or around the unit to prevent injury.
- The heat exchanger fins are sharp enough to cut. To avoid injury wear gloves or cover the fins while working around them.
- Do not touch the refrigerant pipes during and immediately after operation as the refrigerant pipes may be hot or cold, depending on the condition of the refrigerant flowing through the refrigerant piping, compressor, and other refrigerant cycle parts. Your hands may suffer burns or frostbite if you touch the refrigerant pipes. To avoid injury, give the pipes time to return to normal temperature or, if you must touch them, be sure to wear proper gloves.
- Install drain piping to proper drainage. Improper drain piping may result in water leakage and property damage.
- Insulate piping to prevent condensation.
- Be careful when transporting the product.
- Do not turn off the power immediately after stopping operation. Always wait for at least 5 minutes before turning off the power. Otherwise, water leakage may occur.
- Do not use a charging cylinder. Using a charging cylinder may cause the refrigerant to deteriorate.
- Refrigerant R410A in the system must be kept clean, dry, and tight.

  (a) Clean and Dry -- Foreign materials (including mineral oils such as SUNISO oil or moisture) should be prevented from getting into the system.

  (b) Tight -- R410A does not contain any chlorine, does not destroy the ozone layer, and does not reduce the earth's protection again harmful ultraviolet radiation. R410A can contribute to the greenhouse effect if it is released. Therefore take proper measures to check for the tightness of the refrigerant piping installation. Read the chapter *Refrigerant Piping Work* and follow the procedures.
- Since R410A is a blend, the required additional refrigerant must be charged in its liquid state. If the refrigerant is charged in a state of gas, its composition can change and the system will not work properly.
- The indoor unit is for R410A. See the catalog for indoor models that can be connected. Normal operation is not possible when connected to other units.
- Remote controller (wireless kit) transmitting distance can be shorter than expected in rooms with electronic fluorescent lamps (inverter or rapid start types). Install the indoor unit far away from fluorescent lamps as much as possible.
- Indoor units are for indoor installation only. Outdoor units can be installed either outdoors or indoors. This unit is for indoor use.
- Do not install the air conditioner or heat pump in the following locations:
  (a) Where a mineral oil mist or oil spray or vapor is produced, for example, in a kitchen.
  Plastic parts may deteriorate and fall off or result in water leakage.
  (b) Where corrosive gas, such as sulfurous acid gas, is produced.
  Corroding copper pipes or soldered parts may result in refrigerant leakage.
  (c) Near machinery emitting electromagnetic waves.
  Electromagnetic waves may disturb the operation of the control system and cause the unit to malfunction.
  (d) Where flammable gas may leak, where there is carbon fiber, or ignitable dust suspension in the air, or where volatile flammables such as thinner or gasoline are handled. Operating the unit in such conditions can cause a fire.
- Take adequate measures to prevent the outdoor unit from being used as a shelter by small animals. Small animals making contact with electrical parts can cause malfunctions, smoke, or fire. Instruct the user to keep the area around the unit clean.

⚠ NOTE

- Install the power supply and inter-unit wires for the indoor and outdoor units at least 3.5ft away from televisions or radios to prevent image interference or noise. Depending on the radio waves, a distance of 3.5ft may not be sufficient to eliminate the noise.
- Dismantling the unit, treatment of the refrigerant, oil and additional parts must be done in accordance with the relevant local, state, and national regulations.
- Do not use the following tools that are used with conventional refrigerants: gauge manifold, charge hose, gas leak detector, reverse flow check valve, refrigerant charge base, vacuum gauge, or refrigerant recovery equipment.
- If the conventional refrigerant and refrigerator oil are mixed in R410A, the refrigerant may deteriorate.
- This air conditioner or heat pump is an appliance that should not be accessible to the general public.
- As design pressure is 478 psi, the wall thickness of field-installed pipes should be selected in accordance with the relevant local, state, and national regulations.

Accessories

Ⓐ Mounting plate	1	Ⓑ Mounting plate fixing screw 3/16” × 1” (M4 × 25mm)	7	Ⓒ Titanium apatite photocatalytic air-purifying filter *1*2	2
Ⓓ Wireless remote controller	1	Ⓔ Remote controller holder	1	Ⓕ Fixing screw for remote controller holder 1/8” × 13/16” (M3 × 20mm)	2
Ⓖ Dry battery AAA. LR03(alkaline)	2	Ⓗ Indoor unit fixing screw 3/16” × 1/2” (M4 × 12mm)	2	Ⓙ Insulation tape	1
Ⓚ Operation manual	1	Ⓛ Installation manual	1	Ⓜ Warranty	1

*1 Only for FTX(K)09/12/15/18/24∗
*2 09/12 class: without frame
15/18/24 class: with frame

Choosing an Installation Site

Before choosing the installation site, obtain user approval.

1. Indoor unit

The indoor unit should be positioned in a place where:

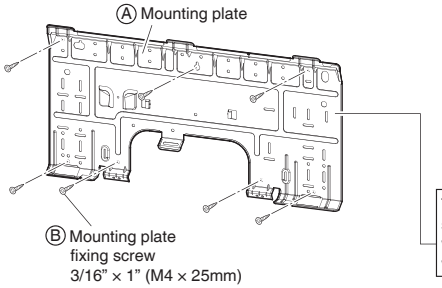
1) the restrictions on the installation requirements specified in **“Indoor Unit Installation Diagram”** on page 4 are met,
2) both the air inlet and air outlet are unobstructed,
3) the unit is not exposed to direct sunlight,
4) the unit is away from sources of heat or steam,
5) there is no source of machine oil vapour (this may shorten the indoor unit service life),
6) cool/warm air is circulated throughout the room,
7) the unit is away from electronic ignition type fluorescent lamps (inverter or rapid start type) as they may affect the remote controller range,
8) the unit is at least 3.3ft (1m) away from any television or radio set (the unit may cause interference with the picture or sound),
9) no laundry equipment is nearby.

2. Wireless remote controller

Turn on all the fluorescent lamps in the room, if any, and find a location where the remote controller signals are properly received by the indoor unit (within 23ft (7m)).

English

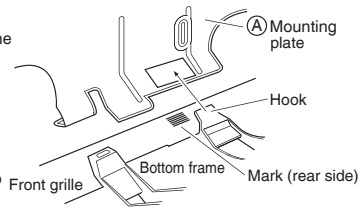
Indoor Unit Installation Diagram

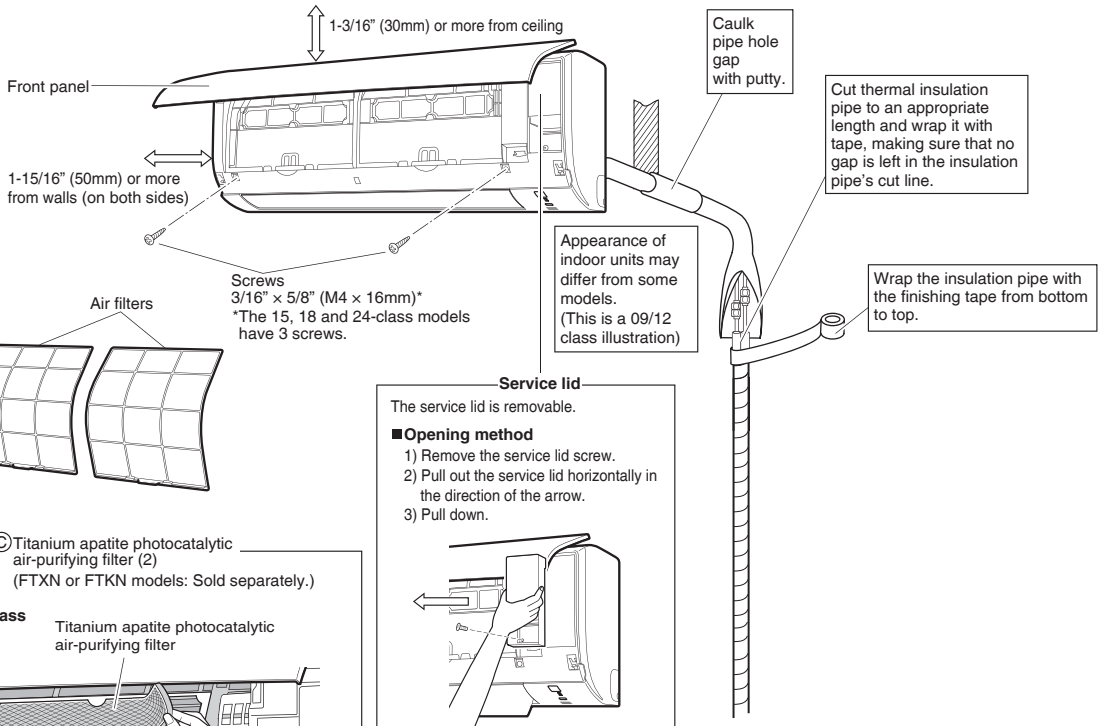


The Ⓐ mounting plate should be installed on a wall which can support the weight of the indoor unit.

■ **How to attach the indoor unit**
Hook the hooks of the bottom frame to the Ⓐ mounting plate.
If the hooks are difficult to hook, remove the front grille.

■ **How to remove the indoor unit**
Push up the marked area (at the lower part of the front grille) to release the hooks. If it is difficult to release, remove the front grille.





Appearance of indoor units may differ from some models. (This is a 09/12 class illustration)

Service lid

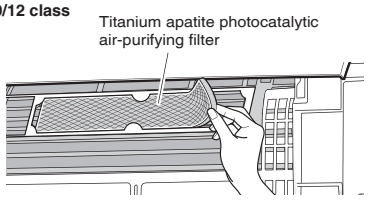
The service lid is removable.

■ **Opening method**

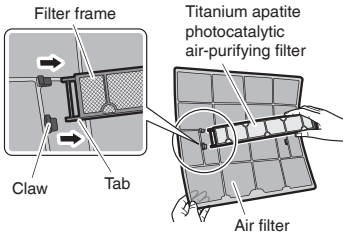
1) Remove the service lid screw.
2) Pull out the service lid horizontally in the direction of the arrow.
3) Pull down.

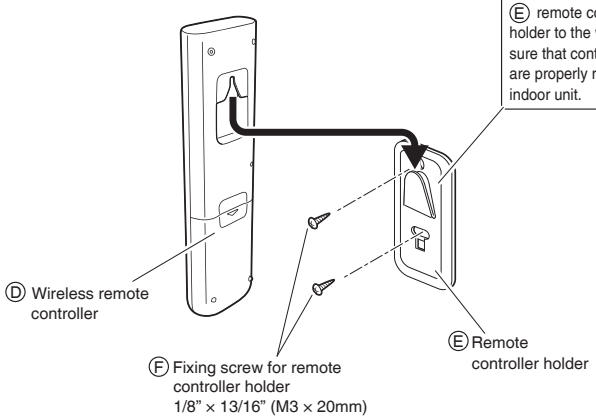
Ⓒ Titanium apatite photocatalytic air-purifying filter (2)
(FTXN or FTKN models: Sold separately.)

09/12 class



15/18/24 class





Before screwing the Ⓔ remote controller holder to the wall, make sure that control signals are properly received by indoor unit.

Indoor Unit Installation

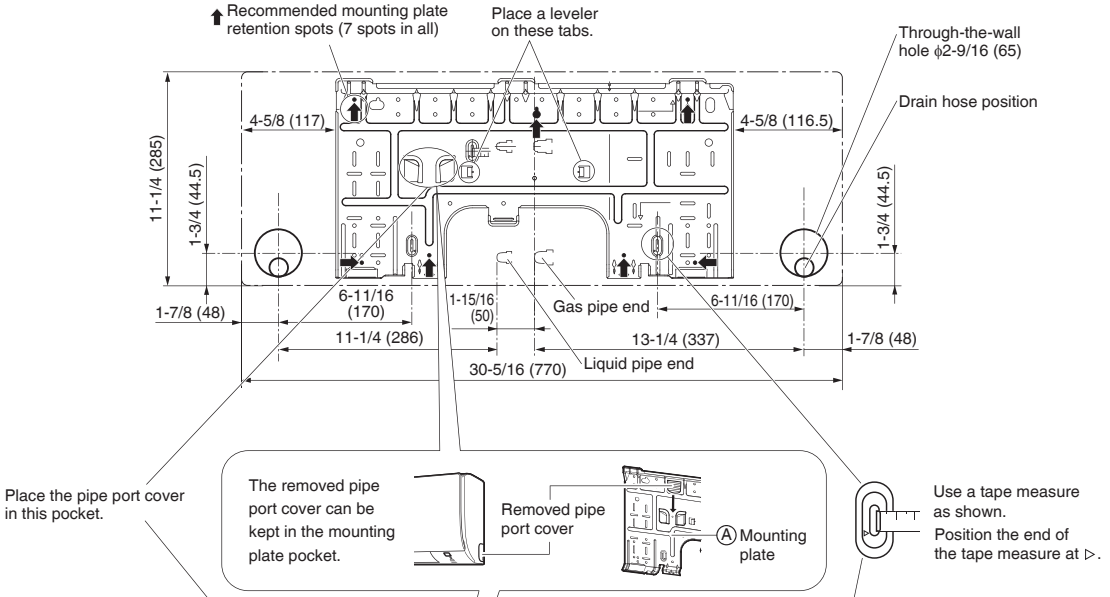
1. Installing the mounting plate

- The mounting plate should be installed on a wall which can support the weight of the indoor unit.

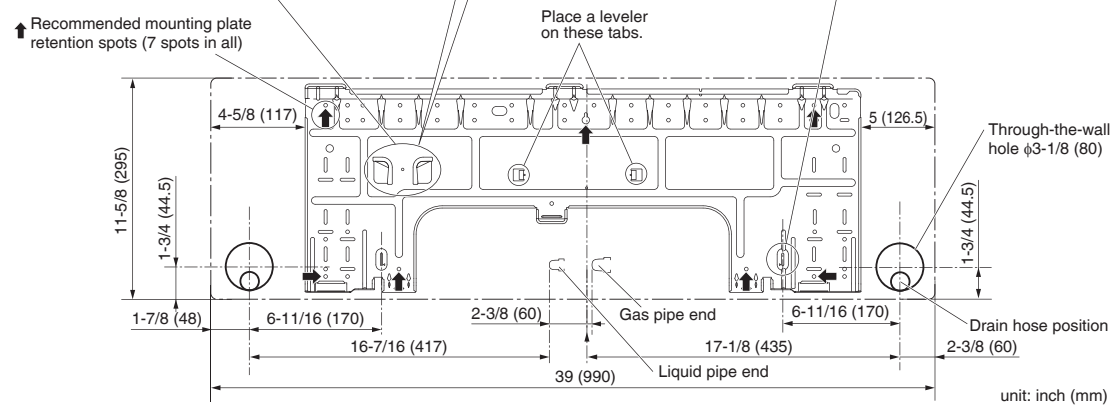
1) Temporarily secure the mounting plate to the wall, make sure that the panel is completely level, and mark the drilling points on the wall.
2) Secure the mounting plate to the wall with screws.

Recommended mounting plate retention spots and dimensions

09/12 class



15/18/24 class



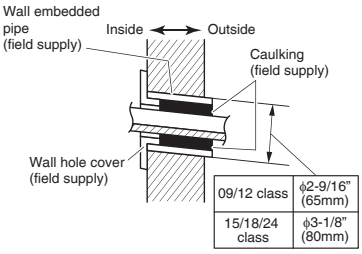
English

2. Drilling a wall hole and installing wall embedded pipe

⚠WARNING

For metal frame or metal board walls, be sure to use a wall embedded pipe and wall hole cover in the feed-through hole to prevent possible heat, electric shock, or fire.

- Be sure to caulk the gaps around the pipes with caulking material to prevent condensation.
  1) Drill a feed-through hole with a ϕ2-9/16 inch (65mm) (for 09/12 class), ϕ3-1/8 inch (80mm) (for 15/18/24 class) diameter through the wall at a downward angle toward the outside.
  2) Insert a wall embedded pipe into the hole.
  3) Insert a wall hole cover into wall pipe.
  4) After completing refrigerant piping, wiring, and drain piping, caulk the pipe hole gap with putty.



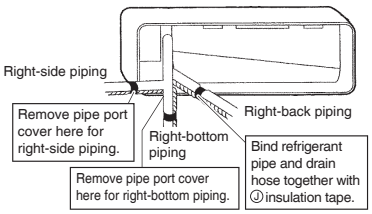
3. Installing the indoor unit

In the case of bending or curing refrigerant pipes, keep the following precautions in mind.
Abnormal sound may be generated if improper work is conducted.

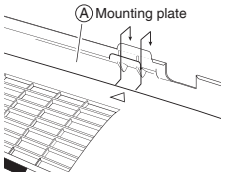
- Do not strongly press the refrigerant pipes onto the bottom frame.
- Do not strongly press the refrigerant pipes on the front grille, either.

3-1. Right-side, right-back, or right-bottom piping

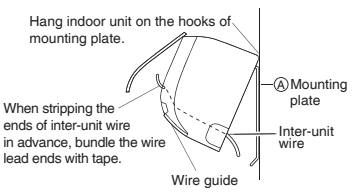
1) Attach the drain hose to the underside of the refrigerant pipes with adhesive vinyl tape.
2) Wrap the refrigerant pipes and drain hose together with Ⓙ insulation tape.



3) Pass the drain hose and refrigerant pipes through the wall hole, then set the indoor unit on the Ⓐ mounting plate hooks by using the △ markings at the top of the indoor unit as a guide.



4) Open the front panel (Refer to "**Installation Tips**"on page 10), then open the service lid (Refer to "**Indoor Unit Installation Diagram**"on page 4).
5) Pass the inter-unit wire from the outdoor unit through the feed-through wall hole and pass to the front of indoor unit from the back. Then pull them at front side. Bend the ends of cable tie wires upward for easier work in advance.
6) Press the bottom frame of the indoor unit with both hands to set it on the Ⓐ mounting plate hooks. Make sure the wire leads do not catch on the edge of the indoor unit.



Indoor Unit Installation

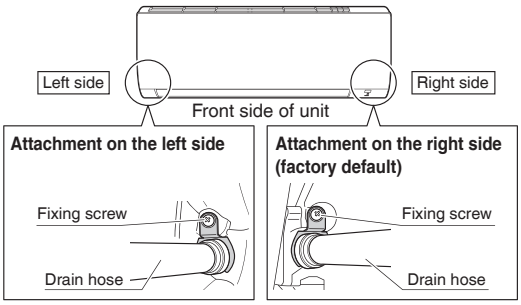
3-2. Left-side, left-back, or left-bottom piping

How to replace the drain plug and drain hose

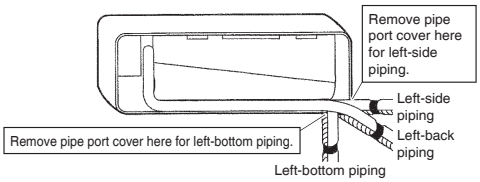
- **Replacing onto the left side**
  1) Remove the fixing screw of drain hose on the right and remove the drain hose.
  2) Remove the drain plug on the left side and attach it to the right side.
  3) Insert the drain hose and tighten with the included fixing screw.
     Forgetting to tighten this may cause water leakages.

Drain hose attachment position

The drain hose is on the back of the unit.

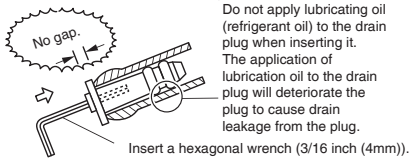


1) Attach the drain hose to the underside of the refrigerant pipes with adhesive vinyl tape.

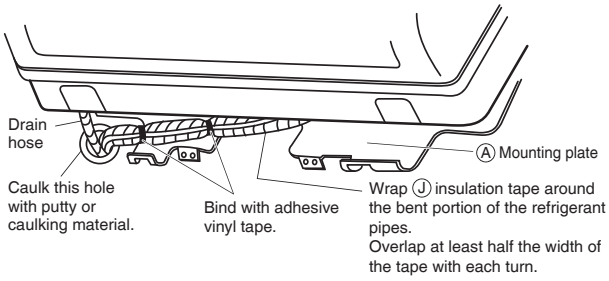


2) Be sure to connect the drain plug to the drain port in place of without drain hose.

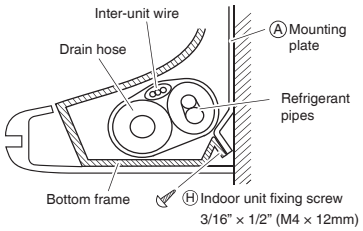
How to set the drain plug.



3) Shape the refrigerant pipes along the pipe path marking on the Ⓐ mounting plate.
4) Pass the drain hose and refrigerant pipes through the wall hole, then position the indoor unit on the Ⓐ mounting plate hooks, using the △ markings at the top of the indoor unit as a guide.
5) Pull in the inter-unit wire.
6) Connect the refrigerant pipes.



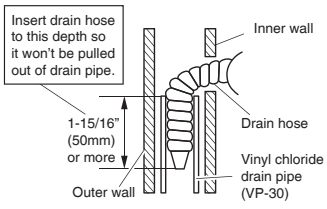
7) In case of pulling the drain hose through the back of the indoor unit, wrap the refrigerant pipes and drain hose together with Ⓙ insulation tape as shown in the right figure.
8) To confirm that the inter-unit wire does not catch by the indoor unit, press the bottom edge of the indoor unit with both hands until it is firmly caught by the Ⓐ mounting plate hooks. Secure the indoor unit to the Ⓐ mounting plate with the Ⓗ indoor unit fixing screws 3/16" × 1/2" (M4 × 12mm).



3-3. Wall embedded piping

Follow the instructions given under left-side, left-back, or left-bottom piping.

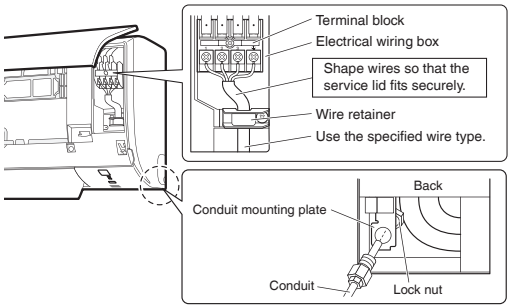
1) Insert the drain hose to this depth so it won't be pulled out of the drain pipe.

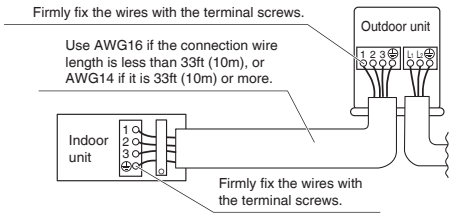


English

4. Wiring

1) As shown in the illustration, insert the wires including the ground wire into the conduit and secure them with lock nut onto the conduit mounting plate.
2) Strip wire ends (3/4 inch (20mm)).
3) Match wire colours with terminal numbers on the terminal block of indoor and outdoor unit and firmly secure the wires in the corresponding terminals with screws.
4) Connect the ground wire to the corresponding terminals.
5) Pull the wires lightly to make sure they are securely connected.
6) While close the service lid, shape the wires so that the service lid fits securely, then close the service lid.



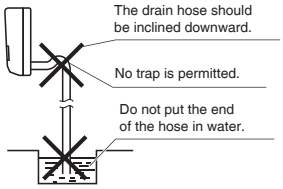


⚠WARNING

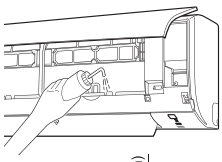
- Do not use tapped wires, extension cords, or starburst connections, as they may cause overheating, electric shock, or fire.
- Do not use locally purchased electrical parts inside the product. (Do not branch the power for the drain pump, etc., from the terminal block.) Doing so may cause electric shock or fire.
- Do not connect the power wire to the indoor unit. Doing so may cause electric shock or fire.

5. Drain piping

1) Connect the drain hose, as described on the right.



2) Remove the air filters and pour some water into the drain pan to check the water flows smoothly.



3) If drain hose extension or embedded drain piping is required, use appropriate parts that match the hose front end.

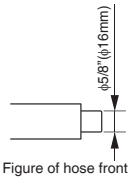
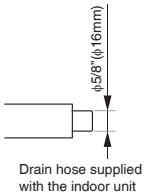
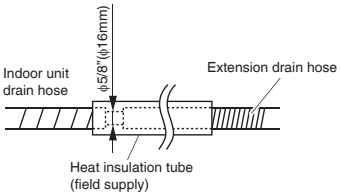


Figure of hose front end

4) When extending the drain hose, use a commercially available extension hose with an inner diameter of 5/8 inch (16mm). Be sure to thermally insulate the indoor section of the extension hose.

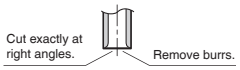




Refrigerant Piping Work

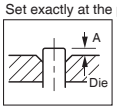
1. Flaring the pipe end

1) Cut the pipe end with a pipe cutter.
2) Remove burrs with the cut surface facing downward, so that the filings do not enter the pipe.
3) Put the flare nut on the pipe.
4) Flare the pipe.
5) Check that the flaring has been done correctly.

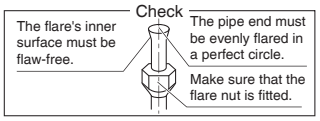


Flaring

Set exactly at the position shown below.



	Flare tool for R410A	Conventional flare tool	
	Clutch-type	Clutch-type (Rigid-type)	Wing-nut type (Imperial-type)
A	0-0.020 inch (0-0.5mm)	0.039-0.059 inch (1.0-1.5mm)	0.059-0.079 inch (1.5-2.0mm)



⚠WARNING

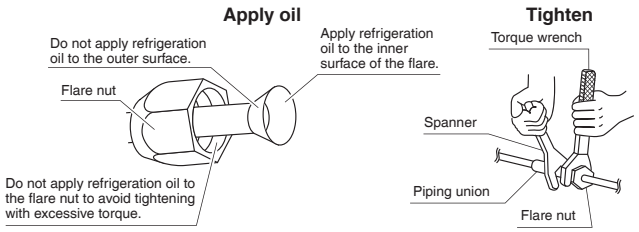
- Do not apply mineral oil to the flare.
- Prevent mineral oil from getting into the system as this would reduce the service life of the units.
- Never use piping which has been used for previous installations. Only use parts which are delivered with this unit.
- Never install a dryer to this R410A unit in order to guarantee its service life.
- The drying material may dissolve and damage the system.
- Incomplete flaring may result in refrigerant gas leakage.

2. Refrigerant piping

⚠CAUTION

- Use the flare nut fixed to the main unit. (This is to prevent the flare nut from cracking as a result of deterioration over time.)
- To prevent gas leakage, apply refrigeration oil only to the inner surface of the flare. (Use refrigeration oil for R410A.)
- Use a torque wrench when tightening the flare nuts to prevent damage to the flare nuts and gas leakage.

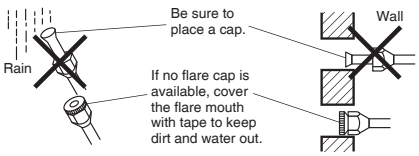
- Align the centers of both flares and tighten the flare nuts 3 or 4 turns by hand, then tighten them fully with a spanner and a torque wrench.



	Piping size	Flare nut tightening torque
Gas side	O.D. 3/8 inch (9.5mm)	24-1/8 – 29-1/2ft • lbf (32.7-39.9N • m)
	O.D. 1/2 inch (12.7mm)	36-1/2 – 44-1/2ft • lbf (49.5-60.3N • m)
	O.D. 5/8 inch (15.9mm)	45-5/8 – 55-5/8ft • lbf (61.8-75.4N • m)
Liquid side	O.D. 1/4 inch (6.4mm)	10-1/2 – 12-3/4ft • lbf (14.2-17.2 N • m)

2-1. Caution on piping handling

- Protect the open end of the pipe against dust and moisture.
- All pipe bends should be as gentle as possible. Use a pipe bender for bending.

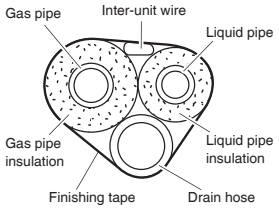


English

2-2. Selection of copper and heat insulation materials

When using commercial copper pipes and fittings, observe the following:

- Insulation material: Polyethylene foam
  Heat transfer rate: 0.041 to 0.052W/mK (0.024 to 0.030Btu/fth°F (0.035 to 0.045kcal/mh°C))
  Be sure to use insulation that is designed for use with HVAC Systems.
- ACR Copper only.



- Be sure to insulate both the gas and liquid piping and observe the insulation dimensions as below.

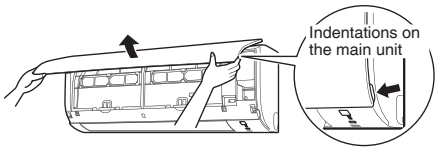
	Piping size	Minimum bend radius	Piping thickness	Thermal insulation size	Thermal insulation thickness
Gas side	O.D. 3/8 inch (9.5mm)	1-3/16 inch (30mm) or more	0.031 inch (0.8mm) (C1220T-O)	I.D. 15/32-19/32 inch (12-15mm)	13/32 inch (10mm) Min.
	O.D. 1/2 inch (12.7mm)	1-9/16 inch (40mm) or more		I.D. 9/16-5/8 inch (14-16mm)	
	O.D. 5/8 inch (15.9mm)	1-15/16 inch (50mm) or more	0.039 inch (1.0mm) (C1220T-O)	I.D. 5/8-13/16 inch (16-20mm)	
Liquid side	O.D. 1/4 inch (6.4mm)	1-3/16 inch (30mm) or more	0.031 inch (0.8mm) (C1220T-O)	I.D. 5/16-13/32 inch (8-10mm)	

- Use separate thermal insulation pipes for gas and liquid refrigerant pipes.

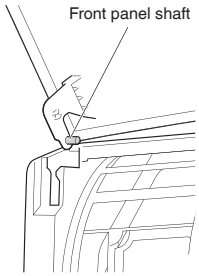
Installation Tips

1. Removing and installing the front panel

- **Removal method**
  1) Place your fingers in the indentations on the main unit (one each on the left and right sides), and open the front panel until it stops.



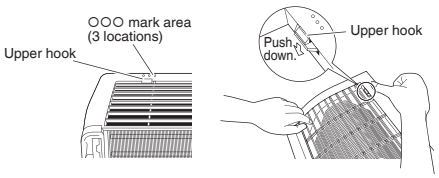
  2) While pushing the left side front panel shaft outward, push up the front panel and remove it. (Remove the right side front panel shaft in the same manner.)
  3) After removing both front panel shafts, pull the front panel toward yourself and remove it.



- **Installation method**
  Align the shaft of the front panel with the grooves of grill, and push all the way in, then close slowly. Push the center of the lower panel surface firmly to engage the hooks.

2. Removing and installing the front grille

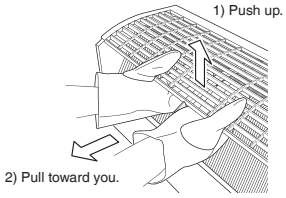
- **Removal method**
  1) Remove the front panel to remove the air filter.
  2) Remove the 2 screws from the front grille.
     (The 15, 18 and 24-class models have 3 screws.)
  3) In front of the ○○○ mark on the front grille, there are 3 upper hooks. Lightly pull the front grille toward you with one hand, and push down on the hooks with the fingers of your other hand.



When there is insufficient work space because the unit is close to ceiling

⚠CAUTION
- Be sure to wear protection gloves.

Place both hands under the center of the front grille, and while pushing up, pull it toward you.

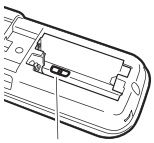


- **Installation method**
  1) Install the front grille and firmly engage the upper hooks (3 locations).
  2) Install 2 screws of the front grille.
     (The 15, 18 and 24-class models have 3 screws.)
  3) Install the air filter and then mount the front panel.

3. How to set the different addresses

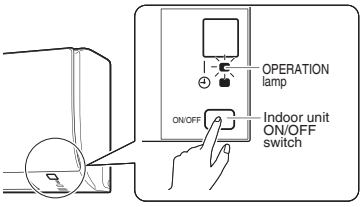
When 2 indoor units are installed in one room, the 2 wireless remote controllers can be set for different addresses. Change the address setting of one of the two units. When cutting the jumper be careful not to damage any of the surrounding parts.

1) Remove the battery cover on the remote controller and cut the address jumper.
2) Press TEMP °F/°C , TEMP °F/°C and OFF at the same time.
3) Press TEMP °F/°C , then select R , press FAN .
   (The indoor unit OPERATION lamp will blink for about 1 minute.)
4) Press the indoor unit ON/OFF switch while the OPERATION lamp is blinking.



Jumper	ADDRESS
EXIST	1
CUT	2

- If setting could not be carried out completely while the OPERATION lamp was blinking, carry out the setting process once again from the beginning.
- After setting is complete, pressing FAN for about 5 seconds will cause the remote controller to return to the previous display.



English

Trial Operation and Testing

1. Trial operation and testing

- Trial operation should be carried out in either COOL or HEAT operation.

1-1. Measure the supply voltage and make sure that it is within the specified range.

1-2. In COOL operation, select the lowest programmable temperature; in HEAT operation, select the highest programmable temperature.

1-3. Carry out the trial operation following the instructions in the operation manual to ensure that all functions and parts, such as the movement of the flap, are working properly.

- To protect the air conditioner, restart operation is disabled for 3 minutes after the system has been turned off.

1-4. After trial operation is complete, set the temperature to a normal level (78°F to 82°F (26°C to 28°C) in COOL operation, 68°F to 75°F (20°C to 24°C) in HEAT operation).

- When operating the air conditioner in COOL operation in winter, or HEAT operation in summer, set it to the trial operation mode using the following method.
  1) Press TEMP °F/°C , TEMP °F/°C and OFF at the same time.
  2) Press TEMP °F/°C , then select , press FAN .
  3) Press COOL or HEAT to turn on the system.
  - Trial operation will stop automatically after about 30 minutes. To stop the operation, press OFF .
  - Some of the functions cannot be used in the trial operation mode.

HEAT PUMP model

COOLING ONLY model

- The air conditioner draws a small amount of power in its standby mode. If the system is not to be used for some time after installation, shut off the circuit breaker to eliminate unnecessary power consumption.
- If the circuit breaker trips to shut off the power to the air conditioner, the system will restore the original operation mode when the circuit breaker is opened again.

2. Test items

Test items	Symptom	Check
Indoor and outdoor units are installed properly on solid bases.	Fall, vibration, noise	
No refrigerant gas leaks.	Incomplete cooling/heating function	
Refrigerant gas and liquid pipes and indoor drain hose extension are thermally insulated.	Water leakage	
Draining line is properly installed.	Water leakage	
System is properly grounded.	Electrical leakage	
The specified wires are used for inter-unit wiring.	No operation or burn damage	
Indoor or outdoor unit's air inlet or air outlet are unobstructed.	Incomplete cooling/heating function	
Stop valves are opened.	Incomplete cooling/heating function	
Indoor unit properly receives remote control commands.	No operation	

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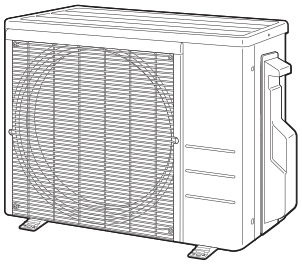
C ETL CM LISTED US
Intertek

Two-dimensional bar code
is a manufacturing code.

3P379970-5B M15B134 (1510) HT

DAIKIN



English

Français

Español

DAIKIN ROOM AIR CONDITIONER

INSTALLATION MANUAL

R410A Split Series

INVERTER

Installation manual
Manuel d'installation
Manual de instalación

MODELS

RX09NMVJU	**RK09NMVJU**	**RXL09QMVJU**
RX12NMVJU	**RK12NMVJU**	**RXL12QMVJU**
RX18NMVJU	**RK18NMVJU**	**RXL15QMVJU**
RX24NMVJU	**RK24NMVJU**	
RXN09NMVJU	**RKN09NMVJU**	
RXN12NMVJU	**RKN12NMVJU**	
RXN18NMVJU	**RKN18NMVJU**	
RXN24NMVJU	**RKN24NMVJU**	

Contents

Safety Considerations

Read these **Safety Considerations for Installation** carefully before installing an air conditioner or heat pump. After completing the installation, make sure that the unit operates properly during the startup operation.
Instruct the user on how to operate and maintain the unit.
Inform users that they should store this installation manual with the operation manual for future reference.
Always use a licensed installer or contractor to install this product. Improper installation can result in water or refrigerant leakage, electric shock, fire, or explosion.
Meanings of **DANGER**, **WARNING**, **CAUTION**, and **NOTE** Symbols:

⚠ **DANGER** ····· Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING** ····· Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION** ····· Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

⚠ **NOTE** ····· Indicates situations that may result in equipment or property-damage accidents only.

⚠ DANGER

- Refrigerant gas is heavier than air and replaces oxygen. A massive leak can lead to oxygen depletion, especially in basements, and an asphyxiation hazard could occur leading to serious injury or death.
- Do not ground units to water pipes, gas pipes, telephone wires, or lightning rods as incomplete grounding can cause a severe shock hazard resulting in severe injury or death. Additionally, grounding to gas pipes could cause a gas leak and potential explosion causing severe injury or death.
- If refrigerant gas leaks during installation, ventilate the area immediately. Refrigerant gas may produce toxic gas if it comes into contact with fire. Exposure to this gas could cause severe injury or death.
- After completing the installation work, check that the refrigerant gas does not leak throughout the system.
- Do not install unit in an area where flammable materials are present due to risk of explosions that can cause serious injury or death.
- Safely dispose all packing and transportation materials in accordance with federal/state/local laws or ordinances. Packing materials such as nails and other metal or wood parts, including plastic packing materials used for transportation may cause injuries or death by suffocation.

⚠ WARNING

- Only qualified personnel must carry out the installation work. Installation must be done in accordance with this installation manual. Improper installation may result in water leakage, electric shock, or fire.
- When installing the unit in a small room, take measures to keep the refrigerant concentration from exceeding allowable safety limits. Excessive refrigerant leaks, in the event of an accident in a closed ambient space, can lead to oxygen deficiency.
- Use only specified accessories and parts for installation work. Failure to use specified parts may result in water leakage, electric shock, fire, or the unit falling.
- Install the air conditioner or heat pump on a foundation strong enough that it can withstand the weight of the unit. A foundation of insufficient strength may result in the unit falling and causing injuries.
- Take into account strong winds, typhoons, or earthquakes when installing. Improper installation may result in the unit falling and causing accidents.

- Make sure that a separate power supply circuit is provided for this unit and that all electrical work is carried out by qualified personnel according to local, state, and national regulations. An insufficient power supply capacity or improper electrical construction may lead to electric shock or fire.
- Make sure that all wiring is secured, that specified wires are used, and that no external forces act on the terminal connections or wires. Improper connections or installation may result in fire.
- When wiring, position the wires so that the electrical wiring box cover can be securely fastened. Improper positioning of the electrical wiring box cover may result in electric shock, fire, or the terminals overheating.
- Before touching electrical parts, turn off the unit.
- It is recommended to install a ground fault circuit interrupter if one is not already available. This helps prevent electric shock or fire.
- Securely fasten the outdoor unit terminal cover (panel). If the terminal cover/panel is not installed properly, dust or water may enter the outdoor unit causing fire or electric shock.
- When installing or relocating the system, keep the refrigerant circuit free from substances other than the specified refrigerant (R410A) such as air. Any presence of air or other foreign substance in the refrigerant circuit can cause an abnormal pressure rise or rupture, resulting in injury.
- Do not change the setting of the protection devices. If the pressure switch, thermal switch, or other protection device is shorted and operated forcibly, or parts other than those specified by Daikin are used, fire or explosion may occur.

⚠ CAUTION

- Do not touch the switch with wet fingers. Touching a switch with wet fingers can cause electric shock.
- Do not allow children to play on or around the unit to prevent injury.
- The heat exchanger fins are sharp enough to cut. To avoid injury wear gloves or cover the fins while working around them.
- Do not touch the refrigerant pipes during and immediately after operation as the refrigerant pipes may be hot or cold, depending on the condition of the refrigerant flowing through the refrigerant piping, compressor, and other refrigerant cycle parts. Your hands may suffer burns or frostbite if you touch the refrigerant pipes. To avoid injury, give the pipes time to return to normal temperature or, if you must touch them, be sure to wear proper gloves.
- Install drain piping to proper drainage. Improper drain piping may result in water leakage and property damage.
- Insulate piping to prevent condensation.
- Be careful when transporting the product.
- Do not turn off the power immediately after stopping operation. Always wait for at least 5 minutes before turning off the power. Otherwise, water leakage may occur.
- Do not use a charging cylinder. Using a charging cylinder may cause the refrigerant to deteriorate.
- Refrigerant R410A in the system must be kept clean, dry, and tight.

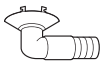
  (a) Clean and Dry -- Foreign materials (including mineral oils such as SUNISO oil or moisture) should be prevented from getting into the system.

  (b) Tight -- R410A does not contain any chlorine, does not destroy the ozone layer, and does not reduce the earth's protection again harmful ultraviolet radiation. R410A can contribute to the greenhouse effect if it is released. Therefore take proper measures to check for the tightness of the refrigerant piping installation. Read the chapter *Refrigerant Piping Work* and follow the procedures.
- Since R410A is a blend, the required additional refrigerant must be charged in its liquid state. If the refrigerant is charged in a state of gas, its composition can change and the system will not work properly.
- The indoor unit is for R410A. See the catalog for indoor models that can be connected. Normal operation is not possible when connected to other units.
- Remote controller (wireless kit) transmitting distance can be shorter than expected in rooms with electronic fluorescent lamps (inverter or rapid start types). Install the indoor unit far away from fluorescent lamps as much as possible.
- Indoor units are for indoor installation only. Outdoor units can be installed either outdoors or indoors. This unit is for indoor use.
- Do not install the air conditioner or heat pump in the following locations:
  (a) Where a mineral oil mist or oil spray or vapor is produced, for example, in a kitchen.
  Plastic parts may deteriorate and fall off or result in water leakage.
  (b) Where corrosive gas, such as sulfurous acid gas, is produced.
  Corroding copper pipes or soldered parts may result in refrigerant leakage.
  (c) Near machinery emitting electromagnetic waves.
  Electromagnetic waves may disturb the operation of the control system and cause the unit to malfunction.
  (d) Where flammable gas may leak, where there is carbon fiber, or ignitable dust suspension in the air, or where volatile flammables such as thinner or gasoline are handled. Operating the unit in such conditions can cause a fire.
- Take adequate measures to prevent the outdoor unit from being used as a shelter by small animals. Small animals making contact with electrical parts can cause malfunctions, smoke, or fire. Instruct the user to keep the area around the unit clean.

⚠ NOTE

- Install the power supply and inter-unit wires for the indoor and outdoor units at least 3.5ft away from televisions or radios to prevent image interference or noise. Depending on the radio waves, a distance of 3.5ft may not be sufficient to eliminate the noise.
- Dismantling the unit, treatment of the refrigerant, oil and additional parts must be done in accordance with the relevant local, state, and national regulations.
- Do not use the following tools that are used with conventional refrigerants: gauge manifold, charge hose, gas leak detector, reverse flow check valve, refrigerant charge base, vacuum gauge, or refrigerant recovery equipment.
- If the conventional refrigerant and refrigerator oil are mixed in R410A, the refrigerant may deteriorate.
- This air conditioner or heat pump is an appliance that should not be accessible to the general public.
- As design pressure is 478 psi, the wall thickness of field-installed pipes should be selected in accordance with the relevant local, state, and national regulations.

Accessories

Ⓐ Installation manual		1	Ⓑ Drain socket*  This is at the bottom of the packaging.		1
Ⓒ Drain cap (1)* 	09/12 class	4	Ⓓ Drain cap (2)* 	09/12 class	2
	15/18/24 class	6		15/18/24 class	3
Ⓔ Warranty		1			

*Only for heat pump models.

Precautions for Selecting a Location

1) Choose a place solid enough to bear the weight and vibration of the unit, where the operating sound will not be amplified.
2) Choose a location where the hot air discharged from the unit or the operating sound will not cause a nuisance to the neighbors of the user.
3) Avoid locations, such as near bedrooms, where the operating sound may cause disturbance.
4) There must be sufficient space to carry the unit into and out of the site.
5) There must be sufficient space for air passage and no obstructions around the air inlet and the air outlet.
6) The site must not be prone to flammable gas leaks in the surrounding area.
7) Install units, power cords and inter-unit wire at least 10ft (3m) away from television and radio sets. (This is to prevent interference to images and sounds. Noise may be produced even if they are more than 10ft (3m) away depending on radio wave conditions.)
8) In coastal areas or other places with a salty atmosphere or one containing sulfate gas, corrosion may shorten the life of the air conditioner.
9) Since water will flow from the drain of the outdoor unit, do not place under the unit anything which must be kept away from moisture.

NOTE
Cannot be installed suspended from a ceiling or stacked.

⚠ CAUTION

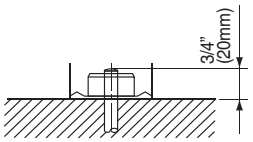
When operating the air conditioner in a low outdoor ambient temperature, be sure to follow the instructions described below.

- To prevent exposure to wind, install the outdoor unit with its suction side facing the wall.
- Never install the outdoor unit at a site where the suction side may be exposed directly to wind.
- To prevent exposure to wind, it is recommended to install a baffle plate on the air discharge side of the outdoor unit.
- In heavy snow areas, select an installation site where the snow will not affect the unit.
- If there is a likelihood of snow accumulating on the outdoor unit, attach a snow protection hood.
- In high humidity areas or heavy snow areas, it is recommended to attach a drain pan heater to prevent ice build-up from the bottom frame.

English

Precautions on Installation

- Check the strength and level of the installation surface so that the unit does not cause any operating vibrations or noise after installation.
- Fix the unit in place securely using foundation bolts, as in the figure. (Prepare 4 sets of 5/16 inch (M8) or 3/8 inch (M10) foundation bolts, nuts and washers; all separately available.)
- It is best to screw in the foundation bolts until their ends are 3/4 inch (20mm) from the foundation surface.

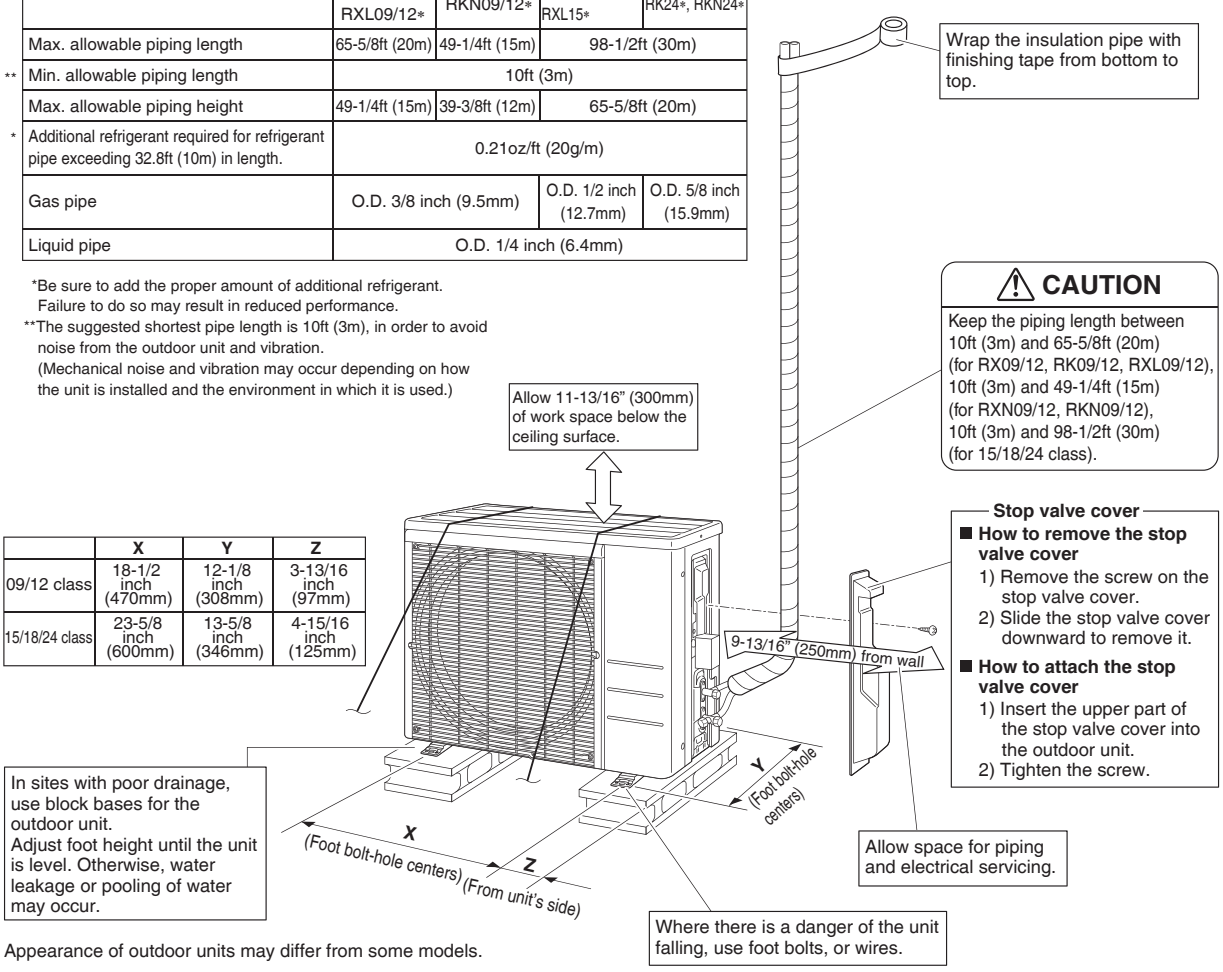


Outdoor Unit Installation Diagram

		RX09/12* RK09/12* RXL09/12*	RXN09/12* RKN09/12*	RX18*, RXN18* RK18*, RKN18* RXL15*	RX24*, RXN24* RK24*, RKN24*
	Max. allowable piping length	65-5/8ft (20m)	49-1/4ft (15m)	98-1/2ft (30m)	
**	Min. allowable piping length	10ft (3m)			
	Max. allowable piping height	49-1/4ft (15m)	39-3/8ft (12m)	65-5/8ft (20m)	
*	Additional refrigerant required for refrigerant pipe exceeding 32.8ft (10m) in length.	0.21oz/ft (20g/m)			
	Gas pipe	O.D. 3/8 inch (9.5mm)		O.D. 1/2 inch (12.7mm)	O.D. 5/8 inch (15.9mm)
	Liquid pipe	O.D. 1/4 inch (6.4mm)			

*Be sure to add the proper amount of additional refrigerant. Failure to do so may result in reduced performance.
**The suggested shortest pipe length is 10ft (3m), in order to avoid noise from the outdoor unit and vibration. (Mechanical noise and vibration may occur depending on how the unit is installed and the environment in which it is used.)

	X	Y	Z
09/12 class	18-1/2 inch (470mm)	12-1/8 inch (308mm)	3-13/16 inch (97mm)
15/18/24 class	23-5/8 inch (600mm)	13-5/8 inch (346mm)	4-15/16 inch (125mm)

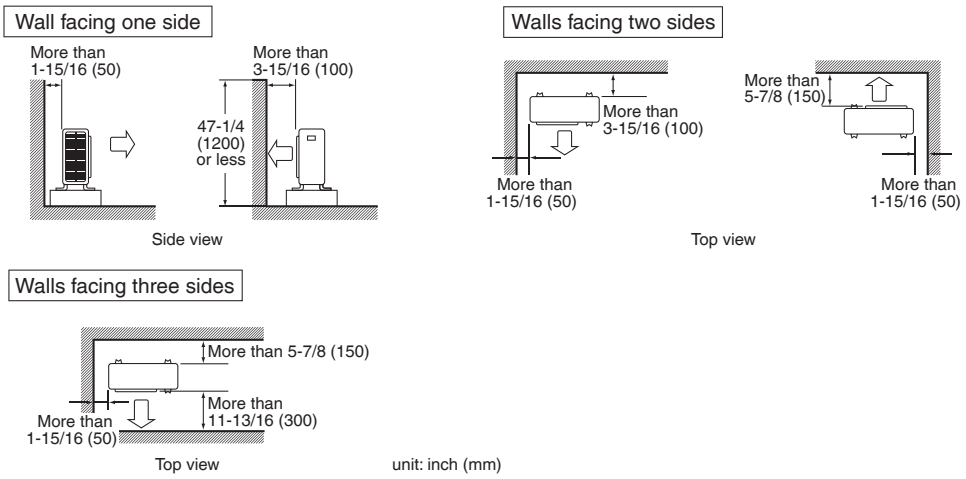


Appearance of outdoor units may differ from some models.

Installation Space Requirements

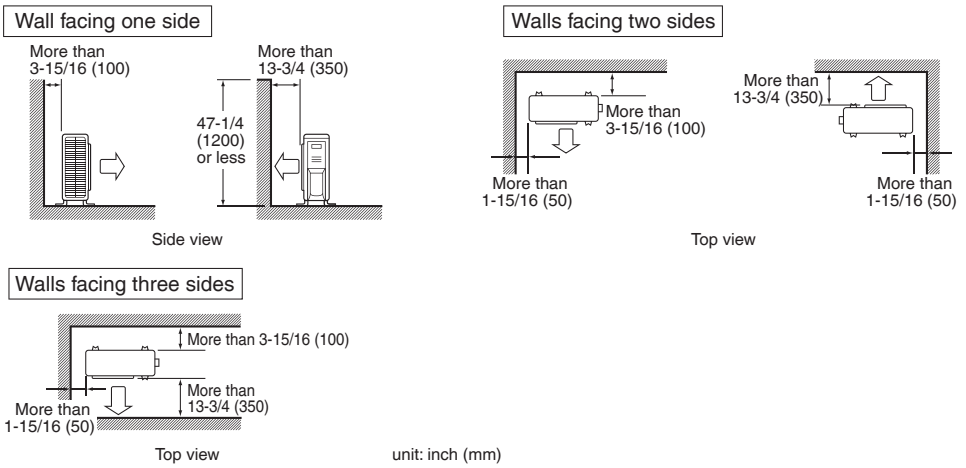
- Where a wall or other obstacle is in the path of the outdoor unit's intake or exhaust airflow, follow the installation space requirements below.
- For any of the below installation patterns, the wall height on the outlet side should be 47-1/4 inch (1200mm) or less.

09/12 class



unit: inch (mm)

15/18/24 class



unit: inch (mm)

Outdoor Unit Installation

1. Installing the outdoor unit

1) When installing the outdoor unit, refer to "**Precautions for Selecting a Location**" and the "**Outdoor Unit Installation Diagram**".
2) If drain work is necessary, follow the procedures on the next page.

English

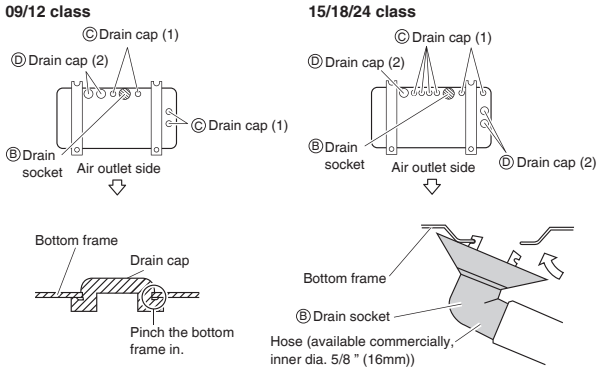
2. Drain work (only for heat pump models, excluding RXL models)

⚠CAUTION

In cold areas, do not use a drain socket, drain caps (1,2) and a drain hose with the outdoor unit. (Drain water may freeze, impairing heating performance.)

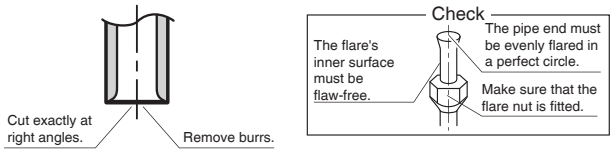
- If the drain port is covered by a mounting base or floor surface, place additional foot bases of at least 1-1/4 inch (30mm) in height under the outdoor unit's feet.

1) Attach Ⓒ drain cap (1) and Ⓓ drain cap (2).
2) Attach Ⓑ drain socket.
   - When attaching Ⓑ drain socket to the bottom frame, make sure to connect the drain hose to the drain socket first.



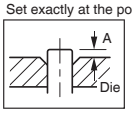
3. Flaring the pipe end

1) Cut the pipe end with a pipe cutter.
2) Remove burrs with the cut surface facing downward, so that the filings do not enter the pipe.
3) Put the flare nut on the pipe.
4) Flare the pipe.
5) Check that the flaring has been done correctly.



Flaring

Set exactly at the position shown below.



	Flare tool for R410A	Conventional flare tool	
	Clutch-type	Clutch-type (Rigid-type)	Wing-nut type (Imperial-type)
A	0-0.020 inch (0-0.5mm)	0.039-0.059 inch (1.0-1.5mm)	0.059-0.079 inch (1.5-2.0mm)

⚠WARNING

- Do not apply mineral oil to the flare.
- Prevent mineral oil from getting into the system as this would reduce the service life of the units.
- Never use piping which has been used for previous installations. Only use parts which are delivered with this unit.
- Never install a dryer to this R410A unit in order to guarantee its service life.
- The drying material may dissolve and damage the system.
- Incomplete flaring may result in refrigerant gas leakage.

4. Refrigerant piping

⚠CAUTION

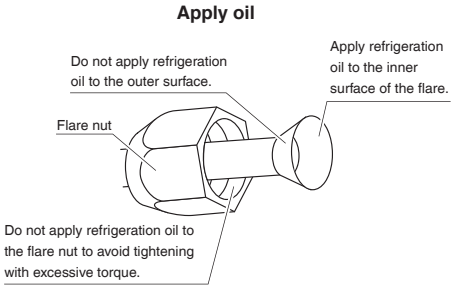
- Use the flare nut fixed to the main unit. (This is to prevent the flare nut from cracking as a result of deterioration over time.)
- To prevent gas leakage, apply refrigeration oil only to the inner surface of the flare. (Use refrigeration oil for R410A.)
- Use a torque wrench when tightening the flare nuts to prevent damage to the flare nuts and gas leakage.

- Align the centers of both flares and tighten the flare nuts 3 or 4 turns by hand, then tighten them fully with a spanner and a torque wrench.

Flare nut tightening torque			
Gas side			Liquid side
3/8 inch (9.5mm)	1/2 inch(12.7mm)	5/8 inch(15.9mm)	1/4 inch (6.4mm)
24-1/8 – 29-1/2ft • lbf (32.7-39.9N • m)	36-1/2 – 44-1/2ft • lbf (49.5-60.3N • m)	45-5/8 – 55-5/8ft • lbf (61.8-75.4N • m)	10-1/2 – 12-3/4ft • lbf (14.2-17.2 N • m)

Width across flats	11/16 inch(17mm)	3/4 inch(19mm)	7/8 inch(22mm)	1-1/16 inch(27mm)
Valve cap tightening torque	10-1/2 – 12-5/8ft • lbf (14.2-17.2N • m)	12-5/8 – 15-3/8ft • lbf (17.1-20.9N • m)	16 – 20-1/4ft • lbf (21.6-27.4N • m)	35-3/8 – 44-1/8ft • lbf (48-59.8N • m)

Service port cap tightening torque
8 – 10-7/8ft • lbf (10.8-14.7N • m)



Outdoor Unit Installation

5. Pressure test and evacuating system

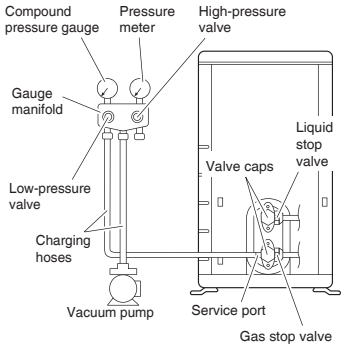
⚠ WARNING

- Do not mix any substance other than the specified refrigerant (R410A) into the refrigeration cycle.
- If refrigerant gas leaks should occur, ventilate the room as soon and as much as possible.
- R410A, as well as other refrigerants, should always be recovered and never be released directly into the environment.
- Use a vacuum pump for R410A exclusively. Using the same vacuum pump for different refrigerants may damage the vacuum pump or the unit.

⚠ CAUTION

It is highly recommended that you do not open/close the stop valves when the outdoor temperature is below –5°F (–21°C) as this may result in refrigerant leakage.

- When piping work is complete, it is necessary to perform a pressure test and evacuate system with a vacuum pump.
- If using additional refrigerant, purge the air from the refrigerant pipes and indoor unit using a vacuum pump, then charge additional refrigerant.
- Use a hexagonal wrench (3/16 inch (4mm)) to operate the stop valve rod.
- All refrigerant pipe joints should be tightened with a torque wrench to the specified tightening torque.



1) Pressurize the liquid pipe and gas pipe from the service ports of each stop valve to 550psi (3.8MPa) (do not pressurize more than 550psi (3.8MPa)) for 1 hour minimum, 24 hours recommended. If there is a pressure drop, check for leaks, make repairs and perform the pressure test again.
2) Connect the gauge manifold's charging hose to the gas stop valve's service port.
3) Fully open the gauge manifold's low-pressure valve (Lo) and completely close its high-pressure valve (Hi). (High-pressure valve will require no further operation.)
4) Evacuate system using vacuum pump to below 500 microns for 1 hour minimum.
5) Close the gauge manifold's low-pressure valve (Lo) and stop vacuum pump. (Maintain this condition for a few minutes to make sure that the compound pressure gauge pointer does not swing back.)*1
6) Remove the valve caps from the liquid stop valve and gas stop valve.
7) Turn the liquid stop valve's rod 90° counter-clockwise with a hexagonal wrench to open the valve. Close it after 5 seconds, and check for gas leakage. Using soapy water, check for gas leakage from the indoor unit's flare and outdoor unit's flare and valve rods. After the check is complete, wipe all soapy water off.
8) Disconnect the charging hose from the gas stop valve's service port, then fully open the liquid and gas stop valves. (Do not attempt to turn the valve rod further than it can go.)
9) Tighten the valve caps and service port caps for the liquid and gas stop valves with a torque wrench to the specified torques. Refer to **"4. Refrigerant piping"** on page 6 for details.

*1 If the compound pressure gauge pointer swings back, the refrigerant may have water content or there may be a loose pipe joint. Check all pipe joints and retighten nuts as needed, then repeat steps 3) through 5).

English

6. Refilling refrigerant

Check the type of refrigerant to be used on the machine nameplate.
Precautions when adding R410A
Fill from the liquid pipe in liquid form.
R410A is a mixed refrigerant, so adding it in gas form may cause the refrigerant composition to change, preventing normal operation.

1) Before filling, check whether the cylinder has a siphon attached or not. (It should have something like “liquid filling siphon attached” displayed on it.)

Filling a cylinder with an attached siphon

Stand the cylinder upright when filling.

There is a siphon pipe inside, so the cylinder need not be upside-down to fill with liquid.

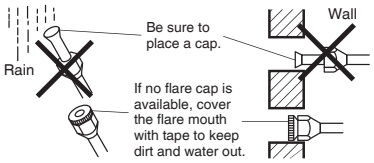
Filling other cylinders

Turn the cylinder upside-down when filling.

- Be sure to use the R410A tools to ensure pressure and to prevent foreign objects entering.

7. Refrigerant piping work

7-1. Cautions on pipe handling



- Protect the open end of the pipe from dust and moisture.
- All pipe bends should be as gentle as possible. Use a pipe bender for bending.

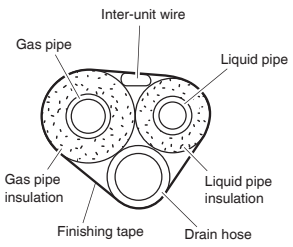
7-2. Selection of copper and heat insulation materials

When using commercial copper pipes and fittings, observe the following:

- Insulation material: Polyethylene foam
  Heat transfer rate: 0.041 to 0.052W/mK (0.024 to 0.030Btu/fth°F (0.035 to 0.045kcal/mh°C))
  Be sure to use insulation that is designed for use with HVAC Systems.
- ACR Copper only.
- Be sure to insulate both the gas and liquid piping and observe the insulation dimensions as below.

	Piping size	Minimum bend radius	Piping thickness	Thermal insulation size	Thermal insulation thickness
Gas side	O.D. 3/8 inch (9.5mm)	1-3/16 inch (30mm) or more	0.031 inch (0.8mm) (C1220T-O)	I.D. 15/32-19/32 inch (12-15mm)	13/32 inch (10mm) Min.
	O.D. 1/2 inch (12.7mm)	1-9/16 inch (40mm) or more		I.D. 9/16-5/8 inch (14-16mm)	
	O.D. 5/8 inch (15.9mm)	1-15/16 inch (50mm) or more	0.039 inch (1.0mm) (C1220T-O)	I.D. 5/8-13/16 inch (16-20mm)	
Liquid side	O.D. 1/4 inch (6.4mm)	1-3/16 inch (30mm) or more	0.031 inch (0.8mm) (C1220T-O)	I.D. 5/16-13/32 inch (8-10mm)	

- Use separate thermal insulation pipes for gas and liquid refrigerant pipes.

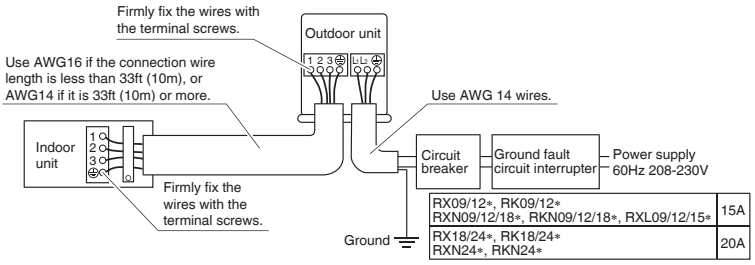


Wiring

⚠ WARNING

- Do not use tapped wires, extension cords, or starburst connections, as they may cause overheating, electric shock, or fire.
- Do not use locally purchased electrical parts inside the product. (Do not branch the power for the drain pump, etc., from the terminal block.) Doing so may cause electric shock or fire.
- Be sure to install a ground fault circuit interrupter. (One that can handle higher harmonics.)
  (This unit uses an inverter. Therefore, a ground fault circuit interrupter capable of handling higher harmonics must be used in order to prevent the ground fault circuit interrupter malfunctioning.)
- Use an all-pole disconnection type circuit breaker with at least 1/8 inch (3mm) between the contact point gaps.
- When carrying out wiring, take care not to pull at the conduit.
- Do not connect the power wire to the indoor unit. Doing so may cause electric shock or fire.

- Do not turn on the circuit breaker until all work is completed.
  1) Strip the insulation from the wire (3/4 inch (20mm)).
  2) Connect the inter-unit wires between the indoor and outdoor units so that the terminal numbers match. Tighten the terminal screws securely. It is recommended that a flathead screwdriver be used to tighten the screws.
  The screws are packed with the terminal block.

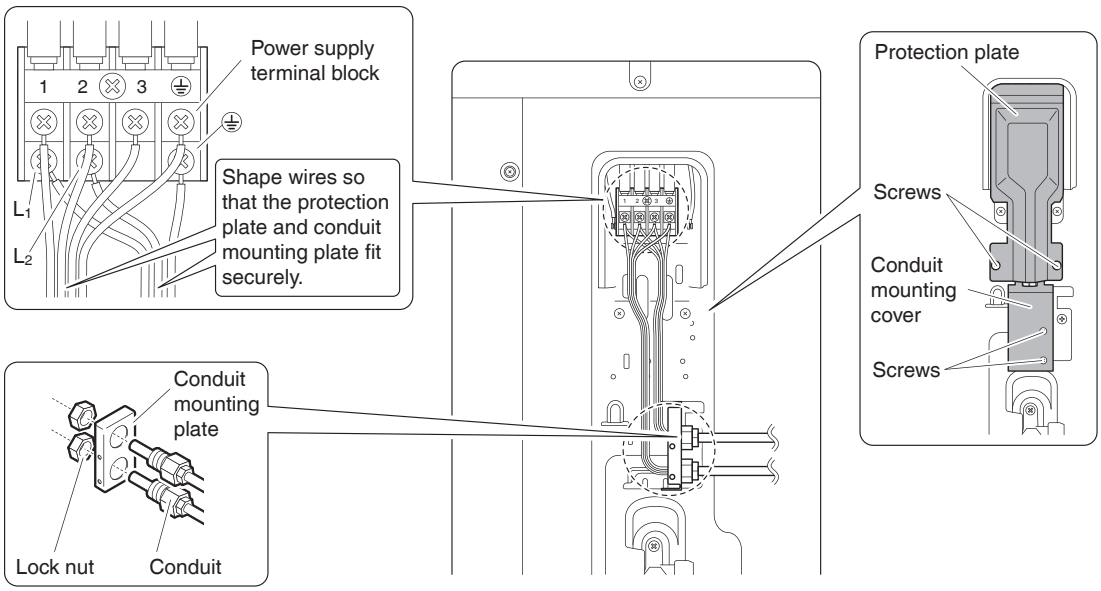


09/12 class

[Method of mounting conduit]

- A protection plate is fixed for protection from the high-voltage section.

1) Dismount the stop valve cover by removing the screw.
2) Dismount the protection plate by removing the 2 screws.
3) Dismount the conduit mounting cover by removing the 2 screws.
4) Pass wires through the conduit and secure them with a lock nut.
5) After completing the work, reattach the stop valve cover, the conduit mounting cover, and the protection plate to its original position.

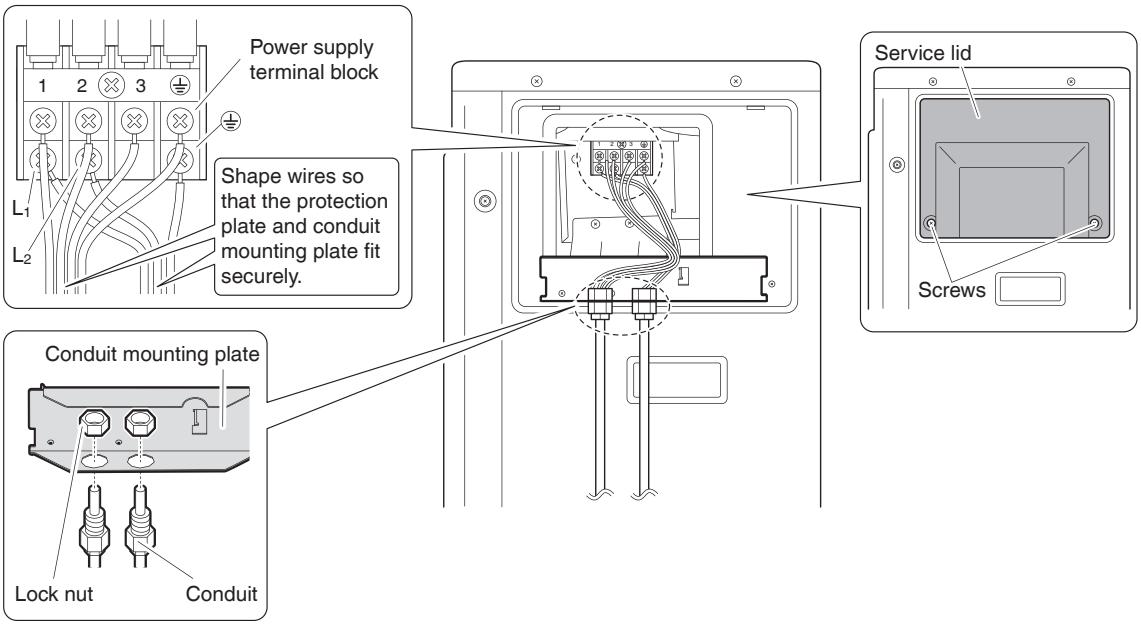


English

15/18/24 class

[Method of mounting conduit]

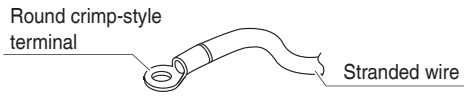
1) Dismount the service lid by removing the 2 screws.
2) Pass wires through the conduit and secure them with a lock nut.
3) After completing the work, reattach the service lid to its original position.

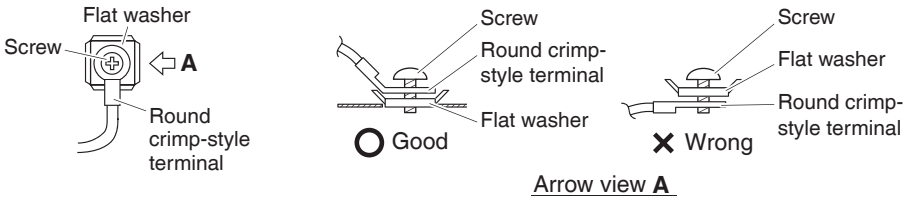


⚠ CAUTION

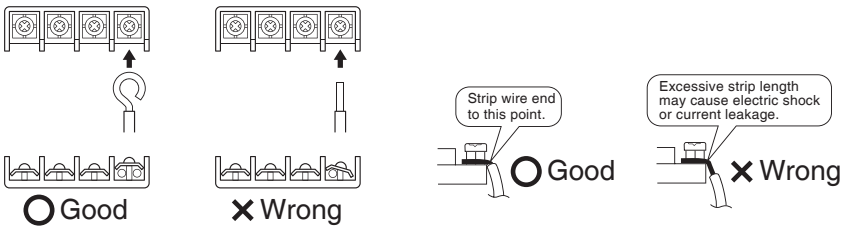
Precautions to be taken for power supply wiring

- When using stranded wires, make sure to use the round crimp-style terminal for connection to the power supply terminal block.





- When connecting the inter-unit wires to the terminal block using a single core wire, be sure to curl the end of the lead. Improper work may cause heat and fires.



Stripping wire at terminal block

Facility Setting* (cooling at low outdoor temperature)

This function is limited only for facilities (the target of air conditioning is equipment (such as computer)). Never use it in a residence or office (the space where there is a human).
***Only for RX, RK, and RXL models.**

■ Cutting jumper 6 (J6) on the circuit board will expand the operation range down to 5°F (–15°C). However it will stop if the outdoor temperature drops below –4°F (–20°C) and start back up once the temperature rises again.

1) Remove the top plate of the outdoor unit. (09/12 class: 3 screws, 15/18/24 class: 6 screws)
2) Remove the front plate. (09/12 class: 4 screws, 15/18/24 class: 8 screws)
3) Cut the jumper (J6) of the PCB inside.

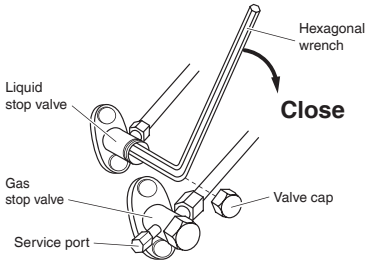
⚠CAUTION

- If the outdoor unit is installed where the heat exchanger of the unit is exposed to direct wind, provide a windbreak wall.
- Intermittent noises may be produced by the indoor unit due to the outdoor fan turning on and off when using facility settings.
- Do not place humidifiers or other items which might raise the humidity in rooms where facility settings are being used. A humidifier might cause dew jumping from the indoor unit outlet vent.
- Cutting jumper 6 (J6) sets the indoor fan tap to the highest position. Notify the user about this.

Pump Down Operation

In order to protect the environment, be sure to pump down when relocating or disposing of the unit.

1) Remove the valve cap from the liquid stop valve and gas stop valve.
2) Carry out forced cooling operation.
3) After 5 to 10 minutes, close the liquid stop valve with a hexagonal wrench.
4) After 2 to 3 minutes, close the gas stop valve and stop forced cooling operation.



Forced cooling operation

■Using the indoor unit ON/OFF switch

Press the indoor unit ON/OFF switch for at least 5 seconds. (The operation will start.)

- Forced cooling operation will stop automatically after about 15 minutes. To stop the operation, press the indoor unit ON/OFF switch.

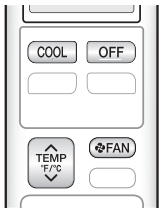
■Using the indoor unit's remote controller

[For wall mounted units]

1) Press TEMP ▲, TEMP ▼ and OFF at the same time.
2) Press TEMP ▲, then select ヲ, press FAN.
3) Press COOL to turn on the system.

- Forced cooling operation will stop automatically after about 30 minutes. To stop the operation, press OFF.

HEAT PUMP model



COOLING ONLY model

[For floor standing units]

1) Press Mode and select the COOL operation.
2) Press On/Off to turn on the system.
3) Press Temp ▲, Temp ▼ and Mode at the same time.
4) Press Temp ▲, select " ヲ ", and press Mode for confirmation.

- Forced cooling operation will stop automatically after about 30 minutes. To stop the operation, press On/Off.

⚠CAUTION

- When pressing the switch, do not touch the terminal block. It has a high voltage, and touching it could cause electric shock.

Trial Operation and Testing

English

1. Trial operation and testing

- Trial operation should be carried out in either COOL or HEAT operation.

1-1. Measure the supply voltage and make sure that it is within the specified range.

1-2. In COOL operation, select the lowest programmable temperature; in HEAT operation, select the highest programmable temperature.

1-3. Carry out the trial operation following the instructions in the operation manual to ensure that all functions and parts, such as the movement of the flap, are working properly.

- To protect the air conditioner, restart operation is disabled for 3 minutes after the system has been turned off.

1-4. After trial operation is complete, set the temperature to a normal level (78°F to 82°F (26°C to 28°C) in COOL operation, 68°F to 75°F (20°C to 24°C) in HEAT operation).

- When operating the air conditioner in COOL operation in winter, or HEAT operation in summer, activate trial operation mode by following the instructions in the installation manual for the indoor unit.
- The air conditioner draws a small amount of power in its standby mode. If the system is not to be used for some time after installation, shut off the circuit breaker to eliminate unnecessary power consumption.
- If the circuit breaker trips to shut off the power to the air conditioner, the system will restore the original operation mode when the circuit breaker is opened again.

2. Test items

Test items	Symptom	Check
Indoor and outdoor units are installed properly on solid bases.	Fall, vibration, noise	
No refrigerant gas leaks.	Incomplete cooling/heating function	
Refrigerant gas and liquid pipes and indoor drain hose extension are thermally insulated.	Water leakage	
Draining line is properly installed.	Water leakage	
System is properly grounded.	Electrical leakage	
The specified wires are used for inter-unit wiring.	No operation or burn damage	
Indoor or outdoor unit's air inlet or air outlet are unobstructed.	Incomplete cooling/heating function	
Stop valves are opened.	Incomplete cooling/heating function	
Indoor unit properly receives remote control commands.	No operation	

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Minato-ku, Tokyo, 108-0075 Japan
http://www.daikin.com

Intertek

Two-dimensional bar code
is a manufacturing code.

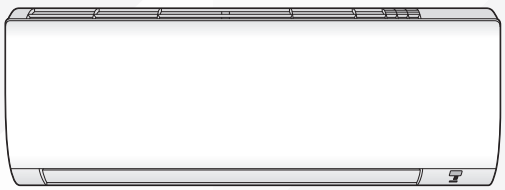
3P379970-6B M15B135 (1511) HT

DAIKIN

English
Français
Español

DAIKIN ROOM AIR CONDITIONER

OPERATION MANUAL



INVERTER

Enjoy year-round comfort.

MODELS

FTK09NMVJU
FTK12NMVJU
FTK18NMVJU
FTK24NMVJU

FTKN09NMVJU
FTKN12NMVJU
FTKN18NMVJU
FTKN24NMVJU

Features


Enhanced comfort and energy savings
COMFORT AIRFLOW
The airflow direction is upward while in COOL operation. This function prevents cold air from blowing directly on your body. Page 15
ECONO
ECONO
This function enables efficient operation by limiting the maximum power consumption. It is useful when using the air conditioner and other electrical devices simultaneously on a shared electrical circuit. Page 16

English

Contents

Read Before Operation

Safety Considerations

- Read these **Safety Considerations** for operation carefully before installing air conditioning equipment. After completing the installation, make sure that the unit operates properly during the startup operation. Instruct the customer on how to operate and maintain the unit. Inform customers that they should store this operation manual with the installation manual for future reference. Meanings of **DANGER**, **WARNING**, and **CAUTION** Symbols:

⚠ **DANGER** ····· Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING** ····· Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION** ····· Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

⚠ DANGER

- For refrigerant leakage, consult your dealer. Refrigerant gas is heavier than air and replaces oxygen. A massive leak could lead to oxygen depletion, especially in basements, and an asphyxiation hazard could occur leading to serious injury or death.
- Refrigerant gas may produce a toxic gas if it comes in contact with fire such as from a fan heater, stove or cooking device. Exposure to this gas could cause severe injury or death.
- Any abnormalities in the operation of the air conditioner such as smoke or fire could result in severe injury or death.
  Turn off the power and contact your dealer immediately for instructions.
- Do not install the unit in an area where flammable materials are present due to risk of explosion resulting in serious injury or death.
- If equipment utilizing a burner is used in the same room as the air conditioner, there is the danger of oxygen deficiency which could lead to an asphyxiation hazard resulting in serious injury or death.
  Be sure to ventilate the room sufficiently to avoid this hazard.
- Safely dispose of the packing materials.
  Packing materials, such as nails and other metal or wooden parts, may cause stabs or other injuries. Tear apart and throw away plastic packaging bags so that children will not play with them. Children playing with plastic bags face the danger of death by suffocation.

⚠ WARNING

- Do not put your finger or other objects into the air outlet or inlet as the fan is rotating at high speed and could cause injury. Always keep small children away from the unit during operation.
- Do not attempt to repair, relocate, modify or reinstall the air conditioner by yourself. Incorrect work or modifications could cause electric shocks, fire or other damage.
  For repairs and reinstallation, consult your Daikin dealer for advice and information.
- Do not use a refrigerant other than the one indicated on the outdoor unit (R410A) when installing, moving or repairing. Using other refrigerants may cause trouble or damage to the unit, and personal injury.
- Do not operate the air conditioner with wet hands.
- If the air conditioner is not cooling properly, the refrigerant may be leaking, contact your authorized dealer or qualified service repairman.
  When making repairs which requires adding refrigerant, consult with your authorized dealer or qualified service repairman.
- Do not attempt to install the air conditioner by yourself. Improper installation could result in water leakage, electric shocks or fire. For installation, consult your authorized dealer or a qualified technician.

⚠ CAUTION

- The air conditioner must be grounded. Improper grounding may result in electric shocks. Do not connect the grounding wire to a gas pipe, water pipe, lightning rod, or a telephone ground line. Follow all local and state electrical codes.
- Do not use this unit for cooling precision instruments, food, plants, animals or works of art.
- Never expose little children, plants or animals directly to the airflow.
- Do not block air inlets nor outlets. Impaired airflow may result in poor performance or equipment problems.
- Do not stand, sit, or place objects on the outdoor unit. To avoid injury, do not remove the fan guard.
- Do not place anything under the indoor or outdoor unit that must be kept away from moisture, such as electrical or electronic equipment. In certain conditions, moisture in the air may condense and drip.
- Check the unit stand and fittings for damage annually.
- Do not touch the air inlet and aluminum fins of outdoor unit. It may cause injury and/or damage the heat transfer surface.
- This appliance is NOT intended for use by young children or impaired persons without proper supervision.

- Young children should be supervised to ensure that they DO NOT play with or near the airflow of this appliance.
- Do not pull at the conduit or hang anything on it. Otherwise it will cause fire or electric shock.
- Do not touch the heat exchanger fins. Improper handling may result in injury.
- Do not turn off the power immediately after stopping operation. Always wait at least 5 minutes before turning off the power to avoid water leakage or other problems.
- Do not wash the indoor unit with excessive water, only use a slightly wet cloth.
- Do not place things such as vessels containing water or anything else on top of the unit. Water may penetrate into the unit and degrade electrical insulations, resulting in an electric shock.
- To avoid personal injury or equipment damage be sure to stop the operation, turn off the circuit breaker or pull out the supply cord before cleaning or servicing the unit. NOTE: More than one disconnect may be required to shut off all power.
- Do not connect the air conditioner to a power supply different from the one specified. It may cause improper operation or fire.
- Depending on the environment, state and local electrical codes, a ground fault circuit interrupter may be required. Improper grounding or lack of a ground fault circuit interrupter may result in electrical shock, injuries, or death.
- It is recommended to install a ground fault circuit interrupter if one is not already available. This helps prevent electrical shocks or fire.
- Arrange the drain hose to ensure smooth drainage. Improper drainage may cause water damage to the building, or its furnishing.
- Depending on the usage environment, water may leak from the air conditioner. If this happens, contact your Daikin dealer.
- The remote controller should be installed in such away that children cannot play with it.
- Do not place objects in direct proximity of the outdoor unit and do not let leaves and other debris accumulate around the unit.
  Leaves attract small animals which can enter the unit. Once in the unit, such animals can cause malfunctions, smoke or fire when making contact with electrical parts.

Installation site

■ Operate the air conditioner in a sufficiently ventilated area and not surrounded by obstacles. Do not use the air conditioner in the following places:

a. Places with a mist of mineral oil, such as cutting oil.
b. Locations such as coastal areas where there is a lot of salt in the air.
c. Locations such as hot springs where there is a lot of sulfur in the air.
d. Locations such as factories where the power voltage varies a lot.
e. In cars, boats, and other vehicles.
f. Locations such as kitchens where oil may splatter or where there is steam in the air.
g. Locations where equipment produces electromagnetic waves.
h. Places with an acid or alkaline mist.

Consider the nuisance of noise to your neighbors

■ Pay Attention to Operating Sound. Be sure to use the following places:

a. Places that can sufficiently withstand the weight of the air conditioner yet can suppress the operating sound and vibration of the air conditioner.
b. Places where warm air from the air outlet of the outside unit or the operating sound of the outside unit does not annoy neighbors.
   Make sure that there are no obstacles close to the outside unit. Obstacles close to the outside unit may drop the performance of the outside unit or increase the operating sound of the outside unit.
   Consult your dealer if the air conditioner in operation generates unusual sounds.

Electrical work

- For power supply, be sure to use a separate power circuit dedicated to the air conditioner.

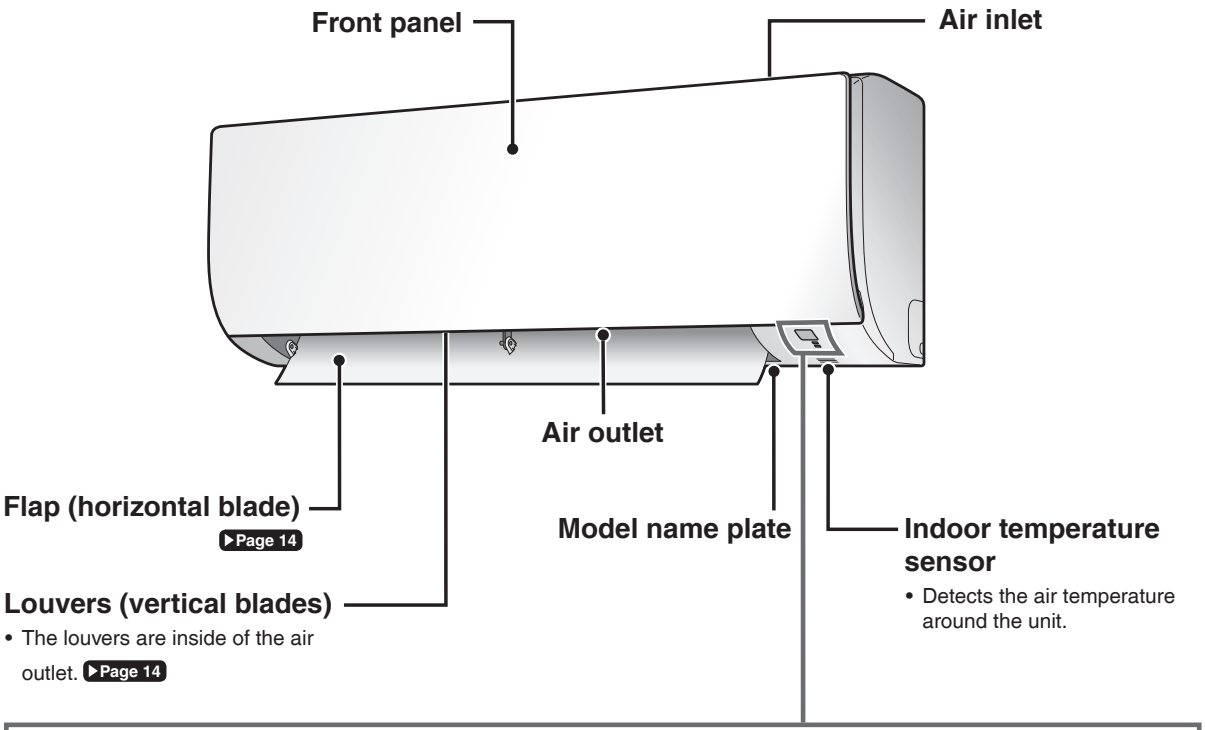
System relocation

■ Relocating the air conditioner requires specialized knowledge and skills. Please consult the dealer if relocation is necessary for moving or remodeling.

Names of Parts

FTK09NMVJU / FTK12NMVJU / FTKN09NMVJU / FTKN12NMVJU

Indoor Unit



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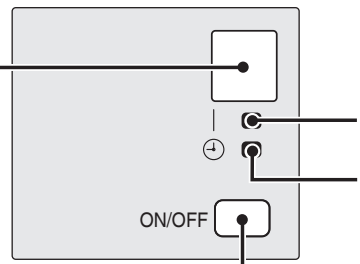


Signal receiver

- Receives signals from the remote controller.
- When the unit receives a signal, you will hear a beep sound.

Case	Sound type
Operation start	beep-beep
Setting changed	beep
Operation stop	long beep

OPERATION lamp (green)

TIMER lamp (orange)

Page 17,18

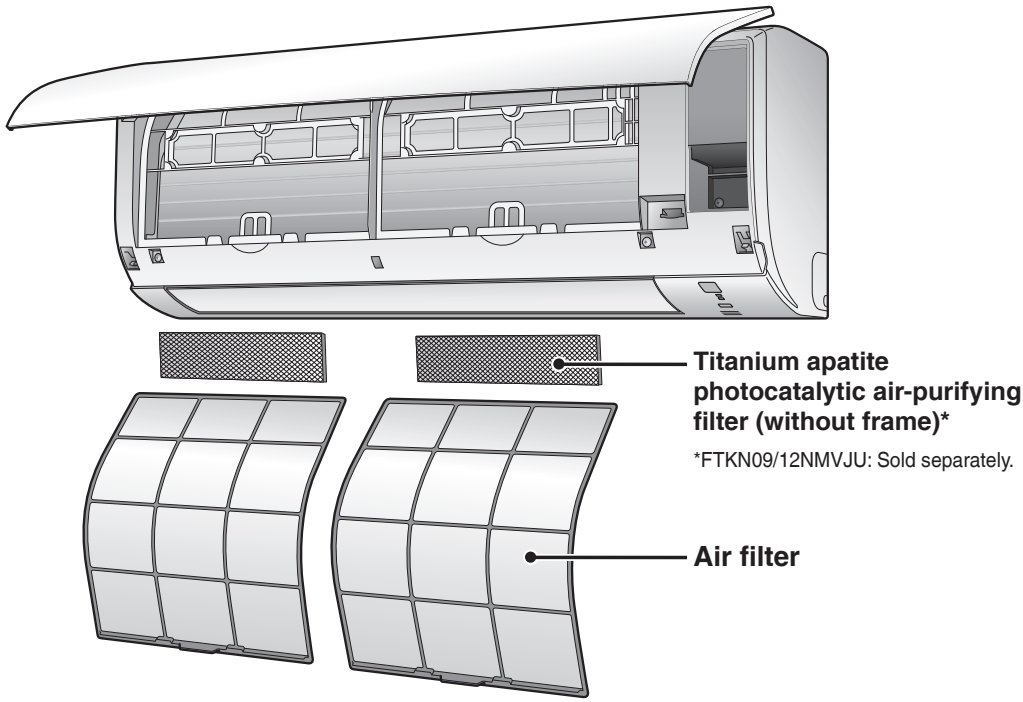
Indoor unit ON/OFF switch

- Press this switch once to start operation. Press once again to stop it.
- For the operation mode setting, refer to the following table.

Mode	Temperature setting	Airflow rate
COOL	72°F (22°C)	AUTO

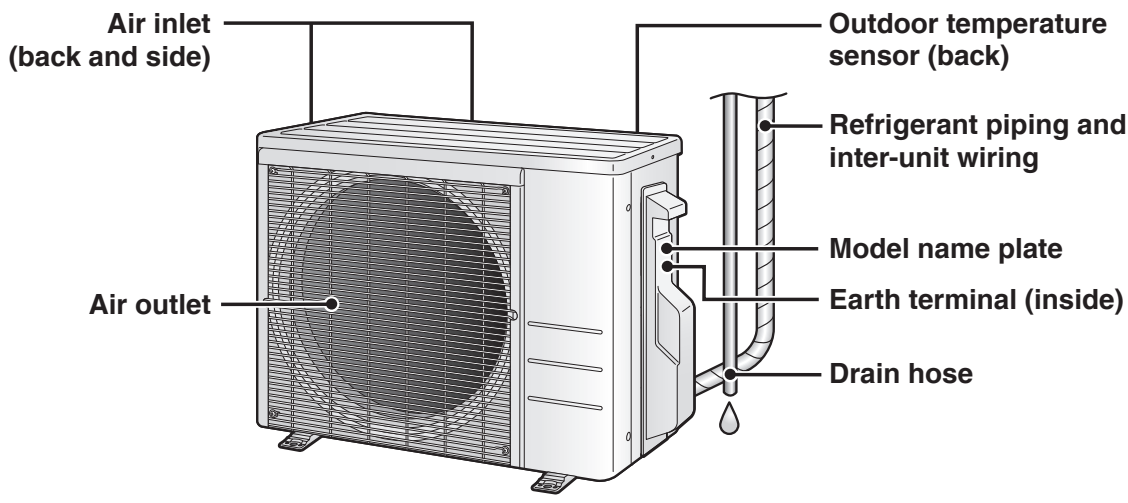
- This switch can be used when the remote controller is missing.

■ Open the front panel



Outdoor Unit

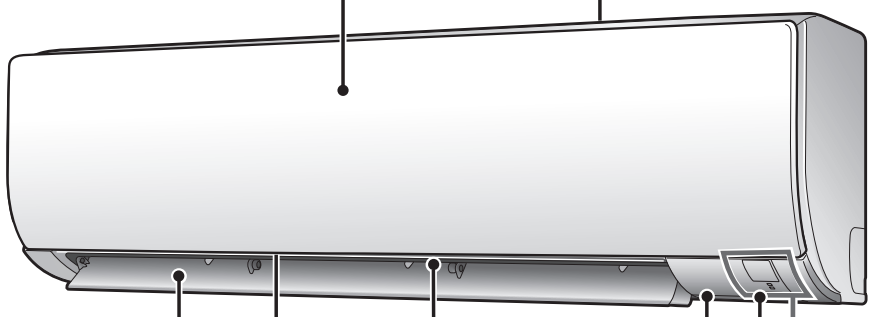
• The appearance of the outdoor unit may differ between different models.



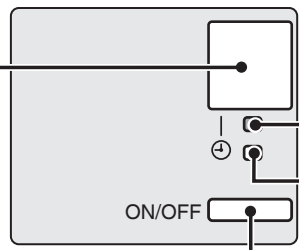
Names of Parts

FTK18NMVJU / FTK24NMVJU / FTKN18NMVJU / FTKN24NMVJU

Indoor Unit



Display



Signal receiver

- Receives signals from the remote controller.
- When the unit receives a signal, you will hear a beep sound.

Case	Sound type
Operation start	beep-beep
Setting changed	beep
Operation stop	long beep

OPERATION lamp (green)

TIMER lamp (orange)

Page 17,18

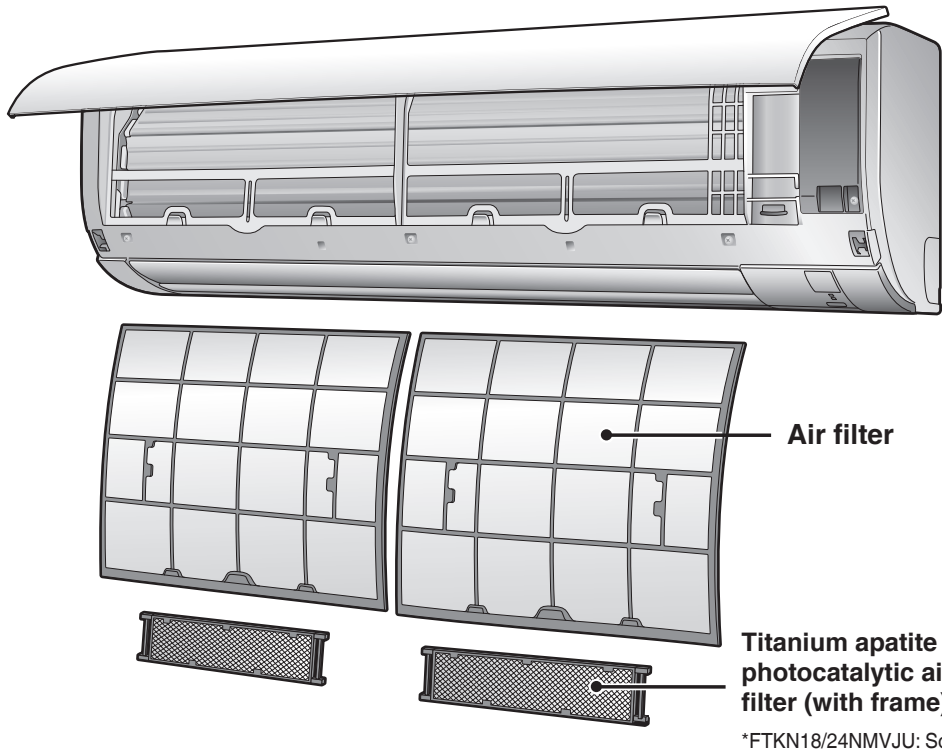
Indoor unit ON/OFF switch

- Press this switch once to start operation. Press once again to stop it.
- For the operation mode setting, refer to the following table.

Mode	Temperature setting	Airflow rate
COOL	72°F (22°C)	AUTO

- This switch can be used when the remote controller is missing.

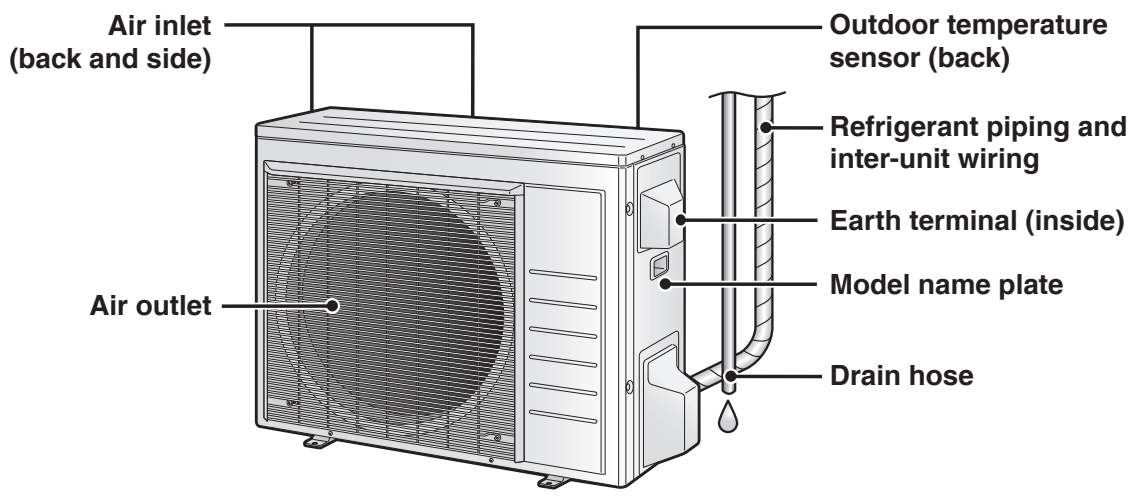
■ Open the front panel



*FTKN18/24NMVJU: Sold separately.

Outdoor Unit

• The appearance of the outdoor unit may differ between different models.



Names of Parts

Remote Controller

Display (LCD)
- Displays the current settings. (In this illustration, each section is shown with its displays on for the purpose of explanation.)

Direct operation buttons
- Starts the COOL, DRY or FAN ONLY operation. ▶Page 11

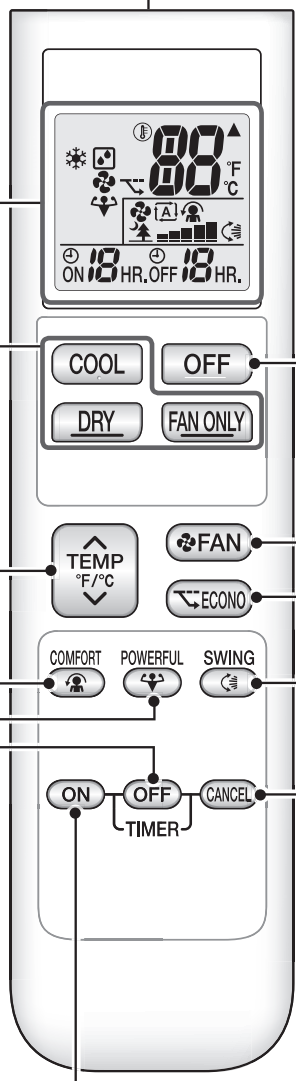
TEMPERATURE adjustment button
- Changes the temperature setting. ▶Page 12

COMFORT button
- COMFORT AIRFLOW operation. ▶Page 15

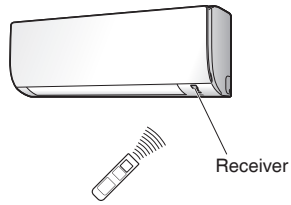
POWERFUL button
- POWERFUL operation. ▶Page 15

OFF TIMER button (NIGHT SET mode) ▶Page 18

ON TIMER button ▶Page 17



Signal transmitter



- To use the remote controller, aim the transmitter at the indoor unit. If there is anything blocking the signals between the unit and the remote controller, such as a curtain, the unit may not operate.
- The maximum transmission distance is about 23ft (7m).

OFF button
- Stops the operation. ▶Page 12

FAN setting button
- Selects the airflow rate setting. ▶Page 13

ECONO button
- ECONO operation. ▶Page 16

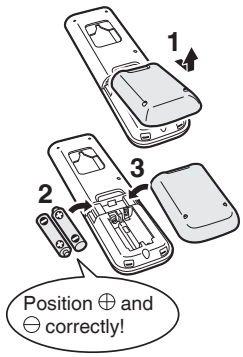
SWING button
- Adjusts the airflow direction. ▶Page 14

TIMER CANCEL button
- Cancels the timer setting. ▶Page 17,18

Unit	Remote Controller	
FTK09/12/18/24NMVJU	ARC480A9	with backlight
FTKN09/12/18/24NMVJU	ARC480A7	without backlight

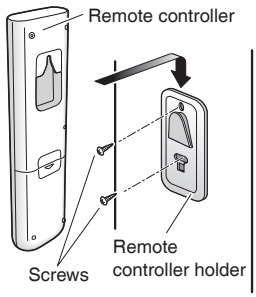
English

Preparation Before Operation



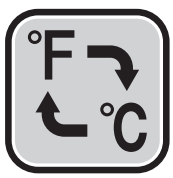
To insert the batteries

1. Remove the back cover by sliding and then slightly lifting it.
2. Insert 2 dry batteries AAA.LR03 (alkaline).
3. Replace the back cover.



To fix the remote controller holder to a wall

1. Choose a place where the signals reach the unit.
2. Attach the holder to a wall, a pillar, or similar location with the screws supplied with the holder.
3. Hang the remote controller on the remote controller holder.



Fahrenheit/Celsius display switch

- Press TEMP °F/°C and ON (TIMER button) simultaneously for about 5 seconds.
  - The temperature will be displayed in Celsius when it is presently displayed in Fahrenheit, and vice versa.
  - The switch operation is only possible when the temperature is being displayed.

Turn on the circuit breaker

- After the power is turned on, the flap of the indoor unit opens and closes once to set the reference position.

NOTE

Notes on batteries

- When replacing the batteries, use batteries of the same type, and replace both old batteries together.
- The batteries will last for about 1 year. If the remote controller display begins to fade and the possible transmission range becomes shorter within a year, however, replace both batteries with new, size AAA.LR03 (alkaline).
- The batteries supplied with the remote controller are for initial operation. The batteries may run out in less than 1 year.

Note on remote controller

- Do not drop the remote controller. Do not get it wet.

Fahrenheit/Celsius display change function of remote controller

- The set temperature may increase when the display is changed to Celsius from Fahrenheit, because a fraction of 0.5°C is rounded up.
- Example: A set temperature of 65°F (equivalent to 18.5°C) will be converted into 19°C.
  When the display is changed to Fahrenheit again, the set temperature will be converted into 66°F (equivalent to 19°C) instead of the original set temperature (65°F) but a set temperature of 66°F (equivalent to 19°C) will be converted into 19°C with no temperature change.
- A reception sound will go off for the transmission of set temperature to the indoor unit at the time of setting the Fahrenheit/Celsius display change function.

MODE COOL · DRY · FAN ONLY Operation

The air conditioner operates with the operation mode of your choice.

To start operation

COOL operation

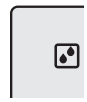
- To lower the temperature.

Press COOL .

DRY operation

- To lower the humidity.

Press DRY .

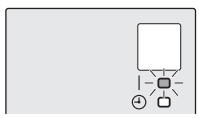


FAN ONLY operation

- To circulate air in the room.

Press FAN ONLY .

- The OPERATION lamp lights green.

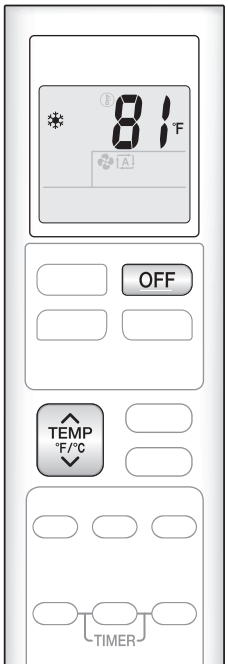


Display

NOTE

Note on DRY operation

- Eliminates humidity while maintaining the indoor temperature as much as possible. It automatically controls temperature and airflow rate, so manual adjustment of these functions is unavailable.



To stop operation

Press OFF .

- The OPERATION lamp goes off.

To change the temperature setting

Press TEMP °F/°C .

- Press ^ to raise the temperature and press v to lower the temperature.

COOL operation	DRY or FAN ONLY operation
64-90°F (18-32°C)	The temperature setting cannot be changed.

Tips for saving energy

Keeping the temperature setting at a moderate level helps save energy.
- Recommended temperature setting
  – For cooling: 78-82°F (26-28°C)

Cover windows with a blind or a curtain.
- Blocking sunlight and air from outdoors increases the cooling effect.

Keep the air filters clean.
- Clogged air filters cause inefficient operation and waste energy. Clean them once every 2 weeks. ▶Page 20, 23

If you are not going to use the air conditioner for a long period, for example in spring or autumn, turn off the circuit breaker.
- The air conditioner always consumes a small amount of electricity even while it is not operating.

Basic Operation

Adjusting the Airflow Rate

You can adjust the airflow rate to increase your comfort.

To adjust the airflow rate setting

Press FAN .

- Each pressing of FAN changes the airflow rate setting in sequence.

- When the airflow is set to " ", quiet operation starts and noise from the indoor unit will become quieter.
- In the quiet operation mode, the airflow rate is set to a weak level.

COOL and FAN ONLY operation	DRY operation
	The airflow rate setting cannot be changed.

NOTE

Note on airflow rate setting

- At smaller airflow rates, the cooling effect is also smaller.

Adjusting the Airflow Direction

You can adjust the airflow direction to increase your comfort.

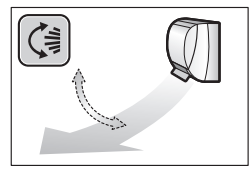
⚠ CAUTION

- Always use a remote controller to adjust the angles of the flap. Moving the flap forcibly by hand may cause a malfunction.
- Be careful when adjusting the louvers. Inside the air outlet, a fan is rotating at a high speed.

To start auto swing

Up and down airflow direction

Press SWING .



- " " is displayed on the LCD.
- The flap (horizontal blade) will begin to swing.

To set the flap at the desired position

- This function is effective while the flap is in auto swing mode.

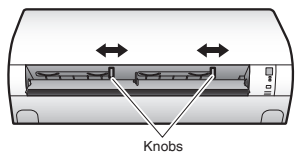
Press SWING when the flap reaches the desired position.

- " " disappears from the LCD.

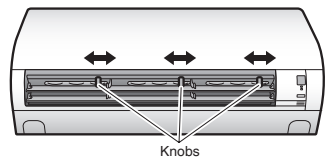
To adjust the louvers at desired position

Hold the knobs and move the louvers (vertical blades).

FTK09NMVJU / FTK12NMVJU
FTKN09NMVJU / FTKN12NMVJU



FTK18NMVJU / FTK24NMVJU
FTKN18NMVJU / FTKN24NMVJU

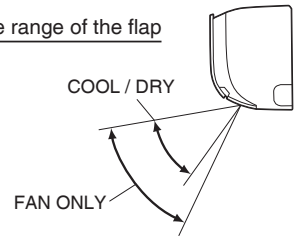


NOTE

Notes on airflow direction setting

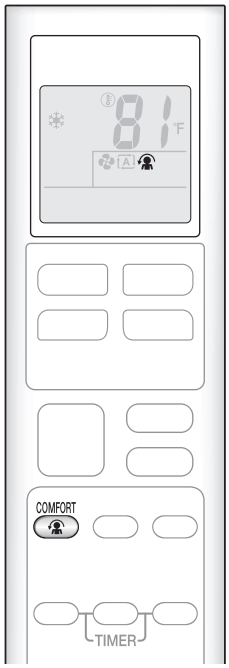
- The movable range of the flap varies according to the operation mode.
- The flap will stop at the upper position when the airflow rate is changed to low during the up and down swing setting.

Movable range of the flap



Useful Functions

COMFORT AIRFLOW Operation



The air direction and flow rate are adjusted so that the air will not blow directly at people in the room.

To start COMFORT AIRFLOW operation

Press COMFORT **.**

- " " is displayed on the LCD.

	COOL and DRY operation
Flap direction	Goes up
Airflow rate	AUTO

- Not available in FAN ONLY mode.

To cancel COMFORT AIRFLOW operation

Press COMFORT **again.**

- " " disappears from the LCD.
- The flap will return to the memory position from before COMFORT AIRFLOW operation.

POWERFUL Operation

POWERFUL operation quickly maximizes the cooling effect in any operation mode. In this mode, the air conditioner operates at maximum capacity.

To start POWERFUL operation

Press POWERFUL **.**

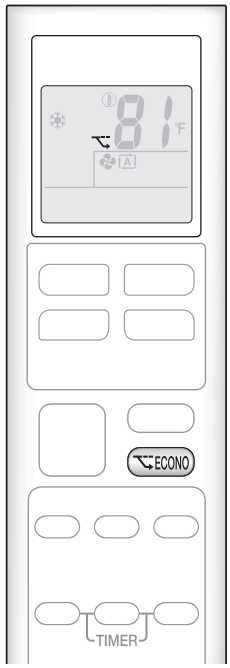
- " " is displayed on the LCD.
- POWERFUL operation ends in 20 minutes. Then the system automatically operates again with the previous settings which were used before POWERFUL operation.

To cancel POWERFUL operation

Press POWERFUL **again.**

- " " disappears from the LCD.

ECONO Operation



ECONO operation enables efficient operation by limiting the maximum power consumption.
This function is useful to prevent the circuit breaker from tripping when the unit operates alongside other appliances on the same circuit.

To start ECONO operation

Press ECONO .

- " " is displayed on the LCD.
- Not available in FAN ONLY mode.

To cancel ECONO operation

Press ECONO again.

- " " disappears from the LCD.

NOTE

Note on COMFORT AIRFLOW operation

- If the up and down airflow direction is selected, the COMFORT AIRFLOW operation will be canceled.

Notes on POWERFUL operation

- Pressing OFF causes the settings to be canceled, and " " disappears from the LCD.
- POWERFUL operation will not increase the capacity of the air conditioner if the air conditioner is already in operation with its maximum capacity demonstrated.

– In COOL operation
To maximize the cooling effect, the capacity of outdoor unit increases and the airflow rate becomes fixed at the maximum setting.
The temperature setting cannot be changed.

– In DRY operation
The temperature setting is lowered by 4.5°F (2.5°C) and the airflow rate is slightly increased.

– In FAN ONLY operation
The airflow rate is fixed at the maximum setting.

Notes on ECONO operation

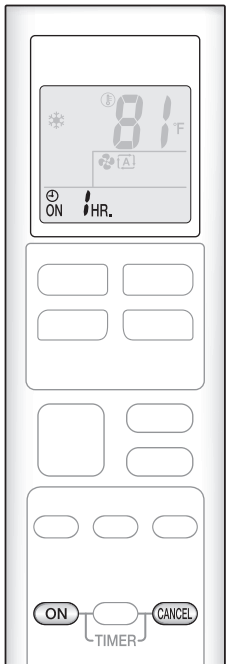
- Pressing OFF causes the settings to be canceled, and " " disappears from the LCD.
- If the power consumption level is already low, switching to ECONO operation will not reduce the power consumption.

Some useful functions can be used together.

COMFORT AIRFLOW + ECONO	Available
POWERFUL + COMFORT AIRFLOW	Not available*
POWERFUL + ECONO	Not available*

*Priority is given to the function of whichever button is pressed last.

ON/OFF TIMER Operation



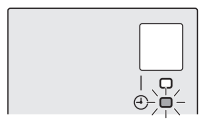
Timer functions are useful for automatically switching the air conditioner on or off at night or in the morning. You can also use the ON TIMER and OFF TIMER together.

To use ON TIMER operation

Press ON .

ON HR. "ON HR." is displayed on the LCD.

- Each pressing of ON advances the time setting by 1 hour. The time can be set between 1 and 12 hours.
- The TIMER lamp lights orange.



Display

To cancel ON TIMER operation

Press CANCEL .

- "ON HR." disappears from the LCD.
- The TIMER lamp goes off.

NOTE

In the following cases, set the timer again.

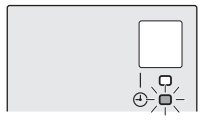
- After the circuit breaker has turned off.
- After a power failure.
- After replacing the batteries in the remote controller.

To use OFF TIMER operation

Press OFF .

OFF 1HR. "OFF 1HR." is displayed on the LCD.

- Each pressing of OFF advances the time setting by 1 hour. The time can be set between 1 and 12 hours.
- The TIMER lamp lights orange.



Display

To cancel OFF TIMER operation

Press CANCEL .

- "OFF 1HR." disappears from the LCD.
- The TIMER lamp goes off.

To combine ON TIMER and OFF TIMER operation

- A sample setting for combining the 2 timers is shown below.
- "ON" and "OFF" are displayed on the LCD.

[Example]

ON 8HR. OFF 1HR.

When setting while the unit is operating
- Stops the unit 1 hour later and starts it 7 hours after that.

ON 2HR. OFF 5HR.

When setting while the unit is stopped
- Starts the unit 2 hours later and stops it 3 hours after that.

NOTE

NIGHT SET mode
- When the OFF TIMER is set, the air conditioner automatically adjusts the temperature setting (0.9°F (0.5°C) up in COOL) to prevent excessive cooling during sleeping hours.

Care and Cleaning

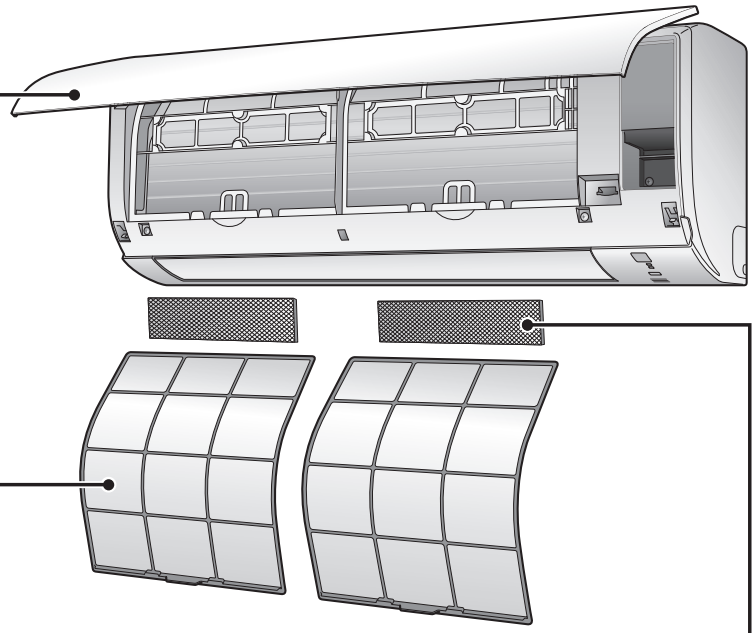
FTK09NMVJU / FTK12NMVJU / FTKN09NMVJU / FTKN12NMVJU

⚠ CAUTION

- Before cleaning, be sure to stop the operation and turn off the circuit breaker.
- Do not touch the aluminium fins of the indoor unit. If you touch those parts, this may cause an injury.

■ Quick reference

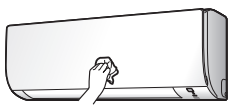
Cleaning parts



Front panel

- Wipe it with a soft damp cloth.
- Only neutral detergent may be used.

If dirty



Air filter

- Vacuum dust or wash the filter.

Once every 2 weeks

▶Page 20

Indoor unit, outdoor unit and remote controller

- Wipe them with a soft cloth.

If dirty

Titanium apatite photocatalytic air-purifying filter (without frame)*

- Vacuum dust or replace the filter.

[Cleaning] **Once every 6 months** ▶Page 21

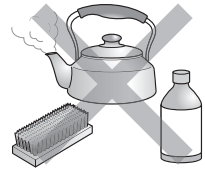
[Replacement] **Once every 3 years** ▶Page 21

*FTKN09/12NMVJU: Sold separately.

NOTE

For cleaning, do not use any of the following:

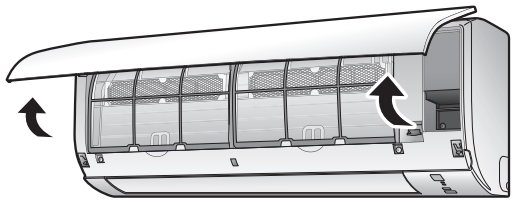
- Water hotter than 104°F (40°C)
- Volatile liquid such as benzene, petrol and thinner
- Polishing compounds
- Rough materials such as a scrubbing brush



■ Air filter

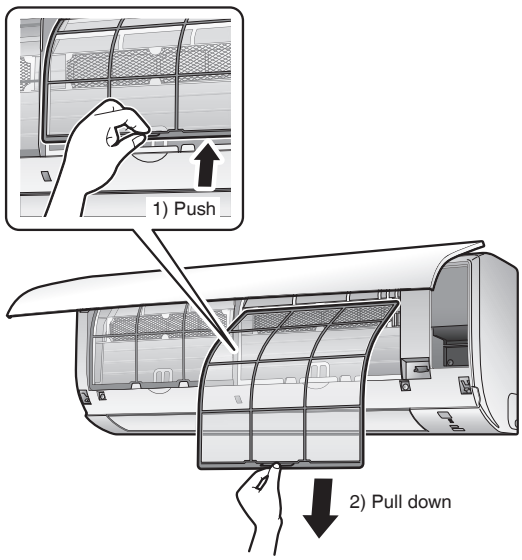
1. Open the front panel.

• Hold the front panel by the sides and open it.



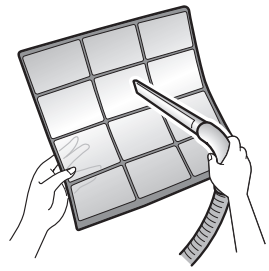
2. Pull out the air filters.

• Push the filter tab at the center of each air filter a little upwards, then pull it down.



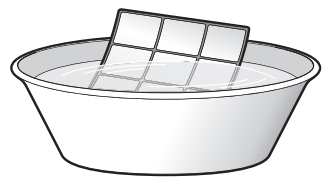
3. Wash the air filters with water or clean them with vacuum cleaner.

• It is recommended to clean the air filters every 2 weeks.



If the dust does not come off easily

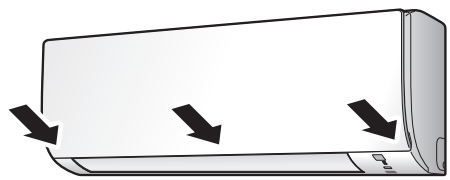
• Wash the air filters with neutral detergent thinned with lukewarm water, then dry them up in the shade.



4. Reattach the filters.

5. Close the front panel slowly.

• Press the panel at both sides and the center.



• Make sure that the front panel is securely fixed.

Care and Cleaning

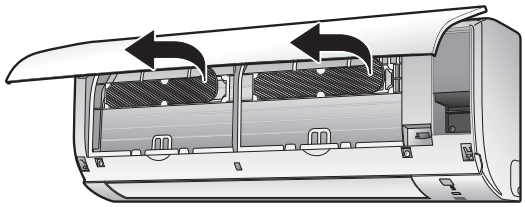
FTK09NMVJU / FTK12NMVJU / FTKN09NMVJU / FTKN12NMVJU

■ Titanium apatite photocatalytic air-purifying filter

1. **Open the front panel and pull out the air filters.** ▶Page 20

2. **Take off the titanium apatite photocatalytic air-purifying filters.**

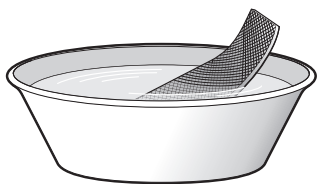
• Remove the filters from the tabs.



3. **Clean or replace the titanium apatite photocatalytic air-purifying filters.**

[Cleaning]

3-1 Vacuum dust, and soak in lukewarm water or water for about 10 to 15 minutes if very dirty.

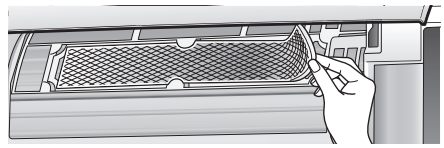


3-2 After washing, shake off remaining water and let them dry in the shade.

• Do not wring out the filter to remove water from it.

[Replacement]

Remove the filter from the tabs and prepare a new one.



• Dispose of the old filter as non-flammable waste.

4. **Insert the titanium apatite photocatalytic air-purifying filters as they were.**

• When attaching the filter, check that the filter is properly set in the tabs.

5. **Reattach the filters.** ▶Page 20

6. **Close the front panel slowly.** ▶Page 20

NOTE

• Operation with dirty filters:
  – cannot deodorize the air,
  – cannot clean the air,
  – results in poor cooling,
  – may cause odor.
• Dispose of old filters as non-flammable waste.
• To order a titanium apatite photocatalytic air-purifying filter, contact the dealer where you bought the air conditioner.

Item	Titanium apatite photocatalytic air-purifying filter 1 set
Part No.	KAF970A46 (without frame)

Care and Cleaning

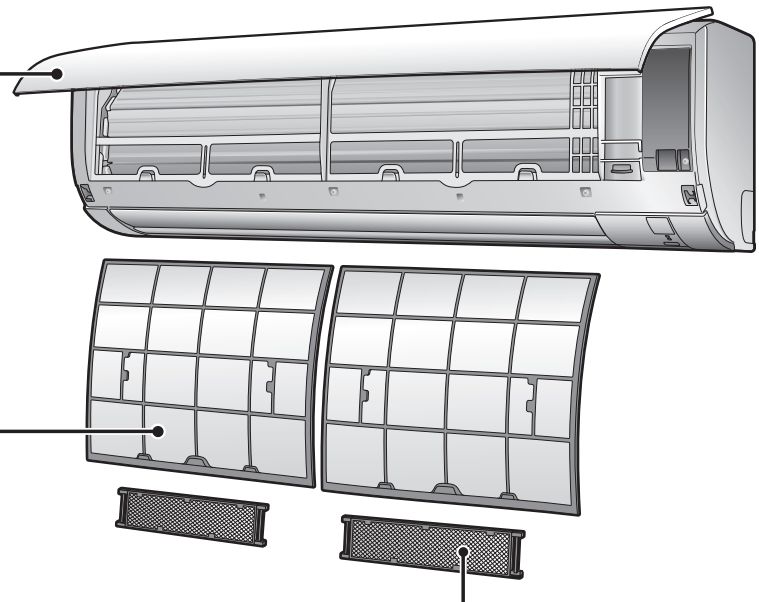
FTK18NMVJU / FTK24NMVJU / FTKN18NMVJU / FTKN24NMVJU

⚠ CAUTION

- Before cleaning, be sure to stop the operation and turn off the circuit breaker.
- Do not touch the aluminium fins of the indoor unit. If you touch those parts, this may cause an injury.

■ Quick reference

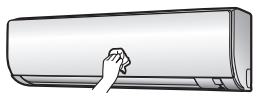
Cleaning parts



Front panel

- Wipe it with a soft damp cloth.
- Only neutral detergent may be used.

If dirty



Air filter

- Vacuum dust or wash the filter.

Once every 2 weeks

▶Page 23

Indoor unit, outdoor unit and remote controller

- Wipe them with a soft cloth.

If dirty

Titanium apatite photocatalytic air-purifying filter (with frame)*

- Vacuum dust or replace the filter.

[Cleaning] **Once every 6 months** ▶Page 24

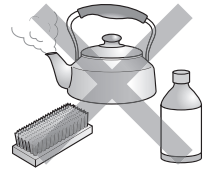
[Replacement] **Once every 3 years** ▶Page 24

*FTKN18/24NMVJU: Sold separately.

NOTE

For cleaning, do not use any of the following:

- Water hotter than 104°F (40°C)
- Volatile liquid such as benzene, petrol and thinner
- Polishing compounds
- Rough materials such as a scrubbing brush



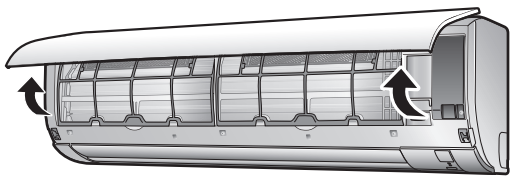
Care and Cleaning

FTK18NMVJU / FTK24NMVJU / FTKN18NMVJU / FTKN24NMVJU

■ Air filter

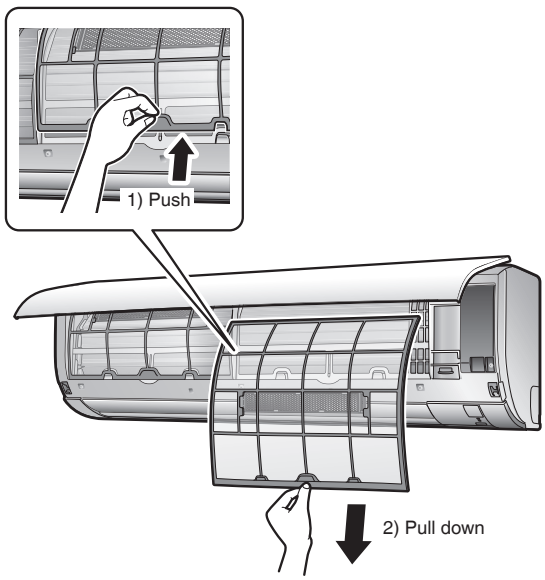
1. Open the front panel.

• Hold the front panel by the sides and open it.



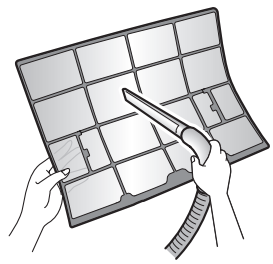
2. Pull out the air filters.

• Push the filter tab at the center of each air filter a little upwards, then pull it down.



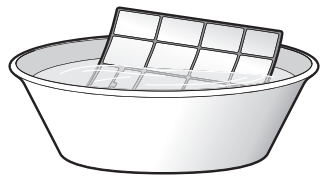
3. Wash the air filters with water or clean them with vacuum cleaner.

• It is recommended to clean the air filters every 2 weeks.



If the dust does not come off easily

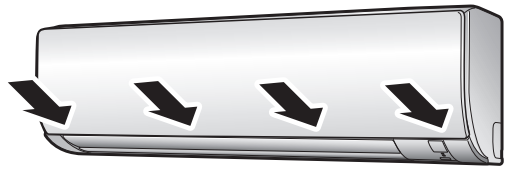
• Wash the air filters with neutral detergent thinned with lukewarm water, then dry them up in the shade.
• Be sure to remove the titanium apatite photocatalytic air-purifying filter. Refer to "**Titanium apatite photocatalytic air-purifying filter**" on the next page.



4. Reattach the filters.

5. Close the front panel slowly.

• Press the front panel at both sides and in the central area.



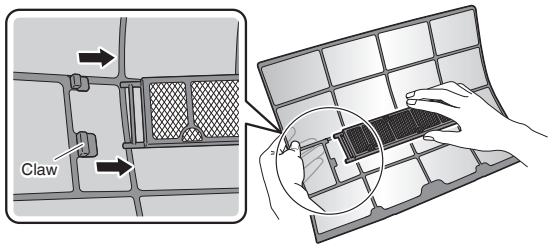
• Make sure that the front panel is securely fixed.

■ Titanium apatite photocatalytic air-purifying filter

1. Open the front panel and pull out the air filters. Page 23

2. Take off the titanium apatite photocatalytic air-purifying filters.

- Hold the recessed parts of the frame and unhook the 4 claws.

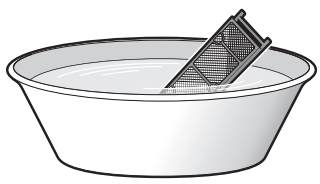


3. Clean or replace the titanium apatite photocatalytic air-purifying filters.

[Cleaning]

3-1 Vacuum dust, and soak in lukewarm water or water for about 10 to 15 minutes if very dirty.

- Do not remove the filter from the frame when washing with water.



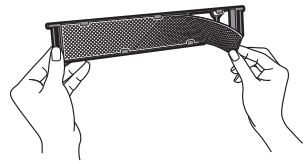
3-2 After washing, shake off remaining water and let them dry in the shade.

- Do not wring out the filter to remove water from it.

[Replacement]

Remove the filter from the filter frame and prepare a new one.

- Do not throw away the filter frame. Reuse the filter frame when replacing the titanium apatite photocatalytic air-purifying filter.



- Dispose of the old filter as non-flammable waste.

4. Insert the titanium apatite photocatalytic air-purifying filters as they were.

- When attaching the filter, check that the filter is properly set in the tabs.

5. Reattach the filters. Page 23

6. Close the front panel slowly. Page 23

NOTE

- Operation with dirty filters:
  – cannot deodorize the air,
  – cannot clean the air,
  – results in poor cooling,
  – may cause odor.
- Dispose of old filters as non-flammable waste.
- To order a titanium apatite photocatalytic air-purifying filter, contact the dealer where you bought the air conditioner.

Item	Titanium apatite photocatalytic air-purifying filter 1 set
Part No.	KAF970A46 (without frame)
	KAF970A45 (with frame)*

*For customers who are using the FTKN18/24NMVJU, please purchase the KAF970A45 (with frame) during your initial purchase.

Care and Cleaning

All models

■ Prior to a long period of non-use

1. Operate the FAN ONLY mode for several hours to dry out the inside.

- Press FAN ONLY .

2. After operation stops, turn off the circuit breaker for the room air conditioner.

3. Take out the batteries from the remote controller.

■ We recommend periodical maintenance

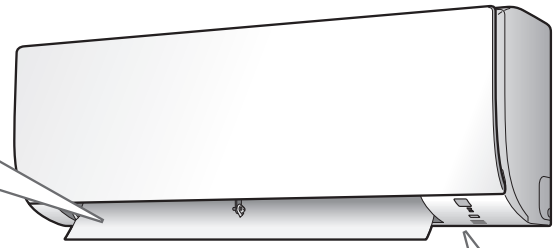
- In certain operating conditions, the inside of the air conditioner may get foul after several seasons of use, resulting in poor performance. It is recommended to have periodical maintenance by a qualified contractor in addition to regular cleaning by the user.
- For qualified contractor maintenance, please contact the dealer where you bought the air conditioner.

FAQ

Indoor unit

The flap does not start swinging immediately.

- The air conditioner is adjusting the position of the flap. The flap will start moving soon.



Operation does not start soon.

■ **When any direct operation button was pressed soon after operation was stopped.**

■ **When the mode was reselected.**

- This is to protect the air conditioner. You should wait for about 3 minutes.

Different sounds are heard.

■ **A sound like flowing water**

- This sound is generated because the refrigerant in the air conditioner is flowing.
- This is a pumping sound of the water in the air conditioner and can be heard when the water is pumped out from the air conditioner during COOL or DRY operation.

■ **Ticking sound**

- This sound is generated when the cabinet and frame of the air conditioner slightly expand or shrink as a result of temperature changes.

■ **Clicking sound during operation or idle time**

- This sound is generated when the refrigerant control valves or the electrical parts operate.

■ **Clopping sound**

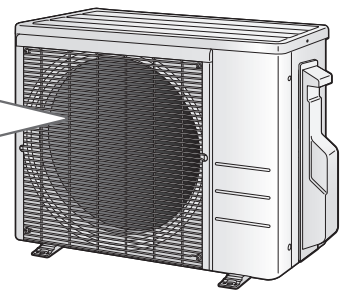
- This sound is heard from the inside of the air conditioner when the exhaust fan is activated while the room doors are closed. Open the window or turn off the exhaust fan.

Outdoor unit

The outdoor unit emits water.

■ **In COOL or DRY operation**

- Moisture in the air condenses into water on the cool surface of the outdoor unit piping and drips.



Troubleshooting

Before making an inquiry or a request for repair, please check the following.
If the problem persists, consult your dealer.

Not a problem
This case is not a problem.

Check
Please check again before requesting repairs.

The air conditioner does not operate

Case	Description / what to check
OPERATION lamp is off.	• Has the circuit breaker been tripped or the fuse blown? • Is there a power failure? • Are batteries set in the remote controller?
OPERATION lamp is blinking.	• Turn off the power with the circuit breaker and restart operation with the remote controller. If the OPERATION lamp is still blinking, check the error code and consult your dealer. ▶Page 30

The air conditioner suddenly stops operating

Case	Description / what to check
OPERATION lamp is on.	• To protect the system, the air conditioner may stop operating after sudden large voltage fluctuations. It automatically resumes operation in about 3 minutes.
OPERATION lamp is blinking.	• Is there anything blocking the air inlet or air outlet of the indoor unit or outdoor unit? Stop operation and after turning off the circuit breaker, remove the obstruction. Then restart operation with the remote controller. If the OPERATION lamp is still blinking, check the error code and consult your dealer. ▶Page 30

The air conditioner does not stop operating

Case	Description / what to check
The air conditioner continues operating even after operation is stopped.	■ **Immediately after the air conditioner is stopped** • The outdoor unit fan continues rotating for about another 1 minute to protect the system. ■ **While the air conditioner is not in operation** • When the outdoor temperature is high, the outdoor unit fan may start rotating to protect the system.

The room does not cool down

Case	Description / what to check
Air does not come out / Air comes out.	■ **Is the airflow rate setting appropriate?** • Is the airflow rate setting low, such as “Indoor unit quiet” or “Airflow rate 1”? Increase the airflow rate setting. ■ **Is the set temperature appropriate?** ■ **Is the adjustment of the airflow direction appropriate?**
Air comes out.	• Is there any furniture directly under or beside the indoor unit? • Is the air conditioner in ECONO operation? ▶Page 16 • Are the air filters dirty? • Is there anything blocking the air inlet or air outlet of the indoor unit or outdoor unit? • Is a window or door open? • Is an exhaust fan turning?

Mist comes out

Case	Description / what to check
Mist comes out of the indoor unit.	☑ • This happens when the air in the room is cooled into mist by the cold airflow during COOL or other operation.

Remote controller

Case	Description / what to check
The unit does not receive signals from the remote controller or has a limited operating range.	☑ • The batteries may be exhausted. Replace both batteries with new dry batteries AAA.LR03 (alkaline). For details, refer to "**Preparation Before Operation**". ▶Page 10 • Signal communication may be disabled if an electronic-starter-type fluorescent lamp (such as inverter-type lamps) is in the room. Consult your dealer if that is the case. • The remote controller may not function correctly if the transmitter is exposed to direct sunlight.
LCD is faint, is not working, or the display is erratic.	☑ • The batteries may be exhausted. Replace both batteries with new dry batteries AAA.LR03 (alkaline). For details, refer to "**Preparation Before Operation**". ▶Page 10
Other electric devices start operating.	☑ • If the remote controller activates other electric devices, move them away or consult your dealer.

Air has an odor

Case	Description / what to check
The air conditioner gives off an odor.	☑ • The room odor absorbed in the unit is discharged with the airflow. We recommend you to have the indoor unit cleaned. Please consult your dealer.

Others

Case	Description / what to check
The air conditioner suddenly starts behaving strangely during operation.	? • The air conditioner may malfunction due to lightning or radio. If the air conditioner malfunctions, turn off the power with the circuit breaker and restart the operation with the remote controller.

Notes on the operating conditions

- If operation continues under any conditions other than those listed in the table,
  - A safety device may activate to stop the operation.
  - Dew may form on the indoor unit and drip from it when COOL or DRY operation is selected.

Mode	Operating conditions
COOL / DRY	Outdoor temperature: 50-115°F (10-46°C) Indoor temperature: 64-90°F (18-32°C) Indoor humidity: 80% max.

Troubleshooting

■ Call your dealer immediately

⚠ WARNING

When an abnormality (such as a burning smell) occurs, stop operation and turn off the circuit breaker.
- Continued operation in an abnormal condition may result in troubles, electric shocks or fire.
- Consult the dealer where you bought the air conditioner.

Do not attempt to repair or modify the air conditioner by yourself.
- Incorrect work may result in electric shocks or fire.
- Consult the dealer where you bought the air conditioner.

If one of the following symptoms takes place, call your dealer immediately.

- **The power cord is abnormally hot or damaged.**
- **An abnormal sound is heard during operation.**
- **The circuit breaker, a fuse, or the earth leakage circuit breaker cuts off the operation frequently.**
- **A switch or a button often fails to work properly.**
- **There is a burning smell.**
- **Water leaks from the indoor unit.**

Turn off the circuit breaker and call your dealer.

■ After a power failure
- The air conditioner automatically resumes operation in about 3 minutes. You should just wait for a while.

■ Lightning
- If there is a risk lightning could strike in the neighborhood, stop operation and turn off the circuit breaker to protect the system.

■ Disposal requirements

- Dismantling of the unit, handling of the refrigerant, oil and other parts, should be done in accordance with the relevant local and national regulations.

■ Fault diagnosis by remote controller

• The remote controller can receive relevant error codes from the indoor unit.

1. When (CANCEL) is held down for about 5 seconds, " 00 " blinks in the temperature display section.

2. Press (CANCEL) repeatedly until a continuous beep is produced.

• The code indication changes as shown below, and notifies you with a long beep.

	CODE	MEANING
SYSTEM	00	NORMAL
	UA	INDOOR-OUTDOOR UNIT COMBINATION FAULT
	U0	REFRIGERANT SHORTAGE
	U2	DROP VOLTAGE OR MAIN CIRCUIT OVERVOLTAGE
	U4	FAILURE OF TRANSMISSION (BETWEEN INDOOR UNIT AND OUTDOOR UNIT)
INDOOR UNIT	A1	INDOOR PCB DEFECTIVENESS
	A5	HIGH PRESSURE CONTROL OR FREEZE-UP PROTECTOR
	A6	FAN MOTOR FAULT
	C4	FAULTY HEAT EXCHANGER TEMPERATURE SENSOR
	C9	FAULTY SUCTION AIR TEMPERATURE SENSOR
OUTDOOR UNIT	EA	COOLING-HEATING SWITCHING ERROR
	E1	CIRCUIT BOARD FAULT
	E5	OL STARTED
	E6	FAULTY COMPRESSOR START UP
	E7	DC FAN MOTOR FAULT
	E8	OVERCURRENT INPUT
	F3	HIGH TEMPERATURE DISCHARGE PIPE CONTROL
	F6	HIGH PRESSURE CONTROL (IN COOLING)
	H0	SENSOR FAULT
	H6	OPERATION HALT DUE TO FAULTY POSITION DETECTION SENSOR
	H8	DC CURRENT SENSOR FAULT
	H9	FAULTY SUCTION AIR TEMPERATURE SENSOR
	J3	FAULTY DISCHARGE PIPE TEMPERATURE SENSOR
	J6	FAULTY HEAT EXCHANGER TEMPERATURE SENSOR
	L3	ELECTRICAL PARTS HEAT FAULT
	L4	HIGH TEMPERATURE AT INVERTER CIRCUIT HEATSINK
	L5	OUTPUT OVERCURRENT
	P4	FAULTY INVERTER CIRCUIT HEATSINK TEMPERATURE SENSOR

NOTE

• A short beep indicates non-corresponding codes.

• To cancel the code display, hold (CANCEL) down for about 5 seconds. The code display also clears if no button is pressed for 1 minute.

Caractéristiques

Sommaire

Français

Considérations sur la sécurité

- Lisez attentivement ces **Considérations sur la sécurité** pour l'utilisation avant d'installer le climatiseur. Après avoir terminé l'installation, assurez-vous que l'unité fonctionne correctement pendant l'opération de démarrage. Informez le client sur la façon de faire fonctionner et d'entretenir l'unité.
  Informez les clients qu'ils doivent stocker ce manuel d'utilisation avec le manuel d'installation pour toute référence ultérieure.
  Signification des symboles **DANGER**, **AVERTISSEMENT**, et **ATTENTION**:

⚠ **DANGER** ····· Indique une situation extrêmement dangereuse qui, si elle n'est pas évitée, entraînera la mort ou des blessures graves.

⚠ **AVERTISSEMENT** ··· Indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut provoquer la mort ou des blessures graves.

⚠ **ATTENTION** ····· Indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut provoquer des blessures mineures ou modérées. Ce symbole peut également être utilisé pour mettre en garde contre des pratiques dangereuses.

⚠ DANGER

- Pour les fuites de réfrigérant, consultez votre revendeur. Le gaz réfrigérant est plus lourd que l'air et remplace l'oxygène. Une fuite importante peut conduire à un appauvrissement en oxygène, en particulier en sous-sol, et un risque d'asphyxie peut survenir et entraîner des blessures graves ou la mort.
- Le gaz réfrigérant peut produire un gaz toxique s'il entre en contact avec une flamme comme à partir d'un ventilateur de chauffage, une cuisinière ou un appareil de cuisson. L'exposition à ce gaz peut provoquer des blessures graves ou la mort.
- Toute anomalie dans le fonctionnement du climatiseur, comme de la fumée ou des flammes, peut entraîner des blessures graves ou la mort.
  Coupez l'alimentation électrique et contactez immédiatement votre revendeur pour obtenir des instructions.
- N'installez pas l'unité dans un endroit où des matériaux inflammables sont présents en raison du risque d'explosion pouvant entraîner des blessures graves ou la mort.
- Si un équipement utilisant un brûleur est utilisé dans la même pièce que le climatiseur, il existe un danger de manque d'oxygène pouvant conduire à un risque d'asphyxie entraînant des blessures graves ou la mort.
  Assurez-vous de suffisamment aérer la pièce pour éviter ce danger.
- Mettez prudemment au rebut les matériaux d'emballage. Les matériaux d'emballage, tels que les clous et autres pièces en métal ou en bois, peuvent causer des coupures ou d'autres blessures. Déchirez et jetez les sacs d'emballage en plastique pour que les enfants ne puissent pas jouer avec. Les enfants qui jouent avec des sacs en plastique risquent de mourir par suffocation.

⚠ AVERTISSEMENT

- Ne mettez pas votre doigt ou d'autres objets dans la sortie ou l'entrée d'air lorsque le ventilateur tourne à grande vitesse, ce qui pourrait provoquer des blessures. Tenez les jeunes enfants éloignés de l'unité pendant son fonctionnement.
- Ne tentez pas de réparer, de déplacer, de modifier ou de réinstaller le climatiseur par vous-même. Tout travail ou modification incorrect peut provoquer des électrocutions, des incendies ou d'autres dommages.
  Pour les réparations et la réinstallation, consultez votre revendeur Daikin pour obtenir des conseils et des informations.
- N'utilisez pas de réfrigérant autre que celui indiqué sur l'unité extérieure (R410A) lors de l'installation, du déplacement ou de la réparation. L'utilisation d'autres réfrigérants peut provoquer des dysfonctionnements ou des dommages à l'unité, ainsi que des blessures.
- Ne faites pas fonctionner le climatiseur avec les mains mouillées.
- Si le climatiseur ne refroidit pas correctement, il se peut qu'il y ait une fuite de réfrigérant ; contactez votre revendeur agréé ou un réparateur qualifié.
  Lors de réparations nécessitant l'ajout de réfrigérant, consultez votre revendeur agréé ou un réparateur qualifié.
- N'essayez pas d'installer le climatiseur par vous-même. Une mauvaise installation peut provoquer des fuites d'eau, des électrocutions ou un incendie. Pour l'installation, consultez votre revendeur agréé ou un technicien qualifié.

⚠ ATTENTION

- Le climatiseur doit être mis à la terre. Une mise à la terre incorrecte peut provoquer des électrocutions. Ne connectez pas le fil de terre à un tuyau de gaz, à une conduite d'eau, à un paratonnerre ou à une ligne de terre téléphonique. Respectez l'ensemble des codes électriques locaux et nationaux.
- N'utilisez pas cette unité pour refroidir des instruments de précision, de la nourriture, des plantes, des animaux ou des œuvres d'art.
- N'exposez jamais directement les jeunes enfants, les plantes ou les animaux directement au flux d'air.
- Ne bloquez pas les entrées d'air ni les sorties. Le flux d'air peut provoquer une baisse de performance ou des dysfonctionnements de l'équipement.
- Ne vous mettez pas debout, ne vous asseyez pas ou ne placez pas d'objets sur l'unité extérieure. Pour éviter toute blessure, ne retirez pas le capot du ventilateur.
- Ne placez rien sous l'unité intérieure ou extérieure qui doit être tenu à l'écart de l'humidité, tels que des équipements électriques ou électroniques. Dans certaines conditions, l'humidité de l'air peut se condenser et s'égoutter.
- Vérifiez annuellement si le support de l'unité et les accessoires ne sont pas endommagés.
- Ne touchez pas à l'entrée d'air ni aux ailettes en aluminium de l'unité extérieure. Cela peut provoquer des blessures et/ou endommager la surface de transfert de chaleur.

- Cet appareil n'est PAS destiné à être utilisé par de jeunes enfants ou des personnes ayant une déficience sans une surveillance adéquate.
- Les jeunes enfants doivent être surveillés pour s'assurer qu'ils NE jouent PAS avec ou près du flux d'air de l'appareil.
- Ne tirez pas sur le conduit ou n'y suspendez rien. Sinon, cela peut provoquer un incendie ou une électrocution.
- Ne touchez pas aux ailettes de l'échangeur de chaleur. Une mauvaise manipulation peut provoquer des blessures.
- Ne coupez pas l'alimentation immédiatement après l'arrêt du fonctionnement. Attendez toujours au moins 5 minutes avant la mise hors tension pour éviter les fuites d'eau ou d'autres problèmes.
- Ne lavez pas l'unité intérieure avec trop d'eau, utilisez seulement un chiffon légèrement humide.
- Ne posez pas de récipients contenant de l'eau ou toute autre chose sur le dessus de l'unité. L'eau peut pénétrer dans l'unité et détériorer les isolants électriques, ce qui provoquerait une électrocution.
- Pour éviter toute blessure ou dommage matériel, veillez à arrêter le fonctionnement, à couper le disjoncteur ou à débrancher le cordon d'alimentation avant de nettoyer ou de réparer l'unité.
  REMARQUE: Il peut être nécessaire d'effectuer plusieurs déconnexions pour couper toute alimentation.
- Ne branchez pas le climatiseur à une alimentation autre que celle spécifiée. Cela peut provoquer un mauvais fonctionnement ou un incendie.
- En fonction de l'environnement et des codes électriques du pays ou de la région, un disjoncteur de fuite de terre peut être nécessaire. Une mauvaise mise à la terre ou l'absence d'un disjoncteur de fuite de terre peut provoquer une électrocution, des blessures ou la mort.
- Il est recommandé d'installer un disjoncteur de fuite de terre s'il n'y en a pas déjà un.
  Cela permet d'éviter les électrocutions ou un incendie.
- Placez le tuyau d'évacuation pour assurer une purge régulière. Une mauvaise purge peut provoquer un dégât des eaux dans le bâtiment ou ses aménagements.
- En fonction de l'environnement d'utilisation, de l'eau peut s'écouler du climatiseur. Si cela se produit, contactez votre revendeur Daikin.
- La télécommande doit être installée à une distance telle que les enfants ne puissent pas jouer avec elle.
- Ne placez pas d'objets à proximité directe de l'unité extérieure et ne laissez pas de feuilles et autres débris s'accumuler autour de l'unité.
  Les feuilles attirent les petits animaux qui peuvent pénétrer dans l'unité. Une fois dans l'unité, ces animaux peuvent provoquer des dysfonctionnements, de la fumée ou un incendie lorsqu'ils entrent en contact avec les pièces électriques.

Site de l'installation

■ Faites fonctionner le climatiseur dans une zone suffisamment aérée et non entourée d'obstacles. N'utilisez pas le climatiseur dans les endroits suivants:

a. Lieux avec un brouillard d'huile minérale, telle de l'huile de coupe.
b. Emplacements tels que des zones côtières où l'air est très salé.
c. Emplacements tels que des sources d'eau chaude où il y a beaucoup de souffre dans l'air.
d. Emplacements tels que des usines où la tension d'alimentation varie beaucoup.
e. Dans des voitures, des bateaux et autres véhicules.
f. Emplacements tels que des cuisines où de l'huile peut éclabousser ou où il y a de la vapeur dans l'air.
g. Emplacements où l'équipement produit des ondes électromagnétiques.
h. Lieux avec un brouillard acide ou alcalin.

Pensez à la nuisance sonore pour vos voisins

■ Faites attention au bruit de fonctionnement. Assurez-vous d'utiliser les endroits suivants:

a. Endroits pouvant résister suffisamment au poids du climatiseur et supprimer le bruit de fonctionnement et les vibrations du climatiseur.
b. Endroits où l'air chaud de la sortie d'air de l'unité extérieure ou le bruit de fonctionnement de l'unité extérieure n'incommode pas les voisins.
   Assurez-vous qu'il n'y a pas d'obstacles à proximité de l'unité extérieure. Les obstacles à proximité de l'unité extérieure peuvent faire chuter le rendement de l'unité extérieur ou augmenter le bruit de fonctionnement de l'unité extérieure.
   Consultez votre revendeur si le climatiseur en fonctionnement génère des sons inhabituels.

Travail électrique

- Pour l'alimentation électrique, assurez-vous d'utiliser un circuit d'alimentation séparé, réservé au climatiseur.

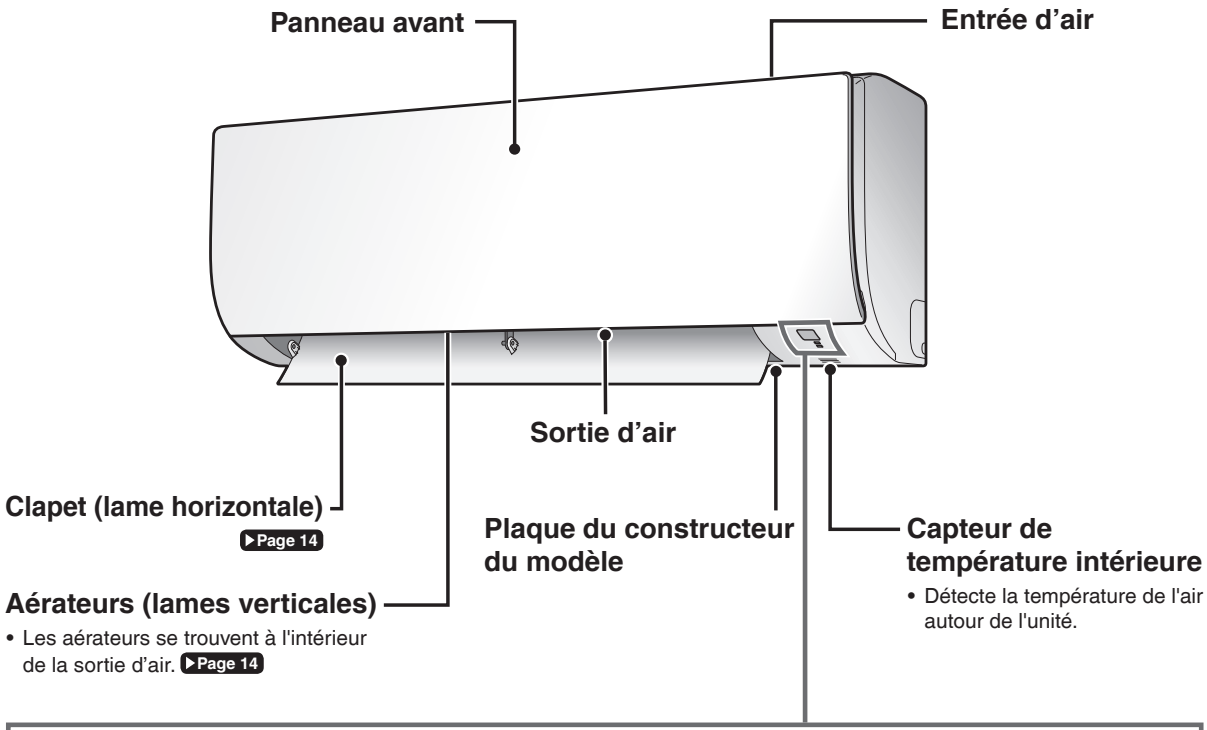
Déplacement du système

■ Déplacer le climatiseur nécessite des connaissances et des compétences spécialisées. Veuillez consulter votre revendeur s'il est nécessaire de déplacer le climatiseur pour le modifier ou le réagencer.

Noms des pièces

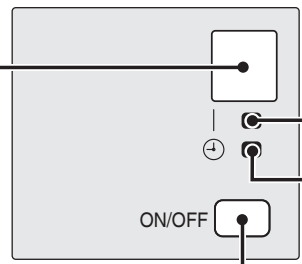
FTK09NMVJU / FTK12NMVJU / FTKN09NMVJU / FTKN12NMVJU

Unité intérieure



- Les aérateurs se trouvent à l'intérieur de la sortie d'air. Page 14
- Détecte la température de l'air autour de l'unité.

Affichage



Récepteur de signal

- Reçoit des signaux de la télécommande.
- Lorsque l'unité reçoit un signal, vous entendez un bip sonore.

Cas	Type de son
Démarrage du fonctionnement	bip-bip
Réglage modifié	bip
Arrêt du fonctionnement	bip long

Témoin de FONCTIONNEMENT (vert)

Témoin MINUTERIE (orange)
Page 17,18

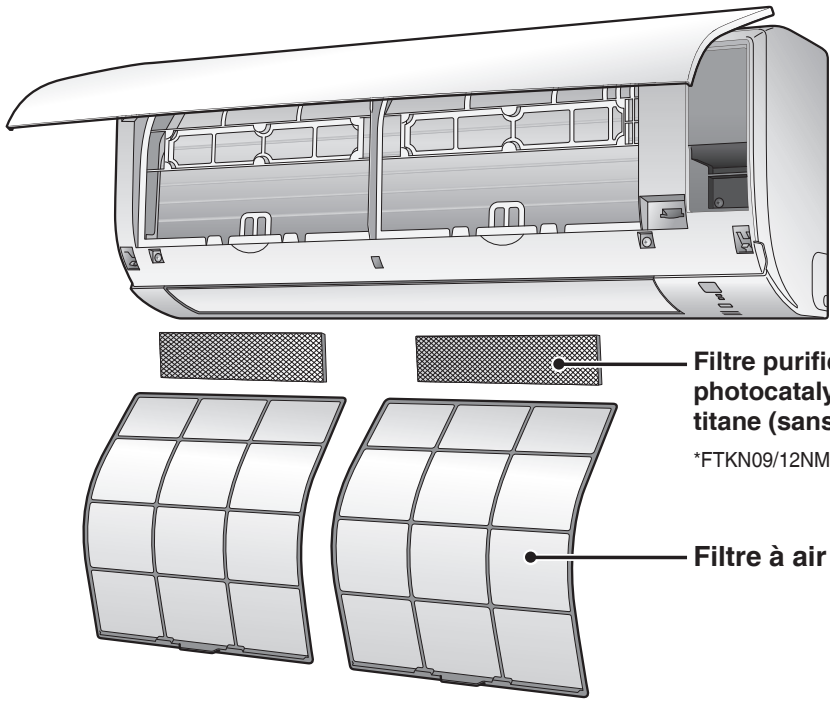
Interrupteur MARCHE/ARRÊT de l'unité intérieure

- Appuyez sur cet interrupteur pour démarrer le fonctionnement. Appuyez à nouveau pour l'arrêter.
- Pour le réglage du mode de fonctionnement, reportez-vous au tableau suivant.

Mode	Réglage de la température	Débit d'air
REFROIDISSEMENT	72°F (22°C)	AUTO

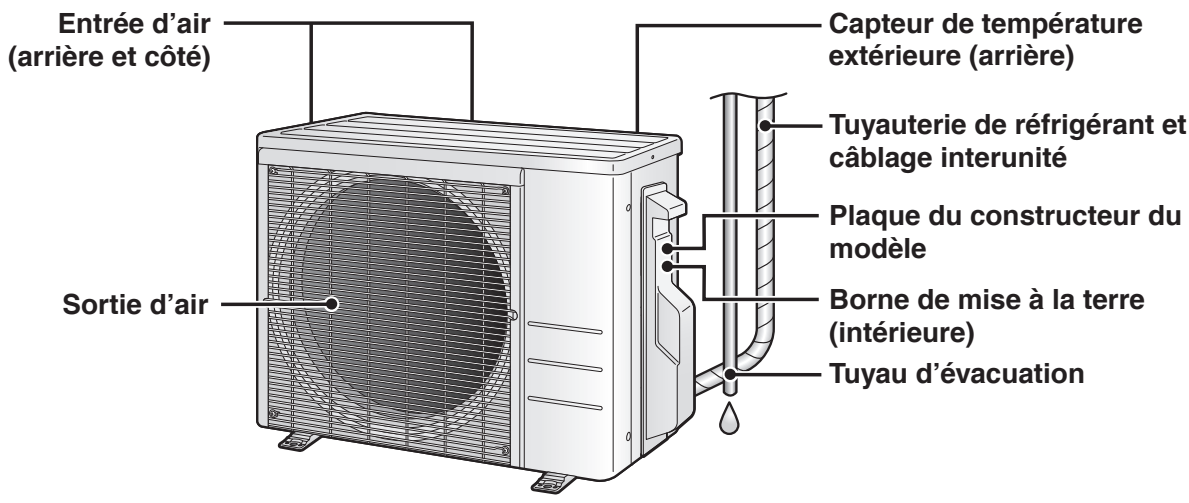
- Cet interrupteur peut être utilisé lorsqu'il n'y a pas de télécommande.

■ Ouvrez le panneau avant



Unité extérieure

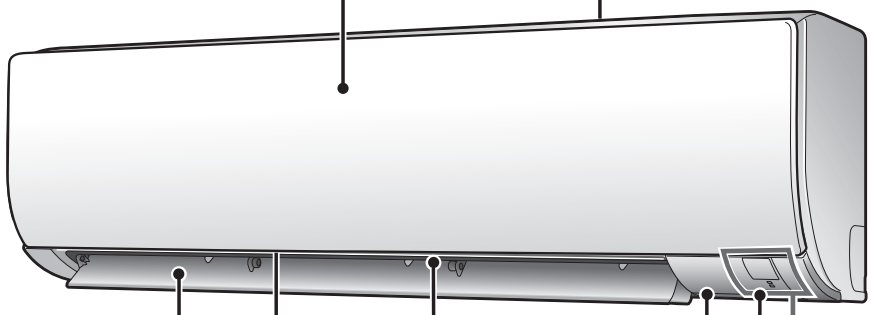
• L'apparence de l'unité extérieure peut différer entre les différents modèles.



Noms des pièces

FTK18NMVJU / FTK24NMVJU / FTKN18NMVJU / FTKN24NMVJU

Unité intérieure



Clapets (lames horizontales)
▶Page 14

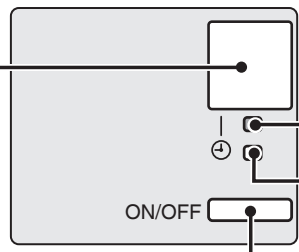
Aérateurs (lames verticales)
- Les aérateurs se trouvent à l'intérieur de la sortie d'air. ▶Page 14

Sortie d'air

Plaque du constructeur du modèle

Capteur de température intérieure
- Détecte la température de l'air autour de l'unité.

Affichage



Récepteur de signal
- Reçoit des signaux de la télécommande.
- Lorsque l'unité reçoit un signal, vous entendez un bip sonore.

Cas	Type de son
Démarrage du fonctionnement	bip-bip
Réglage modifié	bip
Arrêt du fonctionnement	bip long

Témoin de FONCTIONNEMENT (vert)

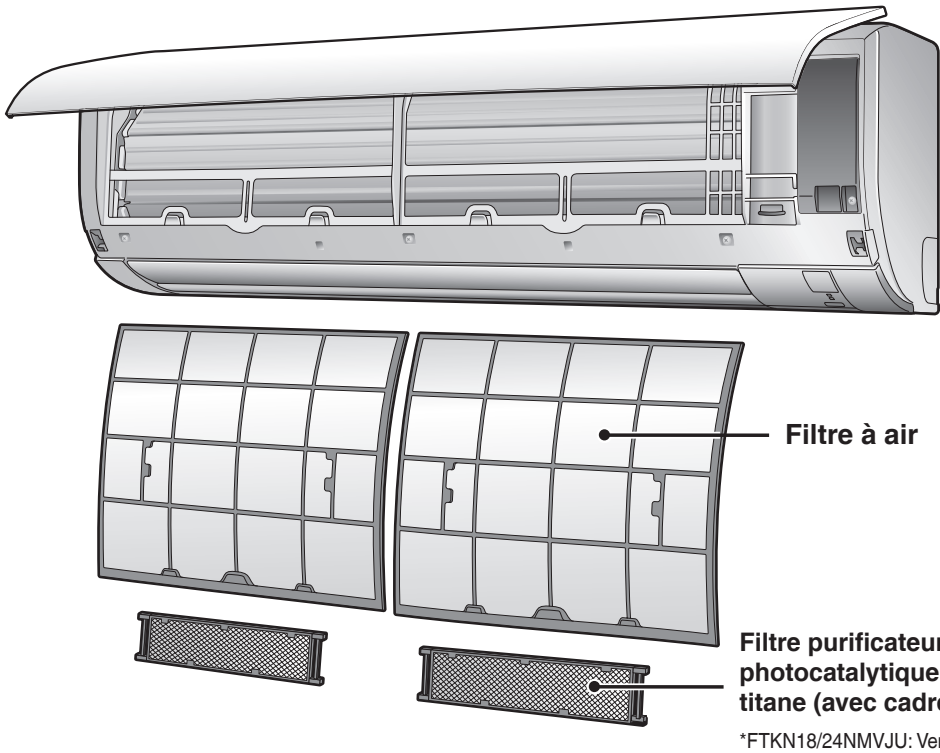
Témoin MINUTERIE (orange)
▶Page 17,18

Interrupteur MARCHE/ARRÊT de l'unité intérieure
- Appuyez sur cet interrupteur pour démarrer le fonctionnement. Appuyez à nouveau pour l'arrêter.
- Pour le réglage du mode de fonctionnement, reportez-vous au tableau suivant.

Mode	Réglage de la température	Débit d'air
REFROIDISSEMENT	72°F (22°C)	AUTO

- Cet interrupteur peut être utilisé lorsqu'il n'y a pas de télécommande.

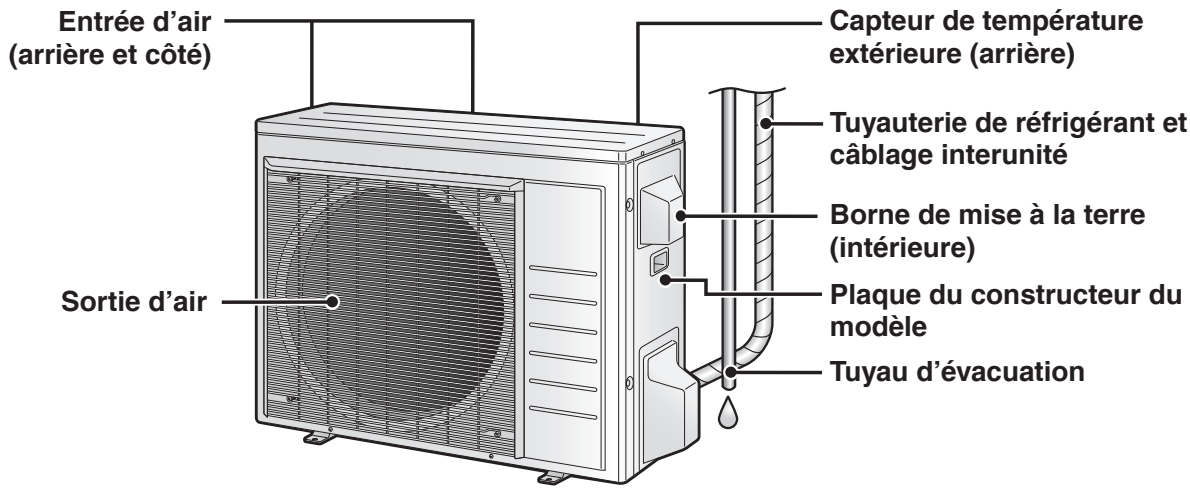
■ Ouvrez le panneau avant



*FTKN18/24NMVJU: Vendu séparément.

Unité extérieure

• L'apparence de l'unité extérieure peut différer entre les différents modèles.



Noms des pièces

Télécommande

Affichage (LCD)
- Affiche les réglages actuels. (Dans cette illustration, chaque section est représentée avec ses affichages allumés dans un but d'explication.)

Boutons fonctionnement direct
- Démarre les fonctionnements VENTILATEUR UNIQUEMENT, SEC ou REFROIDISSEMENT. ▶Page 11

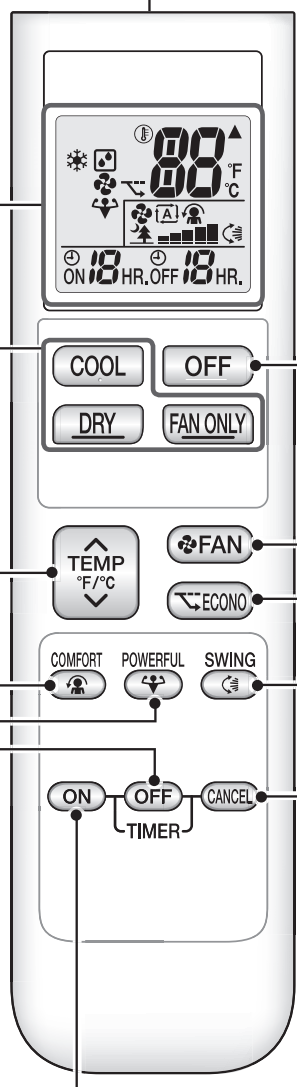
Bouton de réglage de la TEMPÉRATURE
- Modifie le réglage de la température. ▶Page 12

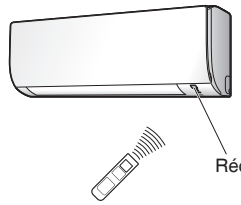
Bouton CONFORTABLE
- Fonctionnement FLUX D'AIR CONFORTABLE. ▶Page 15

Bouton PUISSANT
- Fonctionnement PUISSANT. ▶Page 15

Bouton ARRÊT MINUTERIE (mode RÉGLAGE NOCTURNE) ▶Page 18

Bouton MARCHE MINUTERIE ▶Page 17



Émetteur de signal


- Pour utiliser la télécommande, dirigez l'émetteur vers l'unité intérieure. Si quelque chose bloque les signaux entre l'unité et la télécommande, tel qu'un rideau, l'unité peut ne pas fonctionner.
- La distance de transmission maximale est d'environ 23ft (7m).

Bouton ARRÊT
- Arrête le fonctionnement. ▶Page 12

Bouton de réglage VENTILATEUR
- Sélectionne le réglage du débit d'air. ▶Page 13

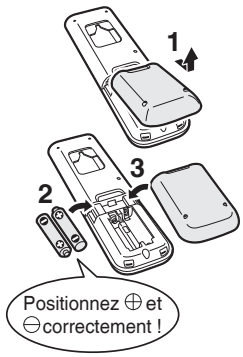
Bouton ÉCONO
- Fonctionnement ÉCONO. ▶Page 16

Bouton OSCILLATION
- Règle la direction du flux d'air. ▶Page 14

Bouton ANNULATION MINUTERIE
- Annule le réglage de la minuterie. ▶Page 17,18

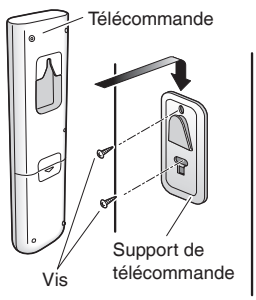
Unité	Télécommande	
FTK09/12/18/24NMVJU	ARC480A9	avec rétro-éclairage
FTKN09/12/18/24NMVJU	ARC480A7	sans rétro-éclairage

Préparation avant l'utilisation



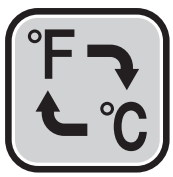
Pour insérer les piles

1. Retirez le couvercle arrière en le faisant glisser puis en le soulevant légèrement.
2. Insérez 2 piles sèches AAA.LR03 (alcaline).
3. Replacez le couvercle arrière.



Pour fixer le support de télécommande sur un mur

1. Choisissez un endroit où les signaux atteignent l'unité.
2. Fixez le support sur un mur, un pilier ou à un endroit similaire avec les vis fournies avec le support.
3. Accrochez la télécommande sur le support de télécommande.



Interrupteur d'affichage Fahrenheit/Celsius

- Appuyez simultanément sur TEMP °F/°C et sur ON (bouton MINUTERIE) pendant environ 5 secondes.
  - La température s'affichera en degrés Celsius si elle s'affiche actuellement en degrés Fahrenheit, et vice versa.
  - Le fonctionnement de l'interrupteur n'est possible que lorsque la température est en cours d'affichage.

Activez le disjoncteur

- Après la mise sous tension, le clapet de l'unité intérieure s'ouvre et se ferme une fois pour définir la position de référence.

REMARQUE

Remarques à propos des piles

- Lors du remplacement des piles, utilisez des piles du même type et remplacez les deux piles usagées ensemble.
- Les piles ont une durée de vie d'environ 1 an. Toutefois, si l'affichage de la télécommande commence à s'estomper et que la portée de transmission devient plus courte au fil de l'année, remplacez les deux piles par des nouvelles, de taille AAA.LR03 (alcaline).
- Les piles fournies avec la télécommande sont destinées au fonctionnement initial. Les batteries peuvent s'épuiser en moins d'1 an.

Remarque à propos de la télécommande

- Ne faites pas tomber la télécommande. Ne la mouillez pas.

Fonction de changement d'affichage Fahrenheit/Celsius de la télécommande

- La température réglée peut augmenter lorsque l'affichage passe des degrés Celsius aux degrés Fahrenheit, due à un arrondi de 0,5°C.
- Exemple: Une température réglée à 65°F (équivalent à 18,5°C) est convertie à 19°C.
  Lorsque l'affichage repasse en Fahrenheit, la température réglée est convertie à 66°F (équivalent à 19°C) au lieu de la température réglée à l'origine (65°F) mais une température réglée à 66°F (équivalent à 19°C) sera convertie à 19°C, sans modification de la température.
- Un son de réception retentit à la transmission de la température réglée de l'unité intérieure au moment du réglage de la fonction de modification de l'affichage Fahrenheit/Celsius.

Fonctionnement REFROIDISSEMENT · SEC · VENTILATEUR UNIQUEMENT

Le climatiseur fonctionne dans le mode de fonctionnement de votre choix.

Pour démarrer le fonctionnement

Fonctionnement REFROIDISSEMENT

• Pour abaisser la température.

Appuyez sur COOL .

Fonctionnement SEC

• Pour abaisser l'humidité.

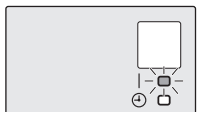
Appuyez sur DRY .

Fonctionnement VENTILATEUR UNIQUEMENT

• Pour faire circuler l'air dans la pièce.

Appuyez sur FAN ONLY .

• Le témoin de FONCTIONNEMENT s'allume en vert.

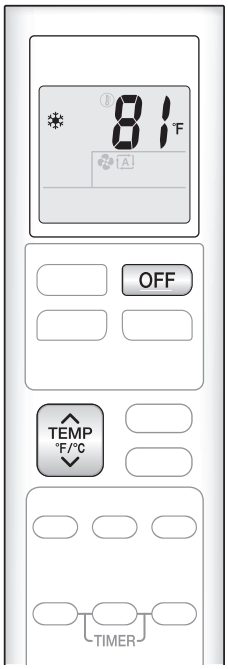


Affichage

REMARQUE

Remarque à propos du fonctionnement SEC

• Élimine l'humidité tout en maintenant autant que possible la température intérieure. Il contrôle automatiquement la température et le débit d'air, le réglage manuel de ces fonctions n'est donc pas disponible.



Pour arrêter le fonctionnement

Appuyez sur OFF.

- Le témoin de FONCTIONNEMENT s'éteint.

Pour modifier le réglage de la température

Appuyez sur TEMP °F/°C.

- Appuyez sur ^ pour augmenter la température et appuyez sur v pour abaisser la température.

Fonctionnement REFROIDISSEMENT	Fonctionnement SEC ou VENTILATEUR UNIQUEMENT
64-90°F (18-32°C)	Le réglage de la température ne peut pas être modifié.

Conseils pour économiser l'énergie

Maintenir le réglage de la température à un niveau modéré permet d'économiser de l'énergie.

- Réglage de la température recommandé
  – Pour le refroidissement: 78-82°F (26-28°C)

Couvrez les fenêtres avec un store ou un rideau.

- Bloquer les rayons du soleil et l'arrivée d'air en provenance de l'extérieur augmente l'effet de refroidissement.

Maintenez les filtres à air propres.

- Des filtres à air encrassés provoquent un fonctionnement inefficace et un gaspillage d'énergie. Nettoyez-les une fois toutes les 2 semaines. ▶Page 20, 23

Si vous n'utilisez pas le climatiseur pendant une longue période, par exemple au printemps ou en automne, coupez le disjoncteur.

- Le climatiseur consomme toujours une faible quantité d'électricité même s'il ne fonctionne pas.

Réglage du débit d'air

Vous pouvez régler le débit d'air pour augmenter votre confort.

Pour ajuster le réglage du débit d'air

Appuyez sur FAN .

- À chaque fois que vous appuyez sur FAN, le réglage du débit d'air change en séquence.

- Lorsque le débit d'air est réglé sur " ", un fonctionnement silencieux démarre et le bruit de l'unité intérieure s'atténue.
- En mode de fonctionnement silencieux, le débit d'air est réglé sur un niveau faible.

Fonctionnement REFROIDISSEMENT et VENTILATEUR UNIQUEMENT	Fonctionnement SEC
	Le réglage du débit d'air ne peut pas être modifié.

REMARQUE

Remarque à propos du réglage du débit d'air

- Pour les petits débits d'air, l'effet de refroidissement est également plus faible.

Réglage de la direction du flux d'air

Vous pouvez régler la direction du flux d'air pour augmenter votre confort.

⚠ ATTENTION

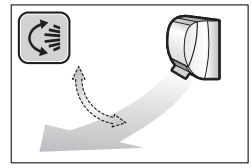
- Utilisez toujours une télécommande pour régler les angles du clapet. Forcer le déplacement du clapet à la main peut entraîner un dysfonctionnement.
- Soyez prudent lorsque vous réglez les aérateurs. À l'intérieur de la sortie d'air, un ventilateur tourne à une vitesse élevée.

Pour démarrer l'oscillation automatique

Direction du flux d'air vers le haut et vers le bas

Appuyez sur SWING .

- " " s'affiche sur l'écran LCD.
- Le clapet (lame horizontale) commence à osciller.



Pour régler le clapet à la position désirée

- Cette fonction est efficace lorsque le clapet est en mode d'oscillation automatique.

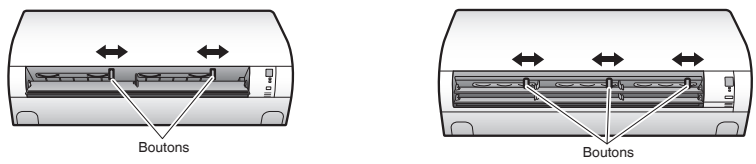
Appuyez sur SWING lorsque le clapet atteint la position désirée.

- " " disparaît de l'écran LCD.

Pour régler les aérateurs à la position désirée

Maintenez les boutons et déplacez les aérateurs (lames verticales).

FTK09NMVJU / FTK12NMVJU FTKN09NMVJU / FTKN12NMVJU	FTK18NMVJU / FTK24NMVJU FTKN18NMVJU / FTKN24NMVJU

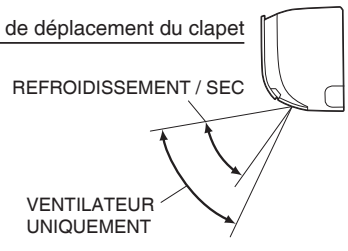


REMARQUE

Remarques à propos du réglage de la direction du flux d'air

- La plage de déplacement du clapet varie en fonction du mode de fonctionnement.
- Le volet s'arrête à la position supérieure lorsque le débit d'air est ralenti lors du réglage de l'oscillation vers le haut et vers le bas.

Plage de déplacement du clapet



Fonctionnement FLUX D'AIR CONFORTABLE

La direction de l'air et le débit sont réglés de telle sorte que l'air ne souffle pas directement sur les personnes dans la pièce.

Pour démarrer le fonctionnement FLUX D'AIR CONFORTABLE

Appuyez sur COMFORT .

- " " s'affiche sur l'écran LCD.

	Fonctionnement SEC et REFROIDISSEMENT
Direction du clapet	Monte
Débit d'air	AUTO

- Non disponible en mode VENTILATEUR UNIQUEMENT.

Pour annuler le fonctionnement FLUX D'AIR CONFORTABLE

Appuyez à nouveau sur COMFORT .

- " " disparaît de l'écran LCD.
- Le clapet revient à la position mémorisée avant le fonctionnement FLUX D'AIR CONFORTABLE.

Fonctionnement PUISSANT

Le fonctionnement PUISSANT maximise rapidement l'effet de refroidissement dans n'importe quel mode de fonctionnement. Dans ce mode, le climatiseur fonctionne à sa capacité maximale.

Pour démarrer le fonctionnement PUISSANT

Appuyez sur POWERFUL .

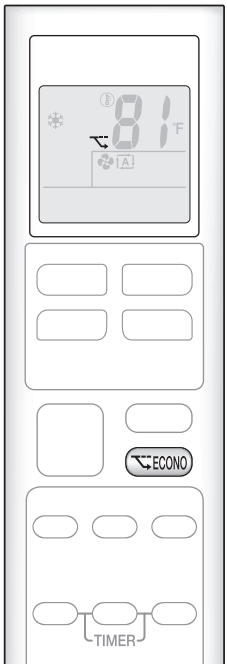
- " " s'affiche sur l'écran LCD.
- Le fonctionnement PUISSANT se termine dans 20 minutes. Le système refonctionne ensuite à nouveau automatiquement avec les réglages précédents, utilisés avant le fonctionnement PUISSANT.

Pour annuler le fonctionnement PUISSANT

Appuyez à nouveau sur POWERFUL .

- " " disparaît de l'écran LCD.

Fonctionnement ÉCONO



Le fonctionnement ÉCONO permet un fonctionnement efficace en limitant au maximum la consommation d'énergie.
Cette fonction est utile pour empêcher le disjoncteur de se déclencher lorsque l'unité fonctionne en parallèle avec d'autres appareils sur le même circuit.

Pour démarrer le fonctionnement ÉCONO

Appuyez sur ECONO .

- " " s'affiche sur l'écran LCD.
- Non disponible en mode VENTILATEUR UNIQUEMENT.

Pour annuler le fonctionnement ÉCONO

Appuyez à nouveau sur ECONO .

- " " disparaît de l'écran LCD.

REMARQUE

Remarque à propos du fonctionnement FLUX D'AIR CONFORTABLE
- Si la direction du flux d'air de haut en bas est sélectionnée, le mode FLUX D'AIR CONFORTABLE est annulé.

Remarques à propos du fonctionnement PUISSANT
- Appuyer sur OFF annule les réglages, et " " disparaît de l'écran LCD.
- Le fonctionnement PUISSANT n'augmente pas la capacité du climatiseur si le climatiseur fonctionne déjà à sa capacité maximale démontrée.

– En fonctionnement REFROIDISSEMENT
Pour maximiser l'effet de refroidissement, la capacité de l'unité extérieure augmente et le débit d'air se fixe au réglage maximum.
Le réglage de la température ne peut pas être modifié.

– Dans le fonctionnement SEC
Le réglage de la température est abaissé de 4,5°F (2,5°C) et le débit d'air est légèrement augmenté.

– En fonctionnement VENTILATEUR UNIQUEMENT
Le débit d'air est fixé à la valeur maximale.

Remarques à propos du fonctionnement ÉCONO
- Appuyer sur OFF annule les réglages, et " " disparaît de l'écran LCD.
- Si le niveau de la consommation d'énergie est déjà bas, le passage au fonctionnement ÉCONO ne réduit pas la consommation d'énergie.

Certaines fonctions utiles peuvent être utilisées simultanément.

FLUX D'AIR CONFORTABLE + ÉCONO	Disponible
PUISSANT + FLUX D'AIR CONFORTABLE	Non disponible*
PUISSANT + ÉCONO	Non disponible*

* La priorité est donnée à la fonction du bouton sur lequel vous avez appuyé en dernier.

Fonctionnement MINUTERIE MARCHE/ ARRÊT

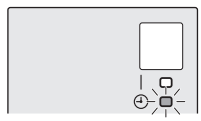
Les fonctions de la minuterie sont utiles pour allumer ou éteindre automatiquement le climatiseur la nuit ou le matin. Vous pouvez également utiliser simultanément MARCHE MINUTERIE et ARRÊT MINUTERIE.

Pour utiliser le fonctionnement MARCHE MINUTERIE

Appuyez sur ON .

ON 1HR. “ ON 1HR. ” s'affiche sur l'écran LCD.

- Chaque pression sur ON avance le réglage du temps d'1 heure. Le temps peut être réglé entre 1 et 12 heures.
- Le témoin de MINUTERIE s'allume en orange.



Affichage

Pour annuler le fonctionnement MARCHE MINUTERIE

Appuyez sur CANCEL .

- “ ON 1HR. ” disparaît de l'écran LCD.
- Le témoin de MINUTERIE s'éteint.

REMARQUE

Dans les cas suivants, réglez à nouveau la minuterie.

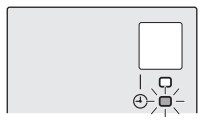
- Après que le disjoncteur a été désactivé.
- Après une panne de courant.
- Après avoir remplacé les piles de la télécommande.

Pour utiliser le fonctionnement ARRÊT MINUTERIE

Appuyez sur OFF .

OFF 1HR. “ OFF 1HR. ” s'affiche sur l'écran LCD.

- Chaque pression sur OFF avance le réglage du temps d'1 heure.
  Le temps peut être réglé entre 1 et 12 heures.
- Le témoin de MINUTERIE s'allume en orange.



Affichage

Pour annuler le fonctionnement ARRÊT MINUTERIE

Appuyez sur CANCEL .

- “ OFF 1HR. ” disparaît de l'écran LCD.
- Le témoin de MINUTERIE s'éteint.

Pour combiner les fonctionnements MARCHE MINUTERIE et ARRÊT MINUTERIE

- Un réglage d'échantillon pour combiner les 2 minuteries est illustré ci-dessous.
- “ ON ” et “ OFF ” s'affichent sur l'écran LCD.

[Exemple]

ON 8HR. OFF 1HR.

Lors du réglage lorsque l'unité est en marche
- Arrête l'unité 1 heure plus tard et la démarre 7 heures après.

ON 2HR. OFF 5HR.

Lors du réglage lorsque l'unité est arrêtée
- Arrête l'unité 2 heures plus tard et la démarre 3 heures après.

REMARQUE

Mode RÉGLAGE NOCTURNE
- Lorsque ARRÊT MINUTERIE est réglé, le climatiseur ajuste automatiquement le réglage de la température (de plus 0,9°F (0,5°C)) dans REFROIDISSEMENT afin d'éviter un refroidissement excessif pendant les heures de sommeil.

Entretien et nettoyage

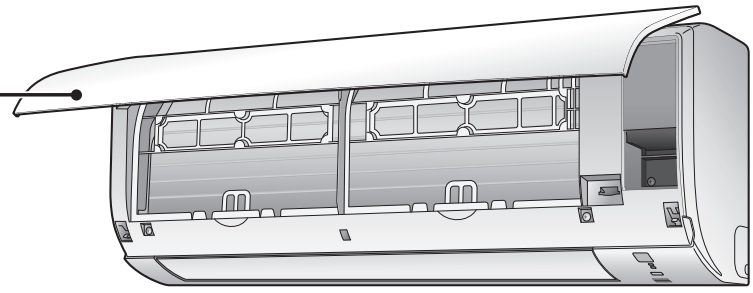
FTK09NMVJU / FTK12NMVJU / FTKN09NMVJU / FTKN12NMVJU

⚠ ATTENTION

- Avant le nettoyage, assurez-vous d'arrêter le fonctionnement et de couper le disjoncteur.
- Ne touchez pas les ailettes en aluminium de l'unité intérieure. Vous pouvez vous blesser si vous touchez ces pièces.

■ Guide de référence rapide

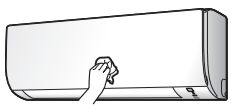
Nettoyage des pièces



Panneau avant

- Essuyez-le avec un chiffon doux et humide.
- Seul un détergent neutre peut être utilisé.

Si sale

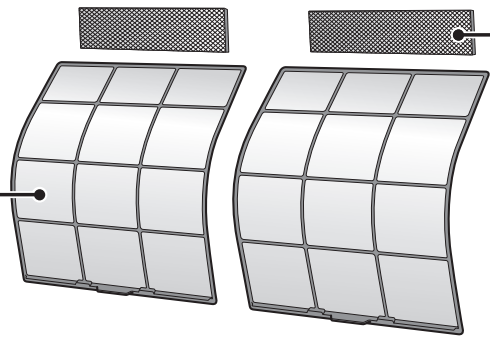


Filtre à air

- Aspirez la poussière ou lavez le filtre.

Une fois toutes les 2 semaines

▶Page 20



Unité intérieure, unité extérieure et télécommande

- Essuyez-les avec un chiffon doux et humide.

Si sale

Filtre purificateur d'air photocatalytique à apatite de titane (sans cadre)*

- Aspirez la poussière ou remplacez le filtre.

[Nettoyage]

Une fois tous les 6 mois

▶Page 21

[Remplacement]

Une fois tous les 3 ans

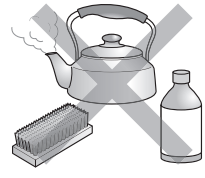
▶Page 21

*FTKN09/12NMVJU: Vendu séparément.

REMARQUE

Pour le nettoyage, n'utilisez aucune des méthodes suivantes:

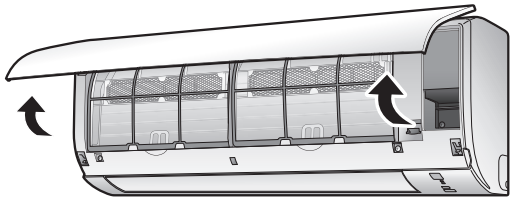
- De l'eau chaude à plus de 104°F (40°C)
- Du liquide volatile tel que du benzène, de l'essence et du diluant
- De la cire
- Des matériaux rugueux tels qu'une brosse de lavage



■ Filtre à air

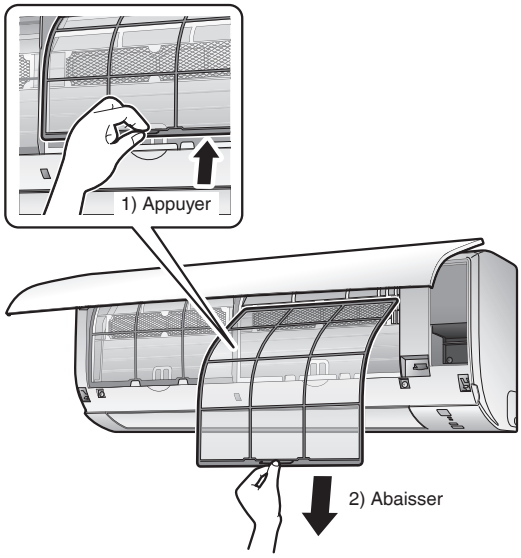
1. Ouvrez le panneau avant.

• Tenez le panneau avant par les côtés et ouvrez-le.



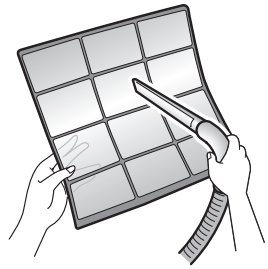
2. Retirez les filtres à air.

• Poussez légèrement vers le haut la languette du filtre au centre de chaque filtre à air, puis tirez-la vers le bas.



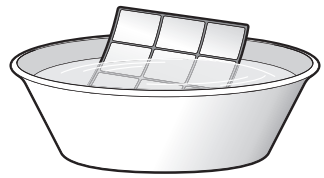
3. Lavez les filtres à air avec de l'eau ou nettoyez-les avec un aspirateur.

• Il est recommandé de nettoyer les filtres à air toutes les 2 semaines.



Si la poussière ne part pas facilement

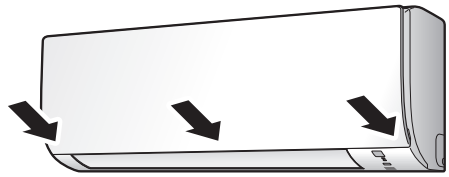
• Lavez les filtres à air avec du détergent neutre dilué avec de l'eau tiède, puis faites-les sécher à l'abri du soleil.



4. Remettez les filtres.

5. Fermez lentement le panneau avant.

• Appuyez sur le panneau des deux côtés et au centre.



• Assurez-vous que le panneau avant est bien fixé.

Entretien et nettoyage

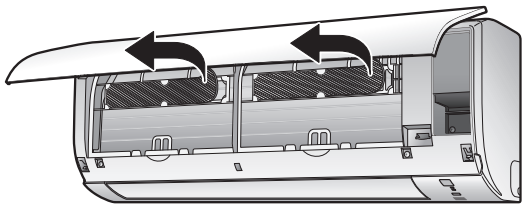
FTK09NMVJU / FTK12NMVJU / FTKN09NMVJU / FTKN12NMVJU

■ Filtre purificateur d'air photocatalytique à apatite de titane

1. **Ouvrez le panneau avant et retirez les filtres à air.** ▶Page 20

2. **Retirez les filtres purificateurs d'air photocatalytique à apatite de titane.**

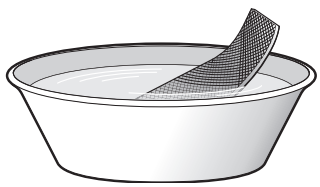
• Retirez les filtres des languettes.



3. **Nettoyez ou remplacez les filtres purificateurs d'air photocatalytique à apatite de titane.**

[Nettoyage]

3-1 Aspirez la poussière et trempez dans l'eau tiède ou dans l'eau pendant environ 10 à 15 minutes si très sale.

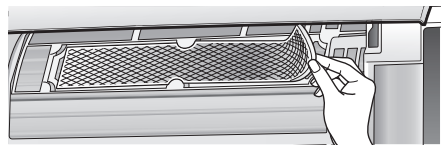


3-2 Après le lavage, secouez l'eau restante et laissez-les sécher à l'abri du soleil.

• Ne pas tordre le filtre pour enlever l'eau.

[Remplacement]

Retirez le filtre des languettes et préparez-en un nouveau.



• Mettez l'ancien filtre au rebut avec les déchets incombustibles.

4. **Insérez les filtres purificateurs d'air photocatalytique à apatite de titane comme ils l'étaient.**

• Lors de la fixation du filtre, vérifiez qu'il est placé correctement dans les languettes.

5. **Remettez les filtres.** ▶Page 20

6. **Fermez lentement le panneau avant.** ▶Page 20

REMARQUE

• Fonctionnement avec des filtres sales:
– ne peut désodoriser l'air,
– ne peut nettoyer l'air,
– pauvres résultats en matière de refroidissement,
– peut entraîner des odeurs.
• Mettez les anciens filtres au rebut avec les déchets incombustibles.
• Pour commander un filtre purificateur d'air photocatalytique à apatite de titane, contactez le revendeur auquel vous avez acheté le climatiseur.

Élément	Filtre purificateur d'air photocatalytique à apatite de titane 1 jeu
Pièce n°	KAF970A46 (sans cadre)

Entretien et nettoyage

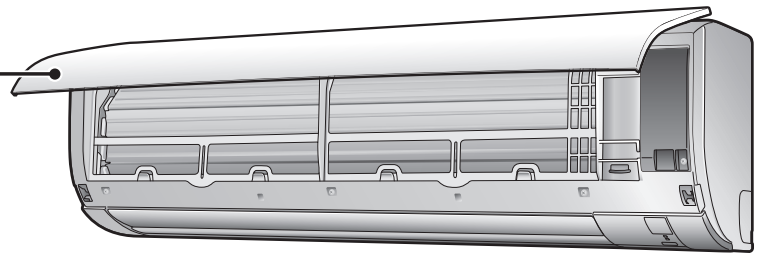
FTK18NMVJU / FTK24NMVJU / FTKN18NMVJU / FTKN24NMVJU

⚠ ATTENTION

- Avant le nettoyage, assurez-vous d'arrêter le fonctionnement et de couper le disjoncteur.
- Ne touchez pas les ailettes en aluminium de l'unité intérieure. Vous pouvez vous blesser si vous touchez ces pièces.

■ Guide de référence rapide

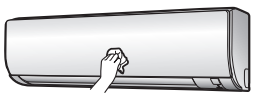
Nettoyage des pièces



Panneau avant

- Essuyez-le avec un chiffon doux et humide.
- Seul un détergent neutre peut être utilisé.

Si sale



Filtre à air

- Aspirez la poussière ou lavez le filtre.

Une fois toutes les 2 semaines

▶Page 23

Unité intérieure, unité extérieure et télécommande

- Essuyez-les avec un chiffon doux et humide.

Si sale

Filtre purificateur d'air photocatalytique à apatite de titane (avec cadre)*

- Aspirez la poussière ou remplacez le filtre.

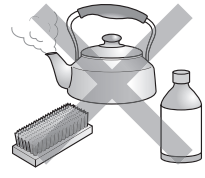
[Nettoyage]	[Remplacement]
Une fois tous les 6 mois	Une fois tous les 3 ans
▶Page 24	▶Page 24

*FTKN18/24NMVJU: Vendu séparément.

REMARQUE

Pour le nettoyage, n'utilisez aucune des méthodes suivantes:

- De l'eau chaude à plus de 104°F (40°C)
- Du liquide volatile tel que du benzène, de l'essence et du diluant
- De la cire
- Des matériaux rugueux tels qu'une brosse de lavage



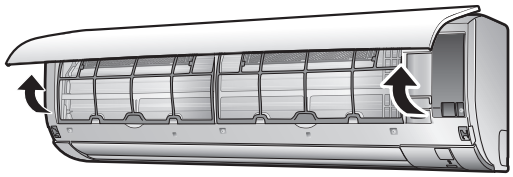
Entretien et nettoyage

FTK18NMVJU / FTK24NMVJU / FTKN18NMVJU / FTKN24NMVJU

■ Filtre à air

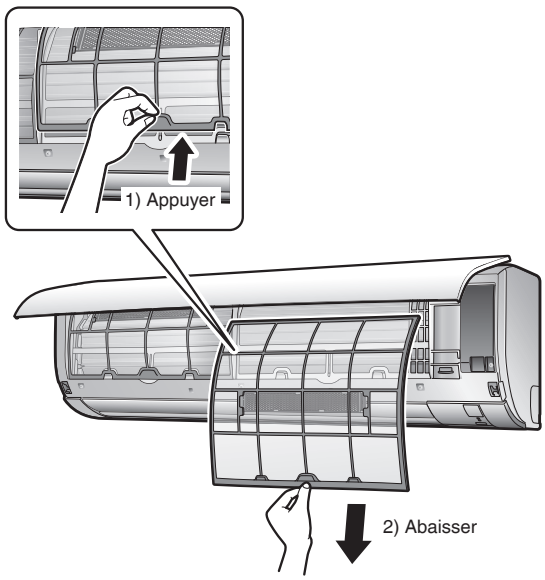
1. Ouvrez le panneau avant.

• Tenez le panneau avant par les côtés et ouvrez-le.



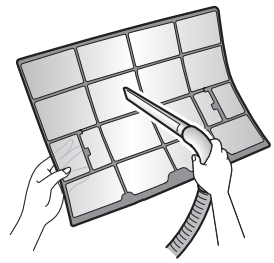
2. Retirez les filtres à air.

• Poussez légèrement vers le haut la languette du filtre au centre de chaque filtre à air, puis tirez-la vers le bas.



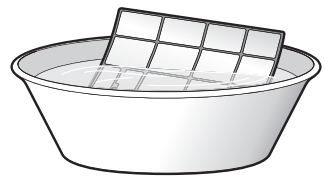
3. Lavez les filtres à air avec de l'eau ou nettoyez-les avec un aspirateur.

• Il est recommandé de nettoyer les filtres à air toutes les 2 semaines.



Si la poussière ne part pas facilement

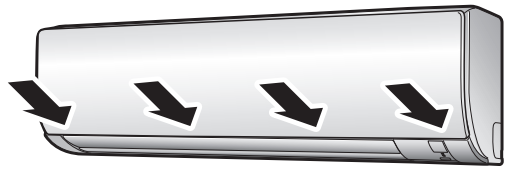
• Lavez les filtres à air avec du détergent neutre dilué avec de l'eau tiède, puis faites-les sécher à l'abri du soleil.
• Assurez-vous de retirer le filtre purificateur d'air photocatalytique à apatite de titane. Reportez-vous à "**Filtre purificateur d'air photocatalytique à apatite de titane**" à la page suivante.



4. Remettez les filtres.

5. Fermez lentement le panneau avant.

• Appuyez sur le panneau avant des deux côtés et dans la zone centrale.



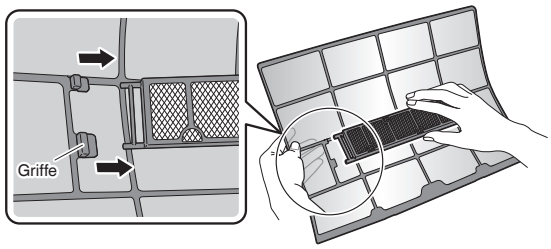
• Assurez-vous que le panneau avant est bien fixé.

■ Filtre purificateur d'air photocatalytique à apatite de titane

1. Ouvrez le panneau avant et retirez les filtres à air. Page 23

2. Retirez les filtres purificateurs d'air photocatalytique à apatite de titane.

- Tenez les parties évidées du cadre et décrochez les 4 griffes.

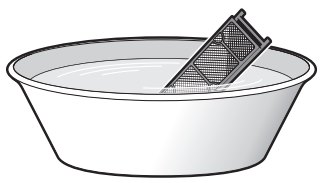


3. Nettoyez ou remplacez les filtres purificateurs d'air photocatalytique à apatite de titane.

[Nettoyage]

3-1 Aspirez la poussière et trempez dans l'eau tiède ou dans l'eau pendant environ 10 à 15 minutes si très sale.

- N'enlevez pas le filtre du cadre lors du lavage avec de l'eau.



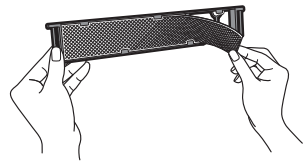
3-2 Après le lavage, secouez l'eau restante et laissez-les sécher à l'abri du soleil.

- Ne pas tordre le filtre pour enlever l'eau.

[Remplacement]

Retirez le filtre du cadre du filtre et préparez-en un nouveau.

- Ne jetez pas le cadre du filtre. Réutilisez le cadre du filtre lors du remplacement du filtre purificateur d'air photocatalytique à apatite de titane.



- Mettez l'ancien filtre au rebut avec les déchets incombustibles.

4. Insérez les filtres purificateurs d'air photocatalytique à apatite de titane comme ils l'étaient.

- Lors de la fixation du filtre, vérifiez qu'il est placé correctement dans les languettes.

5. Remettez les filtres. Page 23

6. Fermez lentement le panneau avant. Page 23

REMARQUE

- Fonctionnement avec des filtres sales:
  – ne peut désodoriser l'air,
  – ne peut nettoyer l'air,
  – pauvres résultats en matière de refroidissement,
  – peut entraîner des odeurs.
- Mettez les anciens filtres au rebut avec les déchets incombustibles.
- Pour commander un filtre purificateur d'air photocatalytique à apatite de titane, contactez le revendeur auquel vous avez acheté le climatiseur.

Élément	Filtre purificateur d'air photocatalytique à apatite de titane 1 jeu
Pièce n°	KAF970A46 (sans cadre)
	KAF970A45 (avec cadre)*

* Pour les clients qui utilisent le FTKN18/24NMVJU, veuillez acheter le KAF970A45 (avec cadre) lors de votre achat initial.

Entretien et nettoyage

Tous les modèles

■ Avant une longue période de non-utilisation

1. Faites fonctionner le mode VENTILATEUR UNIQUEMENT pendant plusieurs heures pour sécher l'intérieur.

• Appuyez sur FAN ONLY .

2. Après l'arrêt du fonctionnement, coupez le disjoncteur pour le climatiseur de la pièce.

3. Retirez les piles de la télécommande.

■ Nous recommandons un entretien périodique

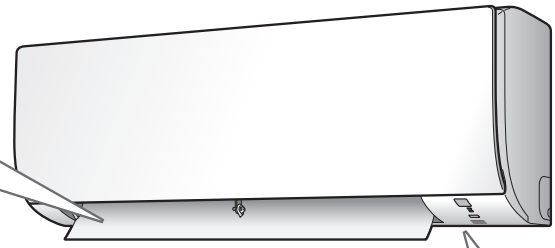
• Dans certaines conditions de fonctionnement, l'intérieur du climatiseur peut s'encrasser après plusieurs saisons d'utilisation, entraînant de mauvaises performances. Il est recommandé de faire réaliser un entretien périodique par un entrepreneur qualifié en complément du nettoyage régulier effectué par l'utilisateur.
• Pour faire assurer un entretien par un entrepreneur qualifié, veuillez contacter le revendeur auquel vous avez acheté le climatiseur.

FAQ

Unité intérieure

Le clapet ne commence pas à osciller immédiatement.

- Le climatiseur règle la position du clapet. Le clapet va commencer à bouger.



Le fonctionnement ne démarre pas immédiatement.

- **Lorsque vous appuyez sur n'importe quel bouton de fonctionnement direct peu de temps après avoir arrêté le fonctionnement.**
- **Lorsque le mode a été resélectionné.**
  - Cela permet de protéger le climatiseur. Vous devez attendre environ 3 minutes.

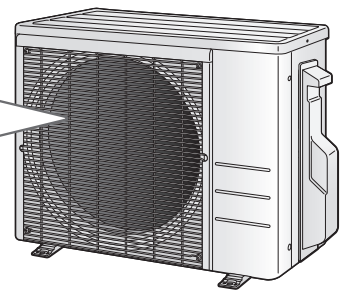
Différents sons se font entendre.

- **Un son comme de l'eau qui coule**
  - Ce son est produit par le réfrigérant qui circule dans le climatiseur.
  - Il s'agit d'un bruit de pompage de l'eau dans le climatiseur qui peut être entendu lorsque l'eau est pompée à partir du climatiseur pendant le fonctionnement REFROIDISSEMENT ou SEC.
- **Tic-tac**
  - Ce bruit est généré lorsque l'armoire et le cadre du climatiseur sont légèrement dilatés ou se contractent en raison des variations de température.
- **Cliquètement pendant le fonctionnement ou le temps d'inactivité**
  - Ce son est généré lorsque les vannes de commande du réfrigérant ou les pièces électriques fonctionnent.
- **Léger battement**
  - Ce son est perceptible à partir de l'intérieur du climatiseur lorsque le ventilateur d'échappement est activé alors que les portes de la pièce sont fermées. Ouvrez la fenêtre ou désactivez le ventilateur d'échappement.

Unité extérieure

L'unité extérieure répand de l'eau.

- **En fonctionnement REFROIDISSEMENT ou SEC**
  - L'humidité dans l'air se condense en eau sur la surface froide de la tuyauterie de l'unité extérieure et coule goutte à goutte.



Dépannage

Avant de faire une demande de renseignements ou de réparation, veuillez vérifier les points suivants.
Si le problème persiste, consultez votre revendeur.

Ce n'est pas un problème
Ce cas n'est pas un problème.

Vérifiez
Veuillez vérifier à nouveau avant de demander des réparations.

Le climatiseur ne fonctionne pas

Cas	Description / ce qu'il faut vérifier
Le témoin de FONCTIONNEMENT est éteint.	• Le disjoncteur s'est-il déclenché ou le fusible a-t-il grillé? • Y a-t-il une coupure de courant? • Les piles sont-elles installées dans la télécommande?
Le témoin de FONCTIONNEMENT clignote.	• Coupez l'alimentation avec le disjoncteur et redémarrez le fonctionnement avec la télécommande. Si le témoin de FONCTIONNEMENT clignote encore, vérifiez le code d'erreur et contactez votre revendeur. ▶Page 30

Le climatiseur s'arrête soudain de fonctionner

Cas	Description / ce qu'il faut vérifier
Le témoin de FONCTIONNEMENT est allumé.	• Pour protéger le système, le climatiseur peut s'arrêter de fonctionner après d'importantes et soudaines variations de tension. Il reprend automatiquement son fonctionnement après environ 3 minutes.
Le témoin de FONCTIONNEMENT clignote.	• Y a t-il quelque chose qui obstrue l'entrée d'air ou la sortie d'air de l'unité intérieure ou de l'unité extérieure? Arrêtez le fonctionnement et après avoir coupé le disjoncteur, retirez ce qui bloque le passage. Redémarrez ensuite le fonctionnement avec la télécommande. Si le témoin de FONCTIONNEMENT clignote encore, vérifiez le code d'erreur et contactez votre revendeur. ▶Page 30

Le climatiseur ne cesse pas de fonctionner

Cas	Description / ce qu'il faut vérifier
Le climatiseur continue de fonctionner même après que le fonctionnement soit arrêté.	■ **Immédiatement après que le climatiseur soit arrêté** • Le ventilateur de l'unité extérieure continue de tourner pendant environ encore 1 minute pour protéger le système. ■ **Bien que le climatiseur ne soit pas en fonctionnement** • Lorsque la température extérieure est élevée, le ventilateur de l'unité extérieure peut se mettre à tourner pour protéger le système.

La pièce ne se rafraîchit pas

Cas	Description / ce qu'il faut vérifier
L'air ne sort pas / L'air sort.	■ **Le réglage du débit d'air est-il approprié?** • Le réglage du débit d'air est-il bas, comme l' “Unité intérieure silencieuse” ou le “Débit d'air 1”? Augmentez le réglage du débit d'air. ■ **La température réglée est-elle appropriée?** ■ **Le réglage de la direction du flux d'air est-il approprié?**
L'air sort.	• Y a t-il du mobilier directement sous ou à côté de l'unité intérieure? • Le climatiseur est-il en fonctionnement ÉCONO? ▶Page 16 • Les filtres à air sont-ils sales? • Y a t-il quelque chose qui obstrue l'entrée d'air ou la sortie d'air de l'unité intérieure ou de l'unité extérieure? • Une fenêtre ou une porte est-elle ouverte? • Un ventilateur d'échappement tourne-t-il?

Du brouillard s'échappe

Cas	Description / ce qu'il faut vérifier
Du brouillard s'échappe de l'unité intérieure.	☑ • Cela se produit lorsque l'air de la pièce est rafraîchi et transformé en brouillard par le flux d'air froid pendant le fonctionnement REFROIDISSEMENT ou tout autre fonctionnement.

Télécommande

Cas	Description / ce qu'il faut vérifier
L'unité ne reçoit pas de signaux de la télécommande ou présente une plage de fonctionnement limitée.	☑ • Les piles sont épuisées. Remplacez les deux piles par des piles sèches neuves AAA.LR03 (alcaline). Pour plus de détails, reportez-vous à “**Préparation avant l’utilisation**”. ▶Page 10 • La communication du signal peut être désactivée si une lampe fluorescente de type démarreur électronique (comme un témoin d’onduleur) se trouve dans la pièce. Consultez votre revendeur si tel est le cas. • La télécommande peut ne pas fonctionner correctement si l'émetteur est exposé à la lumière directe du soleil.
L'affichage LCD est faible, ne fonctionne pas, ou l'affichage est irrégulier.	☑ • Les piles sont épuisées. Remplacez les deux piles par des piles sèches neuves AAA.LR03 (alcaline). Pour plus de détails, reportez-vous à “**Préparation avant l’utilisation**”. ▶Page 10
D'autres appareils électriques commencent à fonctionner.	☑ • Si la télécommande active d'autres appareils électriques, déplacez-les ou consultez votre revendeur.

L'air a une odeur

Cas	Description / ce qu'il faut vérifier
Le climatiseur dégage une odeur.	☑ • L'odeur ambiante absorbée dans l'unité est évacuée avec le flux d'air. Nous vous recommandons de nettoyer l'unité intérieure. Veuillez consulter votre revendeur.

Autres

Cas	Description / ce qu'il faut vérifier
Le climatiseur se met soudain à se comporter bizarrement pendant le fonctionnement.	? • Le climatiseur peut ne pas fonctionner correctement à cause de la foudre ou de la radio. En cas de dysfonctionnement du climatiseur, mettez-le hors tension avec le disjoncteur et redémarrez le fonctionnement avec la télécommande.

Remarques à propos des conditions de fonctionnement

- Si le fonctionnement se poursuit dans des conditions autres que celles énumérées dans le tableau,
  – Un dispositif de sécurité peut s'activer pour arrêter le fonctionnement.
  – De la condensation peut se former sur l'unité intérieure et s'égoutter quand le fonctionnement REFROIDISSEMENT ou SEC est sélectionné.

Mode	Conditions de fonctionnement
REFROIDISSEMENT / SEC	Température extérieure: 50-115°F (10-46°C) Température intérieure: 64-90°F (18-32°C) Humidité intérieure: 80% max.

Dépannage

■ Appelez immédiatement votre revendeur

⚠ AVERTISSEMENT

Lorsqu'une anomalie (comme une odeur de brûlé) se produit, arrêtez le fonctionnement et coupez le disjoncteur.
- Un fonctionnement continu dans des conditions anormales peut provoquer des dysfonctionnements, des électrocutions ou un incendie.
- Consultez le revendeur auquel vous avez acheté le climatiseur.

Ne tentez pas de réparer ou de modifier le climatiseur par vous-même.
- Un travail incorrect peut entraîner des électrocutions ou un incendie.
- Consultez le revendeur auquel vous avez acheté le climatiseur.

Si l'un des symptômes suivants apparaît, contactez immédiatement votre revendeur.

- **Le cordon d'alimentation est anormalement chaud ou endommagé.**
- **Un son anormal est entendu pendant le fonctionnement.**
- **Le disjoncteur, un fusible ou le disjoncteur différentiel arrête fréquemment le fonctionnement.**
- **Souvent, un commutateur ou un bouton ne fonctionne pas correctement.**
- **Il y a une odeur de brûlé.**
- **De l'eau fuit de l'unité intérieure.**

Coupez le disjoncteur et contactez votre revendeur.

■ Après une panne de courant
- Le climatiseur recommence à fonctionner automatiquement après environ 3 minutes. Vous devez juste patienter un moment.

■ Foudre
- S'il existe un risque que la foudre puisse frapper dans votre quartier, arrêtez le fonctionnement et coupez le disjoncteur pour protéger le système.

■ Conditions pour la mise au rebut

- Le démontage de l'unité, la manipulation du réfrigérant, de l'huile et d'autres pièces doivent être effectués en conformité avec les réglementations locales et nationales applicables.

■ Diagnostic d'erreur par la télécommande

• La télécommande peut recevoir les codes d'erreur de l'unité intérieure.

1. **Lorsque (CANCEL) est maintenu enfoncé pendant environ 5 secondes, “ 00 ” clignote dans la section d'affichage de la température.**

2. **Appuyez sur (CANCEL) de manière répétée jusqu'à ce qu'un bip retentisse en continu.**

• L'indication du code change comme indiqué ci-dessous, et vous avertit par un bip long.

	CODE	SIGNIFICATION
SYSTÈME	00	NORMAL
	UA	ERREUR D'ASSOCIATION DE L'UNITÉ EXTÉRIEURE-INTÉRIEURE
	U0	MANQUE DE RÉFRIGÉRANT
	U2	CHUTE DE TENSION OU CIRCUIT PRINCIPAL EN SURTENSION
	U4	PROBLÈME DE TRANSMISSION (ENTRE L'UNITÉ INTÉRIEURE ET L'UNITÉ EXTÉRIEURE)
UNITÉ INTÉRIEURE	A1	DÉFECTUOSITÉ DU PCB INTÉRIEUR
	A5	CONTRÔLE HAUTE PRESSION OU PROTECTEUR DE GEL
	A6	ERREUR DE MOTEUR DU VENTILATEUR
	C4	CAPTEUR DE TEMPÉRATURE DE L'ÉCHANGEUR DE CHAUFFAGE DÉFECTUEUX
	C9	CAPTEUR DE TEMPÉRATURE D'ASPIRATION D'AIR DÉFECTUEUX
UNITÉ EXTÉRIEURE	EA	ERREUR DU COMMUTATEUR CHAUFFAGE-REFROIDISSEMENT
	E1	ERREUR DE LA CARTE DE CIRCUITS
	E5	OL DÉMARRÉ
	E6	DÉMARRAGE DU COMPRESSEUR DÉFECTUEUX
	E7	ERREUR DE MOTEUR DU VENTILATEUR DC
	E8	ENTRÉE DE SURINTENSITÉ
	F3	CONTRÔLE DES TUYAUX D'ÉVACUATION HAUTE TEMPÉRATURE
	F6	CONTRÔLE HAUTE PRESSION (EN REFROIDISSEMENT)
	H0	ERREUR DE CAPTEUR
	H6	INTERRUPTION DE FONCTIONNEMENT DUE À UN CAPTEUR DE DÉTECTION DE POSITION DÉFECTUEUX
	H8	ERREUR DE CAPTEUR DE COURANT CC
	H9	CAPTEUR DE TEMPÉRATURE D'ASPIRATION D'AIR DÉFECTUEUX
	J3	CAPTEUR DE TEMPÉRATURE DES TUYAUX D'ÉVACUATION DÉFECTUEUX
	J6	CAPTEUR DE TEMPÉRATURE DE L'ÉCHANGEUR DE CHAUFFAGE DÉFECTUEUX
	L3	ERREUR DE CHAUFFAGE DES PIÈCES ÉLECTRIQUES
	L4	HAUTE TEMPÉRATURE AU NIVEAU DU RADIATEUR DU CIRCUIT DE L'INVERSEUR
	L5	SURINTENSITÉ DE SORTIE
	P4	CAPTEUR DE TEMPÉRATURE DU RADIATEUR DU CIRCUIT DE L'INVERSEUR DÉFECTUEUX

REMARQUE

• Un bip court indique les codes non correspondants.

• Pour annuler l'affichage du code, maintenez (CANCEL) enfoncé pendant environ 5 secondes. L'affichage du code s'efface également si vous n'appuyez sur aucun bouton pendant 1 minute.

Características

Contenidos

Español

Consideraciones de seguridad

- Lea atentamente estas **Consideraciones de seguridad** sobre la operación antes de instalar el equipo de aire acondicionado. Después de finalizar la instalación, asegúrese de que la unidad funciona correctamente durante la operación de puesta en marcha. Indique al cliente cómo accionar y mantener la unidad.
  Informe a los clientes de la necesidad de guardar este manual de operación junto con el manual de instalación para futuras consultas.
  Significados de **PELIGRO**, **ADVERTENCIA** y **PRECAUCIÓN** Símbolos:

⚠ **PELIGRO** ····· Indica una situación de riesgo inminente que, de no evitarse, causará lesiones graves o la muerte.

⚠ **ADVERTENCIA** ··· Indica una situación de riesgo potencial que, de no evitarse, podría causar lesiones graves o la muerte.

⚠ **PRECAUCIÓN** ··· Indica una situación de riesgo potencial que, de no evitarse, podría causar lesiones menores o moderadas. También podría usarse para alertar sobre prácticas inseguras.

⚠ PELIGRO

- En caso de fugas de refrigerante, consulte con su distribuidor. El gas refrigerante es más pesado que el aire y sustituye al oxígeno. Una fuga considerable podría causar la desaparición del oxígeno, especialmente en sótanos, y podría causar riesgos de asfixia resultantes en lesiones graves o la muerte.
- El gas refrigerante podría producir gases tóxicos al entrar en contacto con llamas, como por ejemplo un termoventilador, una estufa o un dispositivo de cocina. La exposición a dichos gases puede causar lesiones graves o la muerte.
- Cualquier anomalía en el funcionamiento del aire acondicionado, como por ejemplo humo o fuego, puede causar lesiones graves o la muerte.
  Desactive la alimentación y póngase en contacto con su distribuidor para solicitar asistencia.
- No instale la unidad en zonas en las que haya presentes materiales inflamables, ya que podrían suponer un riesgo de explosión y causar lesiones graves o la muerte.
- Si usa equipos con quemadores instalados en la misma habitación que la del aire acondicionado, existe el riesgo de que el oxígeno desaparezca y cause asfixia, provocando lesiones graves o la muerte.
  Asegúrese de ventilar la habitación adecuadamente para evitar dicho peligro.
- Deseche seguramente los materiales de embalaje.
  Los materiales de embalaje, como por ejemplo los clavos y otras piezas metálicas o de madera, pueden causar cortes u otras lesiones. Rompa y deseche las bolsas de plástico del embalaje para que los niños no puedan jugar con ellas. Si un niño juega con una bolsa de plástico, existe el riesgo de que muera por asfixia.

⚠ ADVERTENCIA

- No coloque sus dedos ni ningún otro objeto en la salida o entrada del aire, ya que el ventilador gira a gran velocidad y puede causar lesiones. Mantenga siempre a los niños alejados de la unidad durante la operación.
- No intente reparar, reubicar, modificar ni reinstalar el aire acondicionado usted mismo. Las tareas o modificaciones incorrectas pueden causar descargas eléctricas, incendios u otros daños.
  Para más información sobre las reparaciones y la reinstalación, contacte con su proveedor Daikin en busca de asesoramiento e información.
- No utilice ningún otro tipo de refrigerante que no sea el indicado en la unidad exterior (R410A) durante la instalación, desplazamiento o reparación. El uso de otro tipo de refrigerantes puede causar averías o daños en la unidad y lesiones físicas en la persona.
- No accione el aire acondicionado con las manos mojadas.
- Si el aire acondicionado no enfría correctamente, es posible que existan fugas de refrigerante; contacte con su proveedor autorizado o con un técnico cualificado.
  Al realizar reparaciones que requieran añadir refrigerante, consulte con su proveedor autorizado o con un técnico cualificado.
- No intente instalar el aire acondicionado por su cuenta. Una instalación incorrecta puede provocar fugas de agua, descargas eléctricas o un incendio. Para la instalación, consulte con su proveedor autorizado o con un técnico cualificado.

⚠ PRECAUCIÓN

- El aire acondicionado debe estar conectado a tierra. Una conexión a tierra incorrecta podría causar descargas eléctricas. No conecte el cable de puesta a tierra a tubos de gas, tuberías de agua, pararrayos ni a líneas de teléfono subterráneas. Respete los códigos eléctricos estatales y locales.
- No use esta unidad para enfriar instrumentos de precisión, alimentos, plantas, animales ni obras de arte.
- Nunca exponga a los niños, plantas o animales directamente al flujo de aire.
- No bloquee las salidas ni las entradas de aire. Un flujo de aire incorrecto podría causar un mal rendimiento del equipo o averías en el mismo.
- No se suba, siente ni coloque objetos pesados sobre la unidad exterior. Para evitar lesiones, no extraiga la protección del ventilador.
- No coloque nada que deba mantenerse alejado de la humedad debajo de las unidades exterior e interior, como por ejemplo equipos eléctricos y electrónicos. En ciertas circunstancias, la humedad del aire puede condensarse y gotear.
- Compruebe el soporte y accesorios de la unidad anualmente en busca de daños.
- No toque la entrada de aire ni las aletas de aluminio de la unidad exterior. Puede causar lesiones y/o daños sobre la superficie de transferencia de calor.

- Este aparato NO ha sido diseñado para ser utilizado por niños ni personas con discapacidades sin la supervisión adecuada.
- Deberá supervisar a los niños para garantizar que NO juegan con ni cerca del flujo de aire de este aparato.
- No tire del conducto ni cuelgue nada sobre él. De lo contario causará un incendio o descarga eléctrica.
- No toque las aletas del intercambiador térmico. Una manipulación incorrecta puede causar lesiones.
- No desactive la alimentación inmediatamente después de detener la operación. Espere siempre como mínimo 5 minutos antes de desactivar la alimentación para evitar fugas de agua u otros problemas.
- No lave la unidad interior con mucha agua. Use solamente un paño ligeramente húmedo.
- No coloque objetos que contengan agua, como por ejemplo jarrones, sobre la unidad. El agua podría penetrar en la unidad y degradar los aislantes eléctricos, causando descargas eléctricas.
- Para evitar lesiones personales o daños al equipo, asegúrese de detener la operación, desactivar el disyuntor o desenchufar el cable de alimentación antes de limpiar o reparar la unidad.
  NOTA: Podría ser necesario desconectar más de uno para desactivar toda la alimentación.
- No conecte el aire acondicionado a un suministro de alimentación distinto del indicado. Podría causar un funcionamiento incorrecto o un incendio.
- En función del entorno y de los códigos eléctricos locales y estatales, podría necesitar un interruptor de circuito de fallos en toma a tierra. Una toma a tierra incorrecta o no instalar un interruptor de circuito de fallos en toma a tierra podría causar descargas eléctricas, lesiones o la muerte.
- Se recomienda instalar un interruptor de circuito de fallos en toma a tierra si no hay ya uno instalado.
  Con ello ayudará a evitar descargas eléctricas o incendios.
- Coloque la manguera de drenaje de modo que garantice un drenaje correcto. Un drenaje incorrecto podría causar daños en el edificio o mobiliario a causa de la humedad.
- En función del entorno de uso, podría fugarse agua del aire acondicionado. En dicho caso, contacte con su proveedor Daikin.
- El control remoto debe instalarse de tal modo que los niños no puedan jugar con él.
- No coloque objetos directamente al lado de la unidad exterior ni permita la acumulación de hojas o cualquier otro residuo alrededor de la unidad.
  Las hojas atraen a los animales pequeños, los cuales podrían penetrar en la unidad. Una vez en su interior, dichos animales podrían causar averías, la aparición de humo o incendios al entrar en contacto con las piezas eléctricas.

Sitio de instalación

■ Accione el aire acondicionado en zonas con la ventilación adecuada y que no estén rodeadas por obstáculos. No use el aire acondicionado en los siguientes lugares:

a. Lugares con neblina de aceite mineral, como por ejemplo aceite de corte.
b. Ubicaciones costeras en donde el aire contenga altos niveles de sal.
c. Balnearios en donde el aire contenga altos niveles de azufre.
d. Fábricas en donde la tensión de la alimentación varíe mucho.
e. En coches, embarcaciones y otros vehículos.
f. Cocinas en donde pueda derramarse aceite o en donde exista vapor en el aire.
g. Lugares en los cuales haya equipos que produzcan ondas electromagnéticas.
h. Lugares con neblina ácida o alcalina.

Tenga en cuenta las molestias que el ruido puede

■ Preste atención al ruido de operación. Asegúrese de utilizar el aparato en los siguientes lugares:

a. Lugares capaces de soportar el peso del aire acondicionado y que al mismo tiempo reduzcan el ruido de operación y las vibraciones del aire acondicionado.
b. Lugares en donde el aire templado de la salida del aire de la unidad exterior o el ruido de operación de la unidad exterior no molesten a los vecinos.
   Asegúrese de que no existan obstáculos cerca de la unidad exterior. Los obstáculos cerca de la unidad exterior podrían reducir el rendimiento de la misma o aumentar su ruido de operación.
   Si el aire acondicionado emite ruidos inusuales, consulte con su proveedor.

Trabajo eléctrico

- Para el suministro de alimentación, asegúrese de usar un circuito eléctrico independiente para el aire acondicionado.

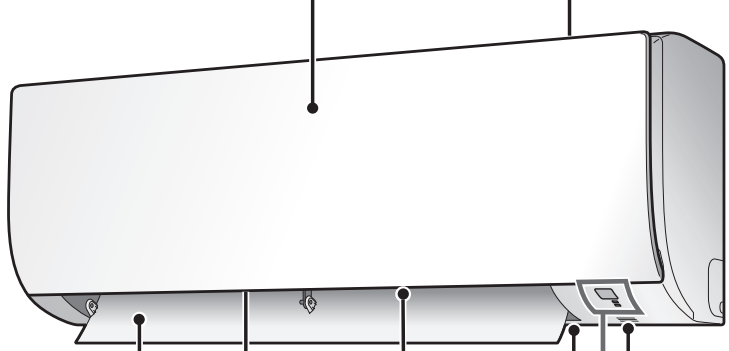
Reubicación del sistema

■ Reubicar el aire acondicionado requiere de conocimientos y técnicas especializadas. Si la reubicación es necesaria para el desplazamiento o remodelado, consulte con su proveedor.

Nombres de las partes

FTK09NMVJU / FTK12NMVJU / FTKN09NMVJU / FTKN12NMVJU

Unidad interior



Panel frontal

Entrada de aire

Salida del aire

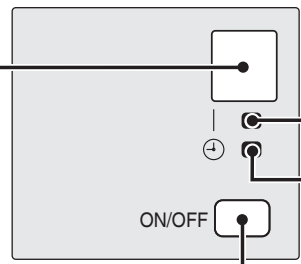
Aleta (hoja horizontal)
▶Página 14

Rejillas (hojas verticales)
- Las rejillas están en el interior de la salida del aire. ▶Página 14

Placa de identificación del modelo

Sensor de temperatura interior
- Detecta la temperatura del aire alrededor de la unidad.

Pantalla



Receptor de señal
- Recibe señales desde el control remoto.
- Cuando la unidad recibe una señal, oirá un sonido de bip.

Caso	Tipo de sonido
Inicio de operaciones	bip-bip
Ajuste modificado	bip
Parada de operaciones	sonido de bip prolongado

Lámpara de OPERACIÓN (verde)

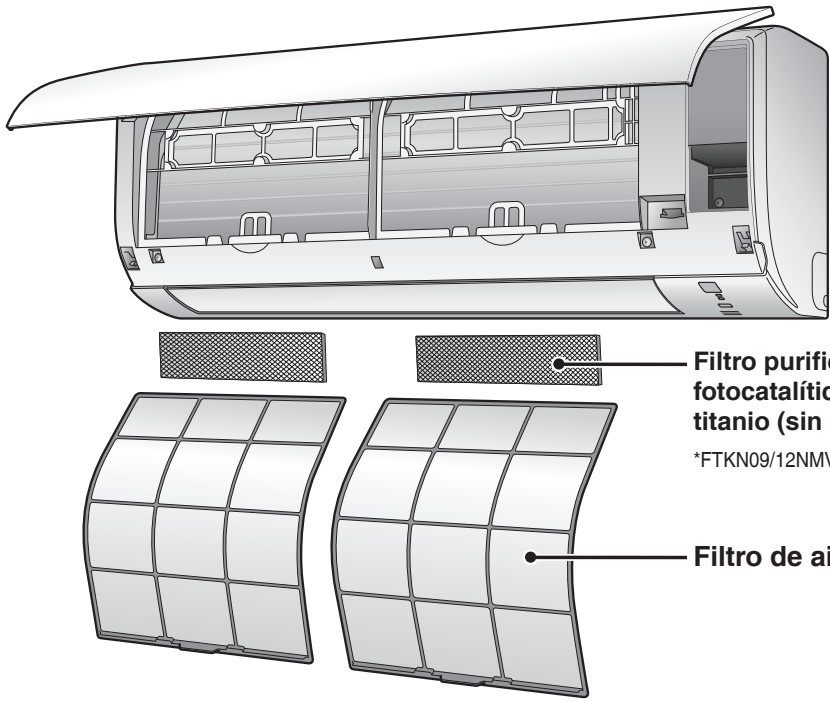
Lámpara de TEMPORIZADOR (naranja) ▶Página 17, 18

Interruptor de ENCENDIDO/APAGADO de la unidad interior
- Pulse una vez este interruptor para iniciar la operación. Vuelva a pulsarlo para detenerla.
- Para más información sobre el ajuste del modo operativo, consulte la siguiente tabla.

Modo	Ajuste de temperatura	Tasa del flujo de aire
FRÍO	72°F (22°C)	AUTO

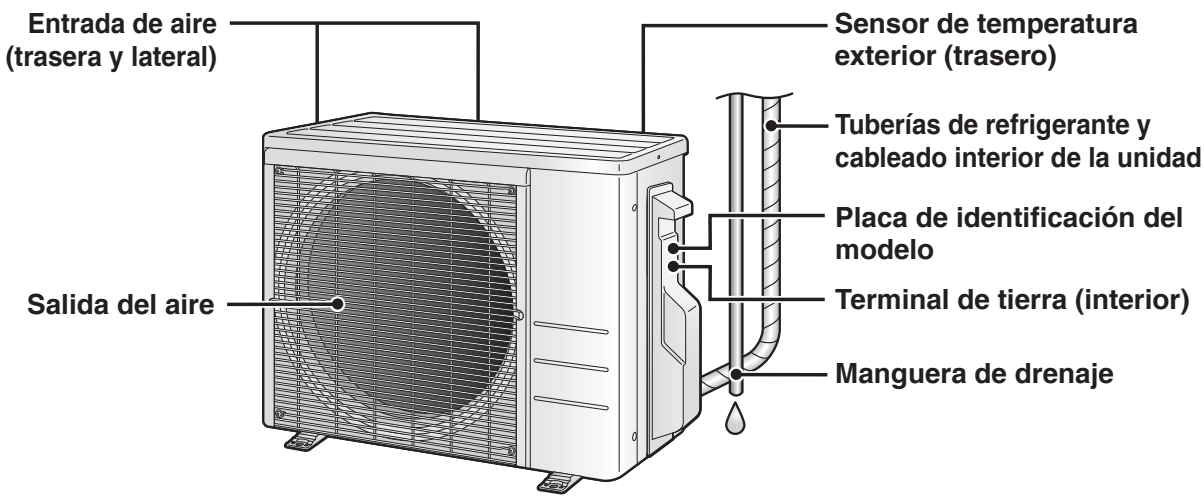
- Este interruptor puede usarse si el control remoto no está accesible.

■ Abrir el panel frontal



Unidad exterior

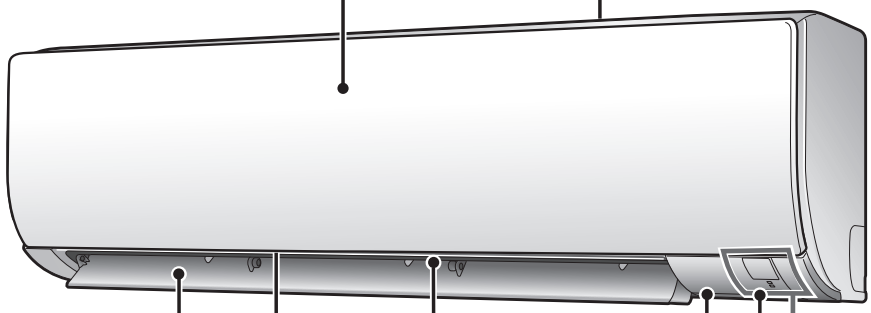
• El aspecto de la unidad exterior de los distintos modelos podría diferir.



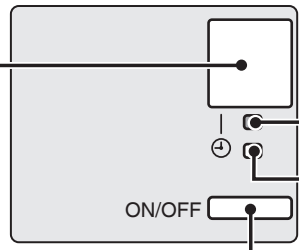
Nombres de las partes

FTK18NMVJU / FTK24NMVJU / FTKN18NMVJU / FTKN24NMVJU

Unidad interior



Pantalla



Receptor de señal

- Recibe señales desde el control remoto.
- Cuando la unidad recibe una señal, oirá un sonido de bip.

Caso	Tipo de sonido
Inicio de operaciones	bip-bip
Ajuste modificado	bip
Parada de operaciones	sonido de bip prolongado

Lámpara de OPERACIÓN (verde)

Lámpara de TEMPORIZADOR (naranja) Página 17, 18

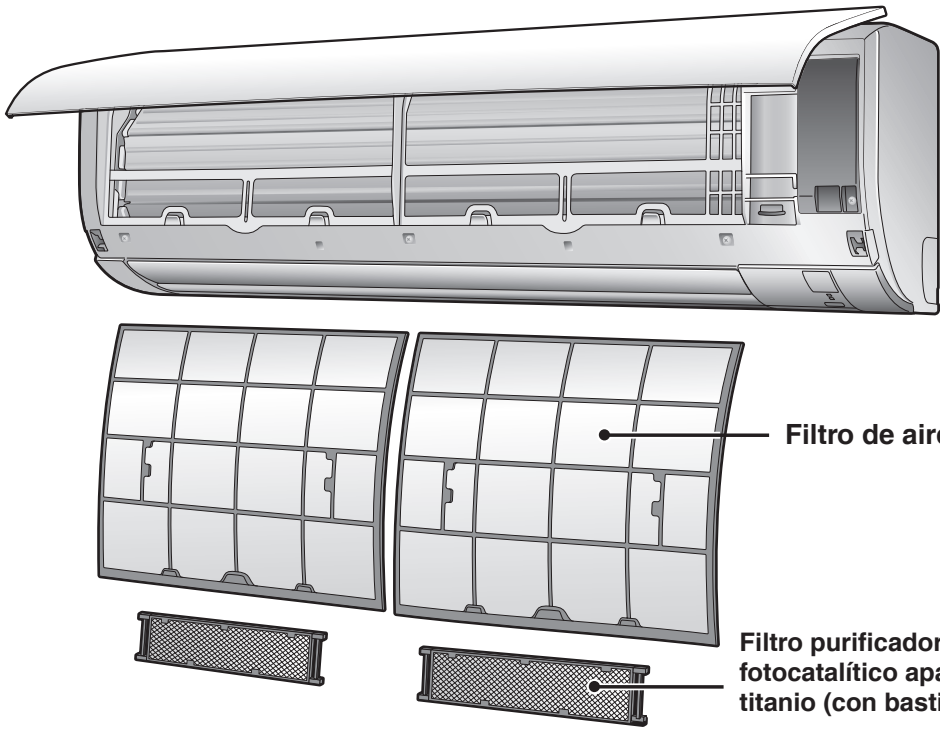
Interruptor de ENCENDIDO/APAGADO de la unidad interior

- Pulse una vez este interruptor para iniciar la operación. Vuelva a pulsarlo para detenerla.
- Para más información sobre el ajuste del modo operativo, consulte la siguiente tabla.

Modo	Ajuste de temperatura	Tasa del flujo de aire
FRÍO	72°F (22°C)	AUTO

- Este interruptor puede usarse si el control remoto no está accesible.

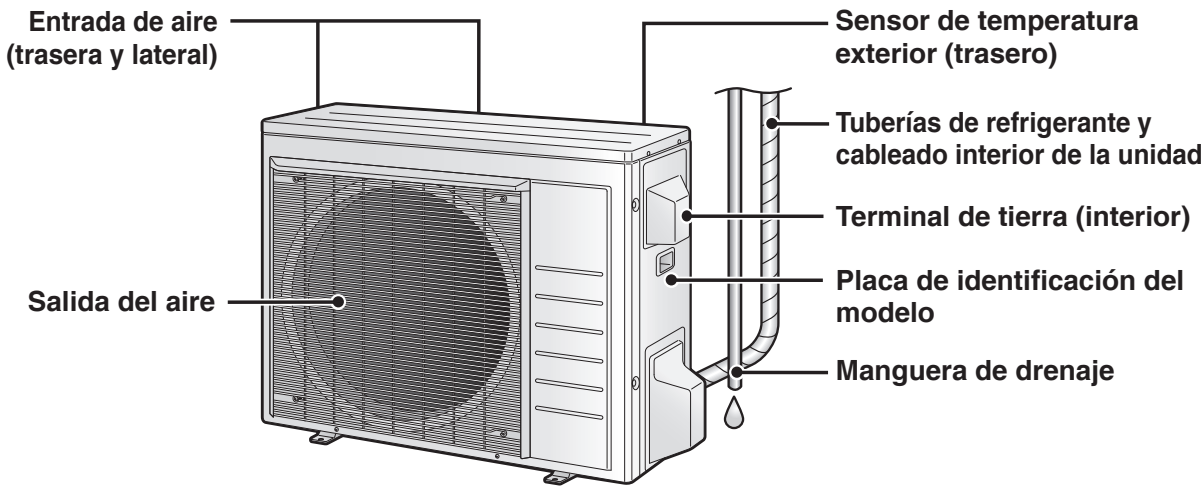
■ Abrir el panel frontal



*FTKN18/24NMVJU: Vendido por separado.

Unidad exterior

• El aspecto de la unidad exterior de los distintos modelos podría diferir.



Nombres de las partes

Control remoto

Pantalla (LCD)
- Visualiza los ajustes actuales. (En esta imagen, cada sección se muestra con todas sus pantallas activadas con propósitos explicativos.)

Botones de operación directa
- Inicia la operación FRÍO, SECO o SOLO VENTILADOR. ▶Página 11

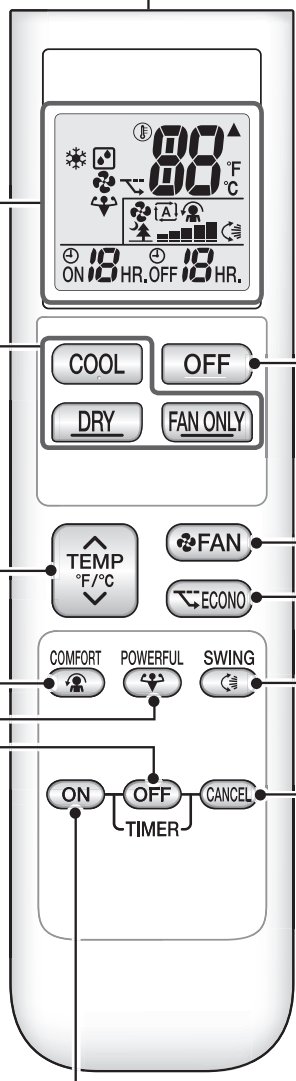
Botón de ajuste de TEMPERATURA
- Cambia el ajuste de temperatura. ▶Página 12

Botón CONFORT
- Operación FLUJO DE AIRE AGRADABLE. ▶Página 15

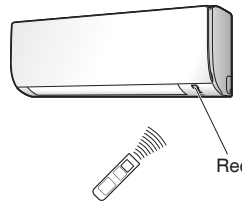
Botón POTENTE
- Operación POTENTE. ▶Página 15

Botón TEMPORIZADOR APAGADO (modo AJUSTE NOCTURNO) ▶Página 18

Botón TEMPORIZADOR ENCENDIDO ▶Página 17



Transmisor de señal



- Para usar el control remoto, apunte el transmisor hacia la unidad interior. Si existe algún objeto bloqueando las señales entre la unidad y el control remoto, como por ejemplo una cortina, la unidad podría no funcionar.
- La distancia de transmisión máxima es de aproximadamente 23ft (7m).

Botón de APAGADO
- Detiene la operación. ▶Página 12

Botón de ajuste del VENTILADOR
- Selecciona el ajuste de la tasa de flujo de aire. ▶Página 13

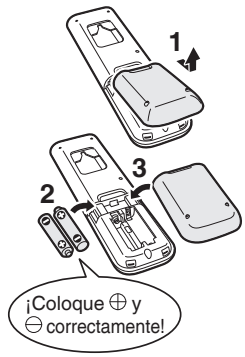
Botón ECONO
- Operación ECONO. ▶Página 16

Botón OSCILACIÓN
- Ajusta la dirección del flujo de aire. ▶Página 14

Botón CANCELAR TEMPORIZADOR
- Cancela el ajuste del temporizador. ▶Página 17, 18

Unidad	Control remoto	
FTK09/12/18/24NMVJU	ARC480A9	con retroiluminación
FTKN09/12/18/24NMVJU	ARC480A7	sin retroiluminación

Preparación previa a la operación

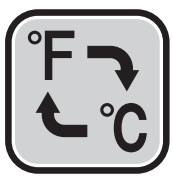


Para introducir las pilas

1. Retire la cubierta trasera deslizándola y elevándola ligeramente.
2. Introduzca 2 pilas secas AAA.LR03 (alcalinas).
3. Vuelva a colocar la cubierta trasera.

Para fijar el soporte del control remoto en una pared

1. Seleccione un lugar en donde las señales puedan alcanzar la unidad.
2. Instale el soporte en una pared, pilar o ubicaciones similares con los tornillos suministrados con el soporte.
3. Cuelgue el control remoto en el soporte del control remoto.



Interruptor de visualización Fahrenheit/Celsius

- Pulse TEMP °F/°C y ON (botón TEMPORIZADOR) simultáneamente durante aproximadamente 5 segundos.
  - La temperatura es visualizada en Celsius si está actualmente visualizada en Fahrenheit y viceversa.
  - La operación del interruptor es posible únicamente al visualizar la temperatura.

Activar el disyuntor

- Después de activar la alimentación, la aleta de la unidad interior se abre y cierra una vez para ajustar la posición de referencia.

NOTA

Avisos sobre las pilas

- Al sustituir las pilas, use pilas del mismo tipo y sustituya ambas pilas usadas al mismo tiempo.
- Las pilas duran aproximadamente 1 año. Si la pantalla del control remoto empieza a desvanecerse y el alcance de la transmisión disminuye antes de que transcurra un año, sustituya ambas pilas por unas nuevas de tamaño AAA.LR03 (alcalinas).
- Las pilas suministradas con el control remoto son para la operación inicial. Las pilas podrían agotarse en menos de 1 año.

Aviso sobre el control remoto

- No deje caer el control remoto. No permita que se moje.

Función de cambio de visualización Fahrenheit/Celsius del control remoto

- La temperatura ajustada podría aumentar si cambia la pantalla de Fahrenheit a Celsius, ya que la cifra se redondea en una fracción de 0.5°C.
- Ejemplo: Una temperatura de ajuste de 65°F (equivalente a 18.5°C) pasará a ser 19°C.
  Si cambia la pantalla de nuevo a Fahrenheit, la temperatura de ajuste será 66°F (equivalente a 19°C) en lugar de la temperatura de ajuste original (65°F) sin embargo, una temperatura de ajuste de 66°F (equivalente a 19°C) pasará a ser 19°C sin ningún cambio de temperatura.
- Al ajustar la función de cambio de visualización Fahrenheit/Celsius, se oirá un sonido de recepción al transmitir la temperatura de ajuste a la unidad interior.

Operación FRÍO · SECO · SOLO VENTILADOR

El aire acondicionado funciona en el modo de operación de su elección.

Para iniciar la operación

Operación FRÍO

- Para reducir la temperatura.

Pulse COOL .

Operación SECO

- Para reducir la humedad.

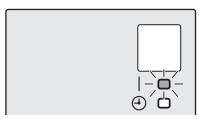
Pulse DRY .

Operación SOLO VENTILADOR

- Para que el aire circule por la habitación.

Pulse FAN ONLY .

- La lámpara de OPERACIÓN se ilumina en verde.

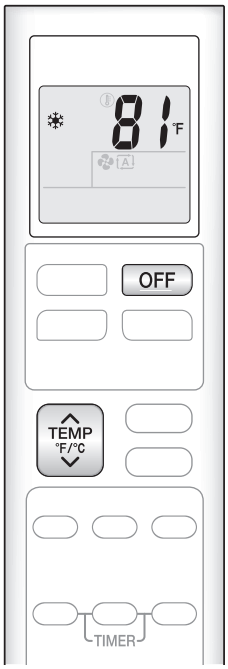


Pantalla

NOTA

Aviso sobre la operación SECO

- Elimina la humedad al mismo tiempo que intenta mantener la temperatura interior tanto como sea posible. Controla automáticamente la temperatura y la tasa del flujo de aire, por lo tanto, el ajuste manual de estas funciones no está disponible.



Para detener la operación

Pulse OFF **.**

- La lámpara de OPERACIÓN se apaga.

Para cambiar el ajuste de temperatura

Pulse TEMP °F/°C **.**

- Pulse ^ para aumentar la temperatura, y pulse v para reducirla.

Operación FRÍO	Operación SECO o SOLO VENTILADOR
64-90°F (18-32°C)	El ajuste de temperatura no puede modificarse.

Sugerencias para ahorrar energía

Mantener el ajuste de temperatura en un nivel moderado ayuda a ahorrar energía.
- Ajuste de temperatura recomendado
  – Para refrigeración: 78-82°F (26-28°C)

Cubra las ventanas con una persiana o cortina.
- Bloquear la luz del sol y el aire exterior aumenta el efecto de refrigeración.

Mantenga los filtros de aire limpios.
- Los filtros de aire atascados causan un funcionamiento ineficaz y desperdician energía. Límpielos una vez cada 2 semanas. ▶Página 20, 23

Si no va a usar el aire acondicionado durante un período prolongado, por ejemplo durante la primavera o el otoño, apague el disyuntor.
- El aire acondicionado siempre consume una pequeña cantidad de electricidad, incluso cuando no está en funcionamiento.

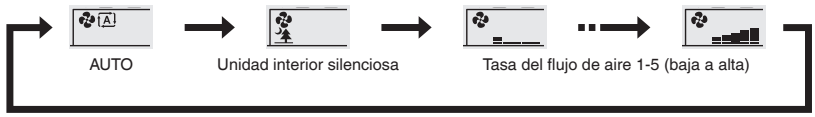
Ajuste de la tasa del flujo de aire

Puede ajustar la tasa del flujo de aire para aumentar su comodidad.

Para configurar el ajuste de la tasa de flujo de aire

Pulse FAN .

- Cada pulsación de FAN modifica secuencialmente el ajuste de la tasa de flujo de aire.



- Si ajusta el flujo de aire en " ", la operación en el modo silencioso se pone en marcha y la unidad interior emite menos ruido.
- En el modo de operación silenciosa, la tasa del flujo de aire está ajustada a un nivel débil.

Operación FRÍO y SOLO VENTILADOR	Operación SECO
	El ajuste de la tasa de flujo de aire no puede modificarse.

NOTA

Aviso sobre el ajuste de la tasa de flujo de aire

- Si la tasa del flujo de aire es pequeña, la refrigeración también será pequeña.

Ajuste de la dirección del flujo de aire

Puede ajustar la dirección del flujo de aire para aumentar su comodidad.

⚠ PRECAUCIÓN

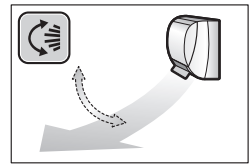
- Use siempre un control remoto para ajustar los ángulos de la aleta. Mover la aleta a la fuerza manualmente puede causar averías.
- Preste atención al ajustar las rejillas. Dentro de la salida del aire hay un ventilador girando a gran velocidad.

Para iniciar la oscilación automática

Subir y bajar la dirección del flujo de aire

Pulse SWING .

- " " es visualizado en la pantalla LCD.
- La aleta (hoja horizontal) comenzará a oscilar.



Para ajustar la aleta en la posición deseada

- Esta función resulta muy útil cuando la aleta está en el modo de oscilación automática.

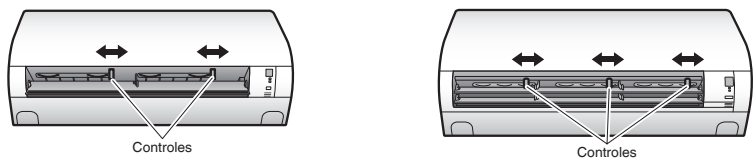
Pulse SWING cuando la aleta alcance la posición deseada.

- " " desaparece de la pantalla LCD.

Para ajustar las rejillas en la posición deseada

Sujete los controles y mueva las rejillas (hojas verticales).

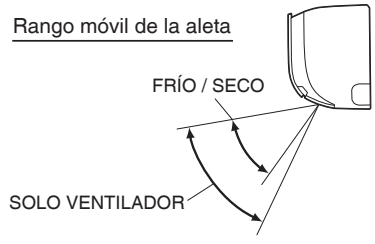
FTK09NMVJU / FTK12NMVJU FTKN09NMVJU / FTKN12NMVJU	FTK18NMVJU / FTK24NMVJU FTKN18NMVJU / FTKN24NMVJU



NOTA

Avisos sobre el ajuste de la dirección del flujo de aire

- El rango móvil de la aleta varía en función del modo operativo.
- La aleta se detendrá en la posición superior cuando la tasa del flujo de aire se cambie al ajuste bajo durante la configuración de oscilación de subida y bajada.



Español

Funciones útiles

Operación FLUJO DE AIRE AGRADABLE

La dirección del aire y su tasa de flujo se ajustan de modo que el aire no sople directamente sobre las personas presentes en la habitación.

Para iniciar la operación FLUJO DE AIRE AGRADABLE

Pulse COMFORT .

- " " es visualizado en la pantalla LCD.

	Operación FRÍO y SECO
Dirección de la aleta	Sube
Tasa del flujo de aire	AUTO

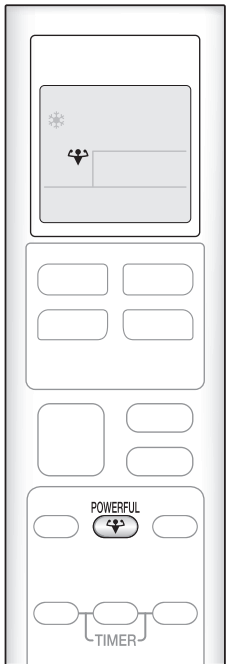
- No disponible en el modo SOLO VENTILADOR.

Para cancelar la operación FLUJO DE AIRE AGRADABLE

Vuelva a pulsar COMFORT .

- " " desaparece de la pantalla LCD.
- La aleta regresará a la posición memorizada desde la anterior operación FLUJO DE AIRE AGRADABLE.

Operación POTENTE



La operación POTENTE maximiza rápidamente el efecto de refrigeración en cualquier modo operativo. En este modo, el aire acondicionado opera a la máxima capacidad.

Para iniciar la operación POTENTE

Pulse POWERFUL .

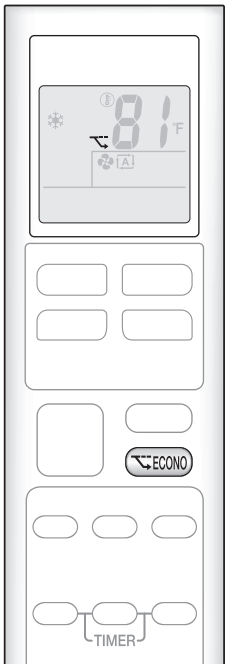
- " " es visualizado en la pantalla LCD.
- La operación POTENTE finaliza en 20 minutos. A continuación, el sistema vuelve a operar automáticamente con los ajustes usados antes de la operación POTENTE.

Para cancelar la operación POTENTE

Vuelva a pulsar POWERFUL .

- " " desaparece de la pantalla LCD.

Operación ECONO



La operación ECONO permite una operación eficiente mediante la limitación del consumo de energía máximo.
Esta función es útil para evitar que el disyuntor salte al accionar la unidad junto con otros aparatos en un mismo circuito.

Para iniciar la operación ECONO

Pulse ECONO .

- " " es visualizado en la pantalla LCD.
- No disponible en el modo SOLO VENTILADOR.

Para cancelar la operación ECONO

Vuelva a pulsar ECONO .

- " " desaparece de la pantalla LCD.

NOTA

Aviso sobre la operación FLUJO DE AIRE AGRADABLE

- Si selecciona la dirección del flujo de aire arriba y abajo, la operación FLUJO DE AIRE AGRADABLE será cancelada.

Avisos sobre la operación POTENTE

- Pulsar OFF cancela los ajustes, y " " desaparece de la pantalla LCD.
- La operación POTENTE no aumentará la capacidad del aire acondicionado si el mismo ya está en funcionamiento con su capacidad máxima ajustada.

– En operación FRÍO
Para maximizar el efecto de refrigeración, la capacidad de la unidad exterior aumenta y la tasa del flujo de aire queda fijada en el ajuste máximo. El ajuste de temperatura no puede modificarse.

– En la operación SECO
El ajuste de temperatura desciende 4.5°F (2.5°C) y la tasa del flujo de aire aumenta ligeramente.

– En operación SOLO VENTILADOR
La tasa del flujo de aire queda fijada en el ajuste máximo.

Avisos sobre la operación ECONO

- Pulsar OFF cancela los ajustes, y " " desaparece de la pantalla LCD.
- Si el nivel del consumo de energía ya es bajo, cambiar a la operación ECONO no reducirá el consumo de energía.

Algunas de las funciones útiles pueden usarse conjuntamente.

FLUJO DE AIRE AGRADABLE + ECONO	Disponible
POTENTE + FLUJO DE AIRE AGRADABLE	No disponible*
POTENTE + ECONO	No disponible*

*La función cuyo botón haya sido pulsado en último lugar tendrá prioridad.

Operación del TEMPORIZADOR ENCENDIDO/APAGADO

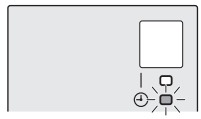
Las funciones del temporizador resultan útiles para cambiar automáticamente el aire acondicionado a encendido o apagado por la noche o por la mañana. También puede usar TEMPORIZADOR ENCENDIDO y TEMPORIZADOR APAGADO conjuntamente.

Para utilizar la operación del TEMPORIZADOR ENCENDIDO

Pulse ON .

ON HR. "ON HR." es visualizado en la pantalla LCD.

- Cada pulsación de ON aumenta el ajuste de la hora en 1 hora. El margen de ajuste de las horas es entre 1 y 12 horas.
- La lámpara TEMPORIZADOR se ilumina en naranja.



Pantalla

Para cancelar la operación del TEMPORIZADOR ENCENDIDO

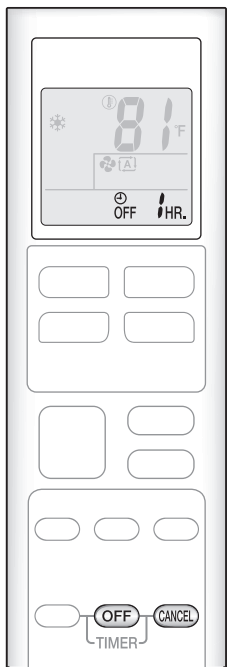
Pulse CANCEL .

- "ON HR." desaparece de la pantalla LCD.
- La lámpara TEMPORIZADOR se apaga.

NOTA

Vuelva a ajustar el temporizador en los siguientes casos.

- Después de haber apagado el disyuntor.
- Después de un corte de corriente.
- Después de sustituir las pilas del control remoto.

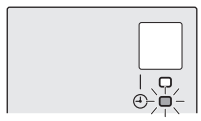


Para utilizar la operación del TEMPORIZADOR APAGADO

Pulse OFF .

OFF 1HR. “OFF 1HR.” es visualizado en la pantalla LCD.

- Cada pulsación de OFF aumenta el ajuste de la hora en 1 hora. El margen de ajuste de las horas es entre 1 y 12 horas.
- La lámpara TEMPORIZADOR se ilumina en naranja.



Pantalla

Para cancelar la operación del TEMPORIZADOR APAGADO

Pulse CANCEL .

- “OFF 1HR.” desaparece de la pantalla LCD.
- La lámpara TEMPORIZADOR se apaga.

Para combinar la operación del TEMPORIZADOR ENCENDIDO y TEMPORIZADOR APAGADO

- A continuación se muestra una configuración a modo de ejemplo que combina los 2 temporizadores.
- “ON” y “OFF” son visualizados en la pantalla LCD.

[Ejemplo]

ON 8HR. OFF 1HR.

Al realizar el ajuste con la unidad en marcha
- Detiene la unidad 1 hora más tarde y la pone en marcha 7 horas después.

ON 2HR. OFF 5HR.

Al realizar el ajuste con la unidad detenida
- Pone en marcha la unidad 2 horas más tarde y la detiene 3 horas después.

NOTA

Modo AJUSTE NOCTURNO
- Al ajustar TEMPORIZADOR APAGADO, el aire acondicionado aumenta automáticamente el ajuste de la temperatura (0.9°F (0.5°C) en FRÍO) para evitar una refrigeración excesiva durante las horas de descanso.

Cuidados y limpieza

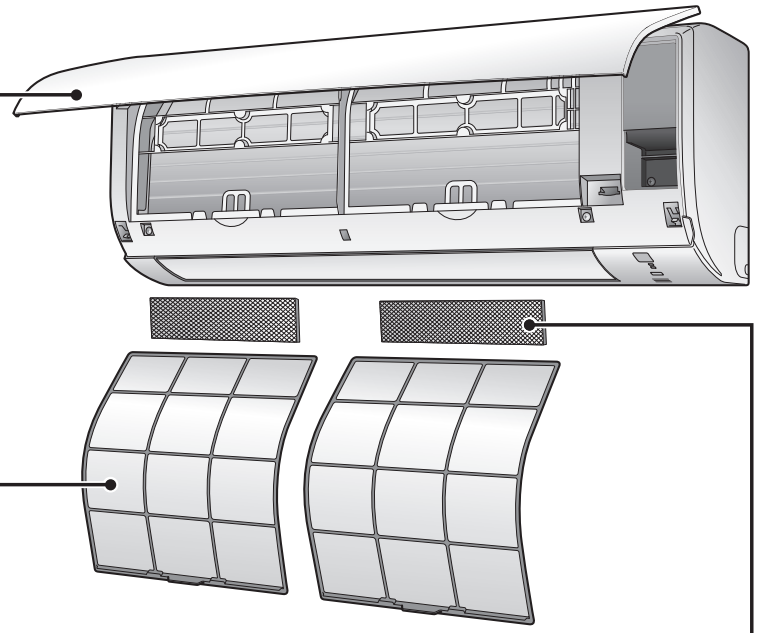
FTK09NMVJU / FTK12NMVJU / FTKN09NMVJU / FTKN12NMVJU

⚠ PRECAUCIÓN

- Antes de realizar la limpieza, asegúrese de detener la operación y de apagar el disyuntor.
- No toque las aletas de aluminio de la unidad interior. Si toca dichas partes, podría sufrir lesiones.

■ Consulta rápida

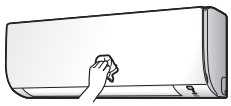
Limpieza de partes



Panel frontal

- Límpielo con un paño suave y húmedo.
- Únicamente puede usar detergente neutro.

Si está sucio



Filtro de aire

- Aspire el polvo o lave el filtro.

Una vez cada 2 semanas

▶Página 20

Unidad interior, unidad exterior y control remoto

- Límpielos con un paño suave.

Si está sucio

Filtro purificador de aire fotocatalítico apatito de titanio (sin bastidor)*

- Aspire el polvo o sustituya el filtro.

[Limpieza]

Una vez cada 6 meses

▶Página 21

[Sustitución]

Una vez cada 3 años

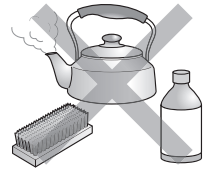
▶Página 21

*FTKN09/12NMVJU: Vendido por separado.

NOTA

Durante la limpieza, no use ninguno de los siguientes productos:

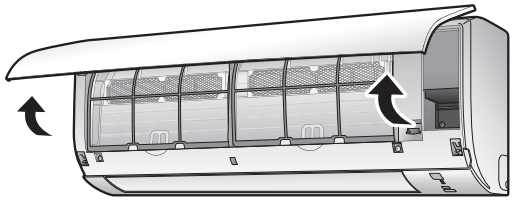
- Agua a una temperatura superior a 104°F (40°C)
- Líquidos volátiles como benceno, petróleo y disolvente
- Compuestos de pulido
- Materiales ásperos, como por ejemplo cepillos



■ Filtro de aire

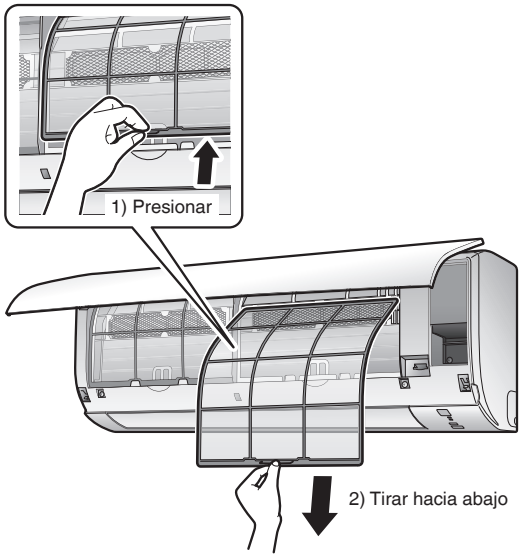
1. Abra el panel frontal.

• Sujete el panel frontal por los lados y ábralo.



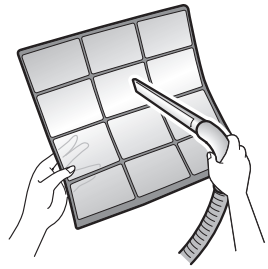
2. Extraiga los filtros de aire.

• Presione la lengüeta del filtro en el centro de cada filtro de aire ligeramente hacia arriba y, a continuación, tire hacia abajo.



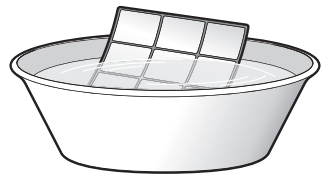
3. Lave los filtros de aire con agua o límpielos con un aspirador.

• Se recomienda limpiar los filtros de aire cada 2 semanas.



Si el polvo no se limpia fácilmente

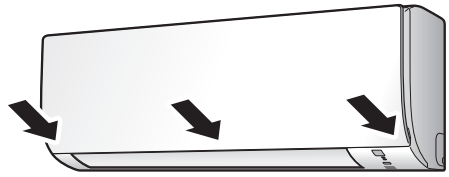
• Lave los filtros de aire con detergente neutro disuelto en agua tibia y, a continuación, deje que se sequen a la sombra.



4. Vuelva a instalar los filtros.

5. Cierre lentamente el panel frontal.

• Pulse el panel en ambos lados y en el centro.



• Asegúrese de que el panel central está correctamente instalado.

Cuidados y limpieza

FTK09NMVJU / FTK12NMVJU / FTKN09NMVJU / FTKN12NMVJU

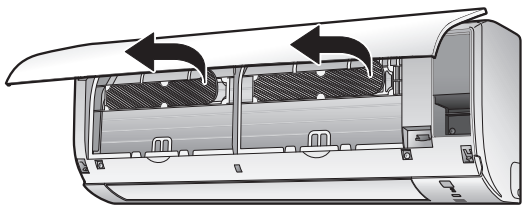
■ Filtro purificador de aire fotocatalítico apatito de titanio

1. **Abra el panel frontal y extraiga los filtros de aire.**

▶Página 20

2. **Extraiga los filtros purificadores de aire fotocatalíticos apatitos de titanio.**

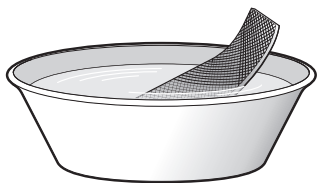
• Extraiga los filtros de las lengüetas.



3. **Limpie o sustituya los filtros purificadores de aire fotocatalíticos apatitos de titanio.**

[Limpieza]

3-1 Si están muy sucios, aspire el polvo y sumerja en agua tibia o en agua durante 10 a 15 minutos.

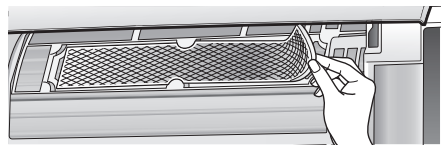


3-2 Después de lavarlo, sacuda el agua restante y deje secar a la sombra.

• No exprima el filtro para secarlo.

[Sustitución]

Extraiga el filtro de las lengüetas y prepare uno nuevo.



• Deseche el filtro antiguo como desechos no inflamables.

4. **Vuelva a colocar los filtros purificadores de aire fotocatalíticos apatitos de titanio tal y como estaban.**

• Al instalar el filtro, compruebe que se encuentre correctamente ajustado en las lengüetas.

5. **Vuelva a instalar los filtros.**

▶Página 20

6. **Cierre lentamente el panel frontal.** ▶Página 20

NOTA

• Operación con filtros sucios:
– no desodorizan el aire,
– no limpian el aire,
– enfriamiento deficiente,
– podrían producir olores.
• Deseche los filtros antiguos como desechos no inflamables.
• Para solicitar un filtro purificador de aire fotocatalítico apatito de titanio, contacte con el proveedor al que le adquirió el aire acondicionado.

Elemento	Filtro purificador de aire fotocatalítico apatito de titanio 1 juego
Núm. de parte	KAF970A46 (sin bastidor)

Cuidados y limpieza

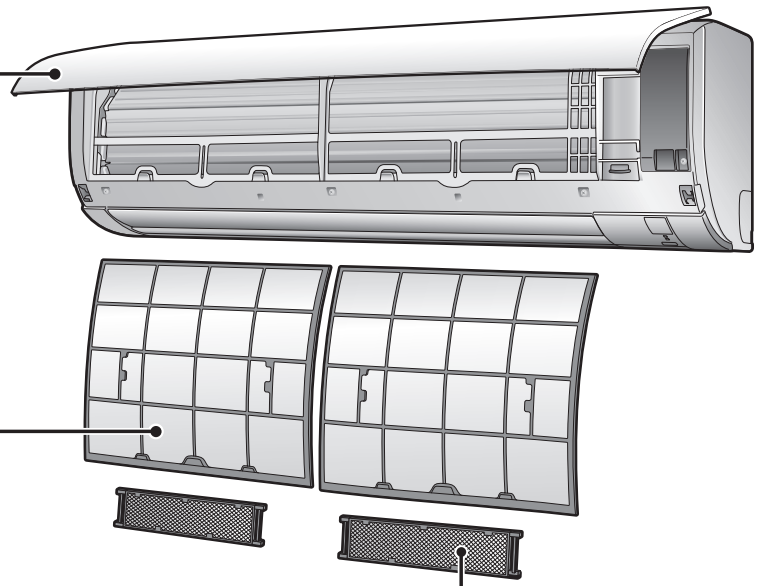
FTK18NMVJU / FTK24NMVJU / FTKN18NMVJU / FTKN24NMVJU

⚠ PRECAUCIÓN

- Antes de realizar la limpieza, asegúrese de detener la operación y de apagar el disyuntor.
- No toque las aletas de aluminio de la unidad interior. Si toca dichas partes, podría sufrir lesiones.

■ Consulta rápida

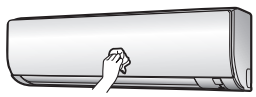
Limpieza de partes



Panel frontal

- Límpielo con un paño suave y húmedo.
- Únicamente puede usar detergente neutro.

Si está sucio



Filtro de aire

- Aspire el polvo o lave el filtro.

Una vez cada 2 semanas

▶Página 23

Unidad interior, unidad exterior y control remoto

- Límpielos con un paño suave.

Si está sucio

Filtro purificador de aire fotocatalítico apatito de titanio (con bastidor)*

- Aspire el polvo o sustituya el filtro.

[Limpieza] **Una vez cada 6 meses**

▶Página 24

[Sustitución] **Una vez cada 3 años**

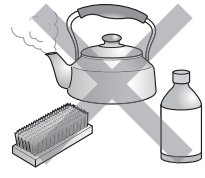
▶Página 24

*FTKN18/24NMVJU: Vendido por separado.

NOTA

Durante la limpieza, no use ninguno de los siguientes productos:

- Agua a una temperatura superior a 104°F (40°C)
- Líquidos volátiles como benceno, petróleo y disolvente
- Compuestos de pulido
- Materiales ásperos, como por ejemplo cepillos



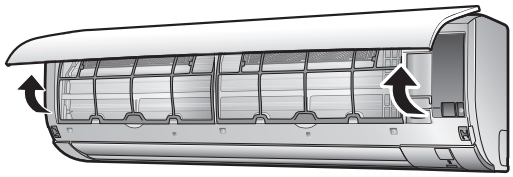
Cuidados y limpieza

FTK18NMVJU / FTK24NMVJU / FTKN18NMVJU / FTKN24NMVJU

■ Filtro de aire

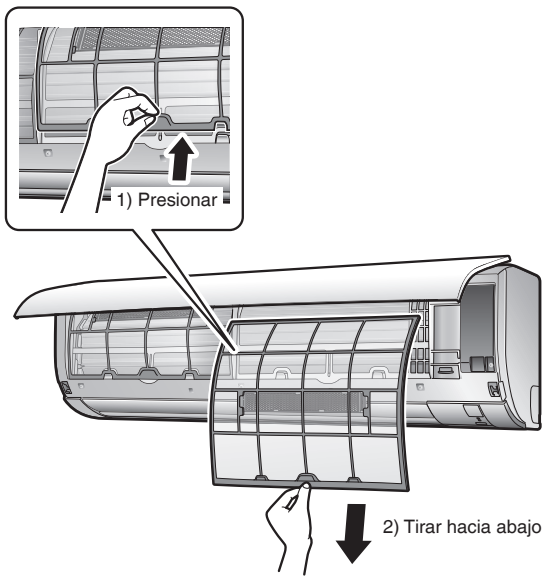
1. Abra el panel frontal.

• Sujete el panel frontal por los lados y ábralo.



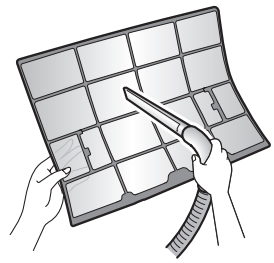
2. Extraiga los filtros de aire.

• Presione la lengüeta del filtro en el centro de cada filtro de aire ligeramente hacia arriba y, a continuación, tire hacia abajo.



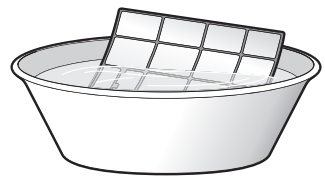
3. Lave los filtros de aire con agua o límpielos con un aspirador.

• Se recomienda limpiar los filtros de aire cada 2 semanas.



Si el polvo no se limpia fácilmente

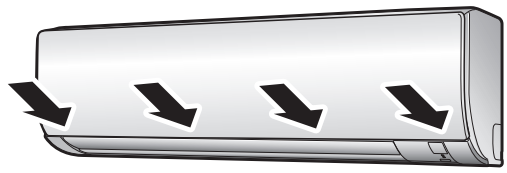
• Lave los filtros de aire con detergente neutro disuelto en agua tibia y, a continuación, deje que se sequen a la sombra.
• Asegúrese de extraer el filtro purificador de aire fotocatalítico apatito de titanio. Consulte "**Filtro purificador de aire fotocatalítico apatito de titanio**" en la siguiente página.



4. Vuelva a instalar los filtros.

5. Cierre lentamente el panel frontal.

• Pulse el panel en ambos lados y en el centro.



• Asegúrese de que el panel central está correctamente instalado.

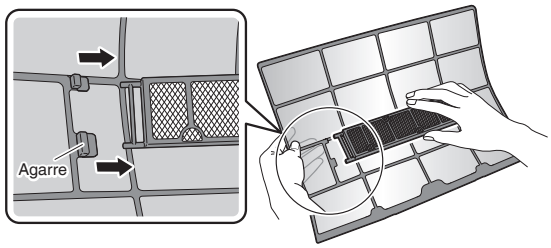
■ Filtro purificador de aire fotocatalítico apatito de titanio

1. Abra el panel frontal y extraiga los filtros de aire.

▶Página 23

2. Extraiga los filtros purificadores de aire fotocatalíticos apatitos de titanio.

- Sujete las piezas hundidas del bastidor y desenganche los 4 agarres.

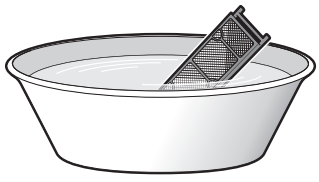


3. Limpie o sustituya los filtros purificadores de aire fotocatalíticos apatitos de titanio.

[Limpieza]

3-1 Si están muy sucios, aspire el polvo y sumerja en agua tibia o en agua durante 10 a 15 minutos.

- No extraiga el filtro del bastidor al lavarlo con agua.



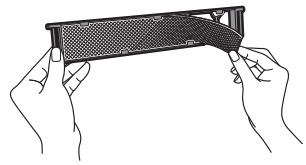
3-2 Después de lavarlo, sacuda el agua restante y deje secar a la sombra.

- No exprima el filtro para secarlo.

[Sustitución]

Extraiga el filtro del bastidor y prepare uno nuevo.

- No deseche el bastidor del filtro. Vuelva a utilizarlo al cambiar el filtro purificador de aire fotocatalítico apatito de titanio.



- Deseche el filtro antiguo como desechos no inflamables.

4. Vuelva a colocar los filtros purificadores de aire fotocatalíticos apatitos de titanio tal y como estaban.

- Al instalar el filtro, compruebe que se encuentre correctamente ajustado en las lengüetas.

5. Vuelva a instalar los filtros.

▶Página 23

6. Cierre lentamente el panel frontal.

▶Página 23

NOTA

- Operación con filtros sucios:
  – no desodorizan el aire,
  – no limpian el aire,
  – enfriamiento deficiente,
  – podrían producir olores.
- Deseche los filtros antiguos como desechos no inflamables.
- Para solicitar un filtro purificador de aire fotocatalítico apatito de titanio, contacte con el proveedor al que le adquirió el aire acondicionado.

Elemento	Filtro purificador de aire fotocatalítico apatito de titanio 1 juego
Núm. de parte	KAF970A46 (sin bastidor)
	KAF970A45 (con bastidor)*

*Los clientes que usen el modelo FTKN18/24NMVJU deben adquirir el KAF970A45 (con bastidor) durante la compra inicial.

Cuidados y limpieza

Todos los modelos

■ Antes de períodos prolongados de desuso

1. Active el modo SOLO VENTILADOR durante varias horas para secar el interior.

• Pulse FAN ONLY .

2. Después de paradas operativas, desactive el disyuntor del aire acondicionado de la habitación.

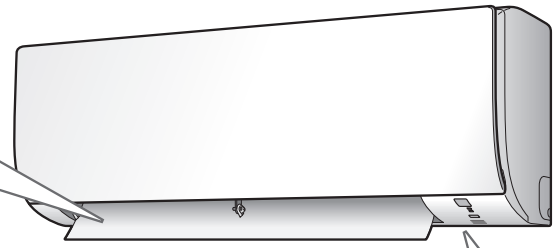
3. Extraiga las pilas del control remoto.

■ Se recomienda un mantenimiento periódico

• En ciertas condiciones operativas, el interior del aire acondicionado podría no funcionar correctamente después de varias temporadas de uso, causando un rendimiento deficiente. Se recomienda que un técnico cualificado realice un mantenimiento periódico además de la limpieza estándar realizada por el usuario.
• Para más información sobre el mantenimiento realizable por un técnico cualificado, contacte con el proveedor al cual adquirió el aire acondicionado.

Preguntas frecuentes

Unidad interior



La aleta no oscila inmediatamente.

- El aire acondicionado está ajustando la posición de la aleta. La aleta comenzará a moverse pronto.

La operación no comienza inmediatamente.

- **Al pulsar cualquier botón de operación directa inmediatamente después de detenerse la operación.**
- **Al volver a seleccionar el modo.**
  - Se realiza con la finalidad de proteger el aire acondicionado.
    Debe esperar aproximadamente 3 minutos.

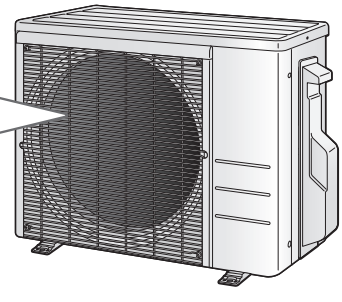
Se oyen distintos sonidos.

- **Un sonido parecido al agua fluyendo**
  - Este sonido lo produce el flujo del refrigerante en el aire acondicionado.
  - Es el sonido del bombeo del agua en el aire acondicionado y puede oírse cuando el agua es bombeada fuera del aire acondicionado durante la operación FRÍO o SECO.
- **Sonido crepitante**
  - Este sonido se produce cuando el armario y el bastidor del aire acondicionado se expanden o encojen ligeramente como resultado de los cambios de temperatura.
- **Sonido de clic durante la operación o tiempo de inactividad**
  - Este sonido se produce cuando las válvulas de control del refrigerante o las piezas eléctricas están en marcha.
- **Sonido de aplauso**
  - Este sonido se produce desde el interior del aire acondicionado al activar el ventilador de escape con las puertas de la habitación cerradas. Abra la ventana o apague el ventilador de escape.

Unidad exterior

La unidad exterior emite agua.

- **En la operación FRÍO o SECO**
  - La humedad del aire se condensa en agua sobre la superficie fría de las tuberías de la unidad exterior y gotea.



Localización de averías

Antes de realizar una solicitud de reparación, compruebe lo siguiente.
Si el problema persiste, contacte con su proveedor.

No existe ningún problema
Este supuesto no es un problema.

Comprobar
Vuelva a comprobar antes de solicitar reparaciones.

El aire acondicionado no funciona

Caso	Descripción / qué comprobar
La lámpara de OPERACIÓN está apagada.	• ¿Ha saltado el disyuntor o se ha fundido el fusible? • ¿Se ha producido un corte de corriente? • ¿Hay pilas instaladas en el control remoto?
La lámpara de OPERACIÓN parpadea.	• Apague la alimentación con el disyuntor y vuelva a iniciar la operación con el control remoto. Si la lámpara de OPERACIÓN sigue parpadeando, compruebe el código de error y consulte con su proveedor. ▶Página 30

El aire acondicionado deja de funcionar repentinamente

Caso	Descripción / qué comprobar
La lámpara de OPERACIÓN está encendida.	• El aire acondicionado podría detenerse después de fluctuaciones del voltaje repentinas y potentes para proteger el sistema. Se reanudará automáticamente la operación en aproximadamente 3 minutos.
La lámpara de OPERACIÓN parpadea.	• ¿Hay algún objeto bloqueando la entrada de aire o la salida del aire de la unidad interior o de la unidad exterior? Detenga la operación y retire la obstrucción después de apagar el disyuntor. A continuación, reanude la operación con el control remoto. Si la lámpara de OPERACIÓN sigue parpadeando, compruebe el código de error y consulte con su proveedor. ▶Página 30

El aire acondicionado no detiene su funcionamiento

Caso	Descripción / qué comprobar
El aire acondicionado continúa operando incluso después de detener la operación.	■ **Inmediatamente después de detener el aire acondicionado** • La unidad exterior continúa girando durante aproximadamente 1 minuto para proteger el sistema. ■ **Mientras el aire acondicionado no está en marcha** • Si la temperatura exterior es alta, el ventilador de la unidad exterior podría comenzar a girar para proteger el sistema.

La habitación no se enfría

Caso	Descripción / qué comprobar
No sale aire / Sale aire.	■ **¿Es correcto el ajuste de la tasa de flujo de aire?** • ¿Es el ajuste de la tasa de flujo de aire bajo, como por ejemplo “Unidad interior silenciosa” o “Tasa del flujo de aire 1”? Aumente el ajuste de la tasa de flujo de aire. ■ **¿Es correcta la temperatura de ajuste?** ■ **¿Es correcto el ajuste de la dirección del flujo de aire?**
Sale aire.	• ¿Hay mobiliario directamente debajo o al lado de la unidad interior? • ¿Está el aire acondicionado en la operación ECONO? ▶Página 16 • ¿Están sucios los filtros? • ¿Hay algún objeto bloqueando la entrada de aire o la salida del aire de la unidad interior o de la unidad exterior? • ¿Hay una ventana o puerta abierta? • ¿Está girando un ventilador de escape?

Sale neblina

Caso	Descripción / qué comprobar
Sale neblina de la unidad interior.	☑ • Se produce cuando el aire de la habitación se enfría y se convierte en neblina por el flujo de aire frío durante la operación FRÍO u otras operaciones.

Control remoto

Caso	Descripción / qué comprobar
La unidad no recibe señales del control remoto o su rango operativo está limitado.	☑ • Las pilas podrían estar agotadas. Sustituya ambas pilas por unas nuevas secas AAA.LR03 (alcalinas). Para más detalles, consulte "**Preparación previa a la operación**". ▶Página 10 • La comunicación de señales podría deshabilitarse si hay lámparas fluorescentes con arranque electrónico (como por ejemplo lámparas de tipo inversor) en la habitación. En dicho caso, consulte con su proveedor. • El control remoto podría no funcionar correctamente si el transmisor está expuesto a la luz directa del sol.
La pantalla LCD se atenúa, no funciona o es errática.	☑ • Las pilas podrían estar agotadas. Sustituya ambas pilas por unas nuevas secas AAA.LR03 (alcalinas). Para más detalles, consulte "**Preparación previa a la operación**". ▶Página 10
Otros dispositivos eléctricos comienzan a funcionar.	☑ • Si el control remoto activa otros dispositivos eléctricos, aléjelos o consulte a su proveedor.

El aire huele

Caso	Descripción / qué comprobar
El aire acondicionado emite olores.	☑ • Los olores de la habitación absorbidos por la unidad son descargados con el flujo de aire. Se recomienda solicitar la limpieza de la unidad interior. Consulte con su proveedor.

Otros

Caso	Descripción / qué comprobar
El aire acondicionado se pone en marcha repentinamente y se comporta de modo extraño durante la operación.	? • El aire acondicionado podría estar averiado a causa de un rayo o radio. Si el aire acondicionado no funciona correctamente, desactive la alimentación con el disyuntor y reinicie la operación con el control remoto.

Avisos sobres las condiciones operativas

- Si continúa el funcionamiento en cualquier estado distinto a los indicados en la tabla,
  - – Un dispositivo de seguridad podría activarse para detener la operación.
  - – Podría aparecer condensación en la unidad interior y gotear al seleccionar la operación FRÍO o SECO.

Modo	Condiciones operativas
FRÍO / SECO	Temperatura exterior: 50-115°F (10-46°C) Temperatura interior: 64-90°F (18-32°C) Humedad interior: 80% máx.

Localización de averías

■ Contacte inmediatamente con su proveedor

⚠ ADVERTENCIA

Si se produce una anomalía (como por ejemplo olor a quemado), detenga el uso y apague el disyuntor.
- El uso continuado en condiciones anormales puede causar problemas, descargas eléctricas o incendios.
- Consulte con el establecimiento en donde adquirió el aire acondicionado.

No intente reparar o modificar el aire acondicionado usted mismo.
- Las reparaciones incorrectas podrían causar descargas eléctricas o incendios.
- Consulte con el establecimiento en donde adquirió el aire acondicionado.

Si se produce uno de los siguientes síntomas, contacte inmediatamente con su proveedor.

- **El cable de alimentación está excesivamente caliente o dañado.**
- **Se oye un sonido anormal durante la operación.**
- **El disyuntor, un fusible o el disyuntor de fuga de tierra desactivan la operación frecuentemente.**
- **Un interruptor o botón no funciona correctamente con frecuencia.**
- **Hay olor a quemado.**
- **Se fuga agua de la unidad interior.**

Apague el disyuntor y contacte con su proveedor.

■ Después de un corte de corriente
- El aire acondicionado reanuda la operación automáticamente en aproximadamente 3 minutos. Espere uno momento.

■ Rayos
- Si existe el riesgo de que un rayo caiga cerca, detenga la operación y apague el disyuntor para proteger el sistema.

■ Requisitos para la eliminación

- El desmontaje de la unidad, la manipulación de refrigerante, aceite y otras piezas deben ser realizados en conformidad con las normativas locales y nacionales relevantes.

■ Diagnósticos de avería por el control remoto

• El control remoto puede recibir códigos de error relevantes desde la unidad interior.

1. Al mantener pulsado (CANCEL) durante aproximadamente 5 segundos, " 00 " parpadeará en la sección de la pantalla de temperatura.

2. Pulse repetidamente (CANCEL) hasta que oiga un bip continuo.

• La indicación de códigos cambia tal y como se indica a continuación, y le informa del estado mediante un sonido de bip prolongado.

	CÓDIGO	SIGNIFICADO
SISTEMA	00	NORMAL
	UA	FALLO DE COMBINACIÓN UNIDAD INTERIOR-EXTERIOR
	U0	FALTA DE REFRIGERANTE
	U2	CAÍDA DEL VOLTAJE O SOBREVOLTAJE EN EL CIRCUITO PRINCIPAL
	U4	FALLO DE LA TRANSMISIÓN (ENTRE LA UNIDAD INTERIOR Y LA UNIDAD EXTERIOR)
UNIDAD INTERIOR	A1	DEFECTUOSIDAD PCB INTERIOR
	A5	CONTROL DE ALTA PRESIÓN O PROTECTOR DE CONGELACIÓN
	A6	FALLO DEL MOTOR DEL VENTILADOR
	C4	SENSOR DE TEMPERATURA DEL INTERCAMBIADOR DE CALOR DEFECTUOSO
	C9	SENSOR DE TEMPERATURA DEL AIRE DE SUCCIÓN DEFECTUOSO
UNIDAD EXTERIOR	EA	ERROR DE CONMUTACIÓN REFRIGERACIÓN-CALEFACCIÓN
	E1	FALLO DE LA PLACA DE CIRCUITOS
	E5	OL INICIADO
	E6	PUESTA EN MARCHA DEL COMPRESOR DEFECTUOSA
	E7	FALLO DEL MOTOR DEL VENTILADOR CC
	E8	ENTRADA DE SOBRECORRIENTE
	F3	CONTROL DE TUBERÍA DE DESCARGA DE TEMPERATURA ALTA
	F6	CONTROL DE ALTA PRESIÓN (EN REFRIGERACIÓN)
	H0	FALLO DEL SENSOR
	H6	INTERRUPCIÓN DE LA OPERACIÓN A CAUSA DE UN SENSOR DE DETECCIÓN DE POSICIÓN DEFECTUOSO
	H8	FALLO DEL SENSOR DE CORRIENTE CC
	H9	SENSOR DE TEMPERATURA DEL AIRE DE SUCCIÓN DEFECTUOSO
	J3	SENSOR DE TEMPERATURA DEL TUBO DE DESCARGA DEFECTUOSO
	J6	SENSOR DE TEMPERATURA DEL INTERCAMBIADOR DE CALOR DEFECTUOSO
	L3	FALLO TÉRMICO DE LAS PIEZAS ELÉCTRICAS
	L4	ALTAS TEMPERATURAS EN EL DISIPADOR DE CALOR DEL CIRCUITO DEL INVERSOR
	L5	SALIDA DE SOBRECORRIENTE
	P4	SENSOR DE TEMPERATURA DEL DISIPADOR DE CALOR DEL CIRCUITO DEL INVERSOR DEFECTUOSO

NOTA

• Un sonido de bip corto indica códigos no correspondientes.

• Para cancelar la pantalla de códigos, mantenga (CANCEL) pulsado durante aproximadamente 5 segundos. La pantalla de códigos también desaparece si no pulsa ningún botón durante 1 minuto.

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Intertek

The two-dimensional bar code is a manufacturing code.

3P379751-2A M14B035A (1411) HT

ENVIRO-TEC®	SERIES C VERTICAL BELT DRIVE BLOWER COIL UNITS	
INSTALLATION, OPERATION & MAINTENANCE	Supersedes: ET115.24-NOM6 (908)	Form ET115.24-NOM6 (615)

MODELS VB & VR

TABLE OF CONTENTS

SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

NOTE is used to highlight additional information which may be helpful to you.

FORM ET115.24-NOM6 (615)

SAFETY CONSIDERATIONS

The equipment covered by this manual is designed for safe and reliable operation when installed and operated within its design specification limits. To avoid personal injury or damage to equipment or property while installing or operating this equipment, it is essential that qualified, experienced personnel perform these functions using good judgment and safe practices. *See the following cautionary statements.*

ELECTRICAL SHOCK HAZARDS. All power must be disconnected prior to installation and serving this equipment. More than one source of power may be present. Disconnect all power sources to avoid electrocution or shock injuries.

MOVING PARTS HAZARDS. Motor and Blower must be disconnected prior to opening access panels. Motors can start automatically, disconnect all power and control circuits prior to servicing to avoid serious crushing or dismemberment injuries.

HOT PARTS HAZARDS. Electric Resistance heating elements must be disconnected prior to servicing. Electric Heaters may start automatically, disconnect all power and control circuits prior to servicing to avoid burns.

Check that the unit assembly and component weights can be safely supported by rigging and lifting equipment.

All assemblies must be adequately secured during lifting and rigging by temporary supports and restraints until equipment is permanently fastened and set in its final location.

All unit temporary and permanent supports must be capable of safely supporting the equipment's weight and any additional live or dead loads that may be encountered. All supports must be designed to meet applicable local codes and ordinances.

All fastening devices must be designed to mechanically lock the assembly in place without the capability of loosening or breaking away due to system operation, vibration, impact or seismic event.

Secure all dampers when servicing damper, actuator or linkages. Dampers may activate automatically, disconnect control circuits or pneumatic control systems to avoid injury.

Protect adjacent flammable materials when brazing, Use flame and heat protection barriers where needed. Have fire extinguisher available and ready for immediate use.

PRE START-UP

Improper installation, adjustment, alterations, service or maintenance can cause injury and property damage, as well as possible voiding of factory warranty. For assistance or additional information, consult a qualified contractor.

Receiving and Inspecting

Thoroughly examine the exterior and interior of all units for transportation damage to the cabinet, piping, blower(s), motor(s), coil(s), electric heat and electrical components. Interior damage may occur, even with no visible exterior damage. If damage is found, immediately file a claim with the carrier. Note the damage on the bill of lading before signing for the shipment.

Check the bill of lading for verification that all items shown (including loose items) have been received. Notify the manufacturer's representative of any shortages or items shipped in error.

Unit Rigging and Placement

Install ductwork to comply with ASHRAE Fundamentals Handbook, SMACNA, NFPA 90A and local code.

The installation must conform with local building codes and the National Electric Code.

Locate unit support in accordance with the mechanical and structural plans. If so equipped, locate the isolator placement and correct size as shown on the submittal drawing.

If floor mount isolators are required, factory or field provisions must be made for isolator attachment. Units can be mounted directly to the floor or on a base rail. The optional base rail is recommended for units with isolators.

Do not handle the unit using coil stubout connectors, as damage may occur at brazed joint(s).

Clearance

All units, including those with electric heat, are listed for zero clearance to combustibles.

Sufficient clearance for normal servicing of this equipment is recommended.

All electrical panels must have 36" working space in front of panel to meet National Electric Code; however, local inspectors may wave this requirement if the hinged cover has a 90° free swing.

FIELD WIRING

Prior to installing any wiring, check the unit name plate for main power voltage, control voltage, transformer sizing and any fuse sizing. All field wiring must comply with National Electric Code and local code requirements.

Tighten all wiring lugs and terminals prior to connecting power to the unit, as they may loosen during transportation.

Route the power lines to the power distribution terminals inside the control enclosure. If a factory wired disconnect switch is installed, then connect the power lines to the line side of the switch.

Mount and wire any field installed items as indicated on the factory supplied wiring diagram. When mounting field installed components, do not jumper out or rewire any factory wiring without written approval from ENVIRO-TEC. Violation will void warranty.

BELTS, DRIVES, AND BEARINGS

NOTE

For safety, please turn off all power before checking belt tension.

Prior to starting the unit, tighten all set screws on the fan(s), sheaves and bearings where applicable. Set screws may loosen during transportation.

Sheaves must be in line. Use a straight edge to verify.

General belt tension rules for V-Belt drives:

- Ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
- Check tension frequently during the first 24-48 hours of operation.
- Over tensioning shortens belt and bearing life.
- Keep belts free from foreign material which may cause slip.
- Make V-Belt inspection on a periodic basis. Tension when slipping. Never apply belt dressing, as this will damage the belt and cause early failure.
- The resilient blower bearing must not deflect laterally once belt is tightened.

DETERMINING DEFLECTION FORCE

(see Fig. 1)

Example	Solution
Belt Span = 20” Belt Type – A, new, unnotched RPM = 1000 Small Sheave Diameter = 4.0”	Deflection = 20 ÷ 64 = .313” (round to 5/16”). *Referring to table below, deflection force at calculated deflection is 6.8lbs.*

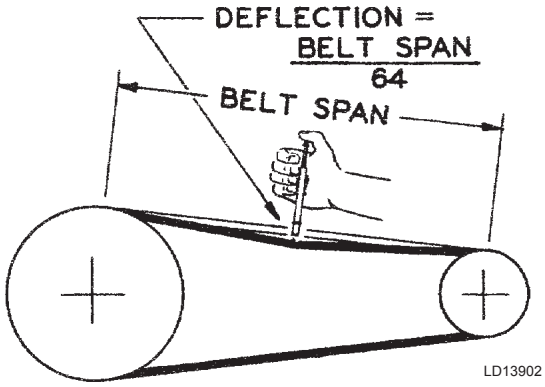

FIG. 1 - COMPUTING DEFLECTION FORCE

See table below for deflection force in pounds.

DEFLECTION FORCE — LBS.

Belt Type	Smalllest Sheave Diameter Range	RPM Range	Super Gripbelts and Unnotched Gripbands		Gripnotch Belts and Notched Gripbands	
			Used Belt	New Belt	Used Belt	New Belt
A, AX	3.0 - 3.6"	1000 - 2500	3.7	5.5	4.1	6.1
	3.8 - 4.8"	1000 - 2500	4.5	6.8	5.0	7.4
	5.0 - 7.0"	1000 - 2500	5.4	8.0	5.7	9.4
B, BX	3.4 - 4.2"	860 - 2500	Not Recommended		4.9	7.2
	4.4 - 5.6"	860 - 2500	5.3	7.9	7.1	10.5
	5.8 - 8.6"	860 - 2500	6.3	9.4	8.5	12.6

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REPLACEMENT PARTS

Replacement parts may be ordered from the local ENVIRO-TEC representative. Factory replacement parts should be used wherever possible to maintain agency listings. Should replacement parts not be purchased from the factory, use only parts duplicating the exact type, size, voltage and other operating characteristics of the original part. Contact the local representative before using any substitute part or making unit modifications. Any substitutions and/or modifications not authorized by the factory will void the unit warranty and could result in personal injury and/or property damage.

When ordering parts, the following information must be supplied to ensure proper part identification:

1. Complete unit model number
2. CO number from the unit nameplate
3. Complete parts description, including any identification numbers.

PIPING

- All piping must comply with applicable state and local codes.
- On water coils, the piping must be in a counter-flow configuration; water inlet on the leaving air side of the coil and at the bottom of the coil to provide the necessary purging of air.
- All water piping should be designed and installed to meet the job requirements.
- Where applicable, freeze protection should be used.
- Supply and return water piping should be supported. Do not suspend piping, controls, and/or shutoff valves from coil headers.
- All refrigerant piping (split systems) should be designed and installed in accordance with AHRI and ASHRAE. Leak testing should be performed before any startup procedures are initiated. On refrigeration systems, follow recommended system evacuation from the condenser unit manufacturer.

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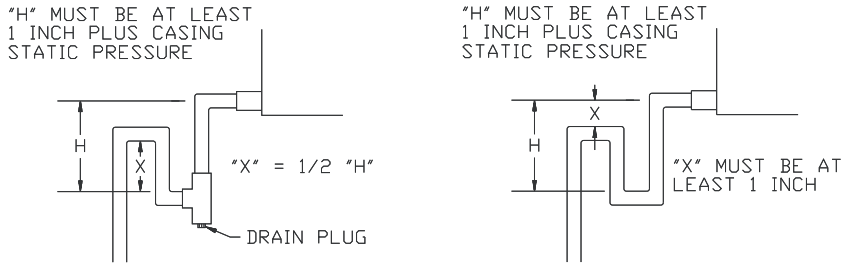
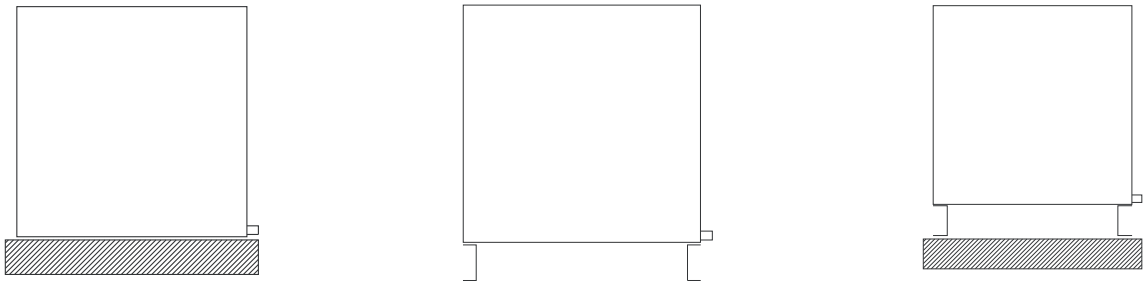
CONDENSATE DRAIN AND TRAPS

Drain lines should be at least the same size as the drain pan connection. Properly sized traps should be used to allow the condensate from the coils to drain from the drain pan. *See Fig. 2.*



Trap detail for negative cabinet static pressure

Trap detail for positive cabinet static pressure



NO BASE RAIL

Housekeeping pad Required to accommodate trap height

WITH BASE RAIL

Depending on static pressure, housekeeping pad may not be needed for trap installation

WITH BASE RAIL AND HOUSEKEEPING PAD

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FIG. 2 - CONDENSATE DRAIN & TRAPS

GENERAL BELT AND BEARING MAINTENANCE

Frequency of bearing re-lubrication depends upon the operating conditions. The proper amount of lubricant in the bearings is very important. Both excessive and inadequate lubrication may cause failure. The bearings should be re-lubricated while they are rotating (if it is safe to do so); the grease should be pumped in slowly until a slight bead forms around the seals. It is solely the owner's responsibility for maintaining a proper lubrication schedule. Failure to do so may cause substantial unit damage and voiding of the factory warranty. Note that only those bearings equipped with a grease fitting can be re-lubricated.

The following is a generic guide intended for standard equipment used in common situations.

This manual is not intended to supplant regulations or local codes having jurisdiction. It is recommended that these items be reviewed and completed prior to initiating equipment start-up.

MAINTENANCE TO BE PERFORMED	EVERY 3 MONTHS OF OPERATION (MINIMUM)	EVERY FALL
Filters (as required)	x	
Grease Bearings	x	
Inspect & Clean Blower Wheel		x
Lubricate Fan Motor (if applicable)		x
Check Belt Tension	x	
Check Electrical Connections		x
Check Bearings, Drives & Blower Wheel for Tightness		x

Normal operation is based on 8 hours a day. If unit runs more than this, adjust accordingly

RECOMMENDED TORQUE FOR TIGHTENING SETSCREWS		
Set Screw Diameter	Minimum Recommended Torque	
	Inch lbs.	Foot lbs.
#10	28	2.3
1/4	66	5.5
5/16	126	10.5
3/8	228	19.0
7/16	348	29.0
1/2	504	42.0
5/8	1104	92.0

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MOTOR ELECTRICAL DATA

HORSEPOWER	MAXIMUM MOTOR AMPERAGE							
	VOLTAGE							
	115/1	208/1	230/1	277/1	208/3	230/3	460/3	575/3
1/3	6.3	3.5	3.2	2.6	1.7	1.5	0.8	-
1/2	7.8	4.3	3.9	3.6	2.2	2.1	1.1	0.9
3/4	10.6	5.4	5.3	5.0	3.2	3.0	1.5	1.2
1	15.0	8.3	7.5	5.5	4.0	3.6	1.8	1.4
1-1/2	-	-	-	-	5.3	5.0	2.5	1.9
2	-	-	-	-	7.0	6.4	3.2	2.5
3	-	-	-	-	9.1	9.0	4.5	3.2

NOTES:
1. AMPs shown above are NEC full load AMPs for standard motor. Actual motor nameplate AMPs may vary.
2. Consult factory for applications requiring special motors.

UNIT WEIGHT DATA

COMPONENT		UNIT SIZE					
		08	12	16	20	25	30
BASIC UNIT		125 [57]	131 [60]	160 [73]	167 [76]	231 [105]	236 [107]
DAMPER SECTION		42 [19]	53 [24]	59 [27]	73 [33]	91 [41]	91 [41]
BLOW THRU ELECTRIC HEATER		42 [19]	42 [19]	42 [19]	50 [23]	55 [25]	55 [25]
DISCHARGE COIL SECTION		35 [16]	37 [17]	49 [22]	53 [24]	76 [35]	80 [36]
SUPPLY PLENUM		22 [10]	26 [12]	35 [16]	38 [17]	76 [35]	76 [35]
RETURN PLENUM (VB)		29 [13]	30 [14]	33 [15]	35 [16]	44 [20]	44 [20]
COIL ROWS	1 ROW - DRY	12 [5]	14 [6]	17 [8]	21 [10]	23 [10]	27 [12]
	1 ROW - WET	14 [6]	17 [8]	21 [10]	26 [12]	28 [13]	34 [15]
	2 ROW - DRY	17 [8]	21 [10]	26 [12]	32 [15]	37 [17]	43 [20]
	2 ROW - WET	21 [10]	27 [12]	33 [15]	42 [19]	48 [22]	56 [25]
	4 ROW - DRY	29 [13]	36 [16]	45 [20]	57 [26]	65 [30]	76 [35]
	4 ROW - WET	37 [17]	47 [21]	58 [26]	75 [34]	86 [39]	101 [46]
	6 ROW - DRY	40 [18]	51 [23]	64 [29]	81 [37]	93 [42]	109 [50]
	6 ROW - WET	52 [24]	66 [30]	84 [38]	109 [50]	124 [56]	146 [66]

NOTES:
1. Unit weight data is shipping weight in pounds (kilograms).
2. Discharge section includes a 2 row coil.

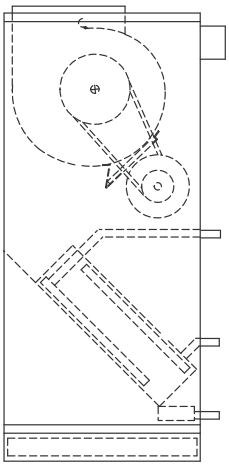
MOTOR/DRIVE WEIGHT DATA

TYPE	MOTOR HP						
	1/3	1/2	3/4	1	1 1/2	2	3
SINGLE PHASE	37 [17]	37 [17]	45 [20]	47 [21]	--	--	--
THREE PHASE	34 [15]	34 [15]	40 [18]	43 [20]	46 [21]	53 [24]	81 [37]

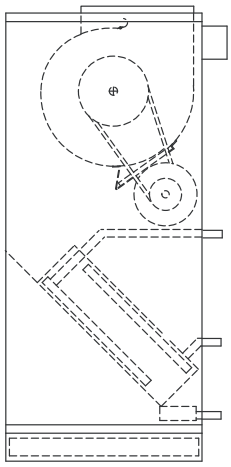
LD13905

FORM ET115.24-NOM6 (615)

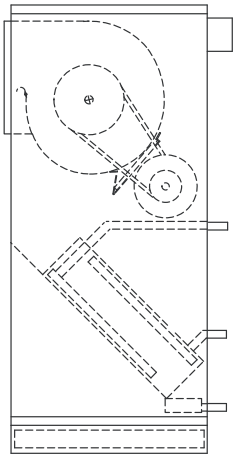
MODEL VB ARRANGEMENTS



Reverse Rotation
Arrangement 1

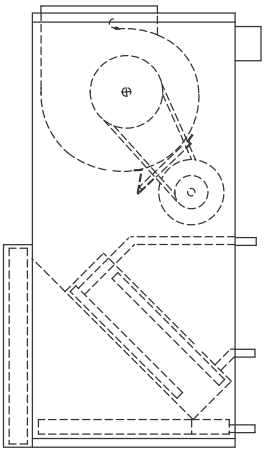


Standard Rotation
Arrangement 2

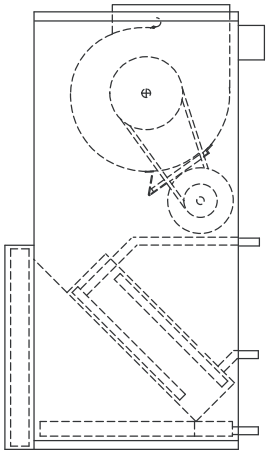


Horizontal Rear Discharge
Arrangement 7

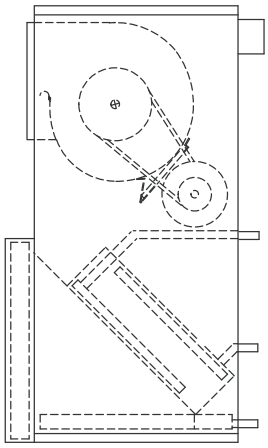
MODEL VR ARRANGEMENTS



Reverse Rotation
Arrangement 1



Standard Rotation
Arrangement 2



Horizontal Rear Discharge
Arrangement 7

NOTES:
1. Refer to Dimensional Data for unit dimensions.
2. Fan arrangements are also available with inlet damper section (Model VR) and return plenum section (Model VB).
3. Side access filter rack standard on arrangement 7 (Model VR).
4. Discharge heating coil section and supply plenum are not available with arrangement 7.
5. All drawings subject to change without prior notice. Refer to www.enviro-tec.com for current submittal drawings.

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FORM ET115.24-NOM6 (615)

INSPECTION & START-UP CHECKLIST

Receiving & Inspection

- ❑ Unit Received Undamaged
- ❑ Unit Arrangement/Hand Correct
- ❑ Unit Received Complete As Ordered
- ❑ Unit Structural Support Complete & Correct

Handling & Installation

- ❑ Unit Mounted Level & Square
- ❑ Proper Electrical Service Provided
- ❑ Proper Service Switch/Disconnect Provided
- ❑ Proper Chilled Water Line Size To Unit
- ❑ Proper Refrigerant Line Sizes To Unit
- ❑ Proper Steam Condensate Trap On Return Line
- ❑ All Services To Unit In Code Compliance
- ❑ Proper Access Provided for Unit & Accessories
- ❑ Proper Overcurrent Protection Provided
- ❑ Proper Hot Water Line To Unit
- ❑ Proper Steam Line Sizes To Unit
- ❑ Proper Steam Supply Pressure To Unit (15psi Max)
- ❑ All Shipping Screws & Braces Removed

Cooling/Heating Connections

- ❑ Protect Valve Package Components From Heat
- ❑ Connect Field Piping To Unit
- ❑ Install Drain Line & Traps As Required
- ❑ Install Condensate Pan Under Piping As Required
- ❑ Mount Valve Packages
- ❑ Pressure Test All Piping For Leaks
- ❑ Insulate All Piping As Required

Ductwork Connections

- ❑ Install Ductwork, Fittings & Grilles As Required
- ❑ Control Outside Air For Freeze Protection
- ❑ Proper Supply & Return Grille Type & Size Used
- ❑ Insulate All Ductwork As Required

Electrical Connections

- ❑ Refer To Unit Wiring Diagram
- ❑ All Field Wiring In Code Compliance
- ❑ Connect Incoming Power Service or Services

Unit Startup

- ❑ General Visual Unit & System Inspection
- ❑ Record Ambient Temperature
- ❑ Close All Unit Isolation Valves
- ❑ Fill Systems With Water/Refrigerant
- ❑ All Ductwork & Grilles In Place
- ❑ Start Fans, Etc.
- ❑ Check All Ductwork & Units For Air Leaks
- ❑ Record All Final Settings For Future Use
- ❑ Check All Dampers For Proper Operation
- ❑ Verify Proper Heating Operation
- ❑ Record Electrical Supply Voltage
- ❑ Check All Wiring For Secure Connections
- ❑ Flush Water Systems
- ❑ Vent Water Systems As Required
- ❑ All Unit Panels & Filters In Place
- ❑ Check For Overload Condition Of All Units
- ❑ Balance Air Systems As Required
- ❑ Check Piping & Ductwork For Vibration
- ❑ Verify Proper Cooling Operation
- ❑ Reinstall All Covers & Access Panels

Blower/Motor

- ❑ Check Sheave Set Screw Tightness
- ❑ Check Blower Wheel Set Screw Tightness
- ❑ Adjust Blower Speed as Necessary for Balancing Airflow
- ❑ Check/Adjust Sheave Alignment
- ❑ Check/Adjust Belt Tension

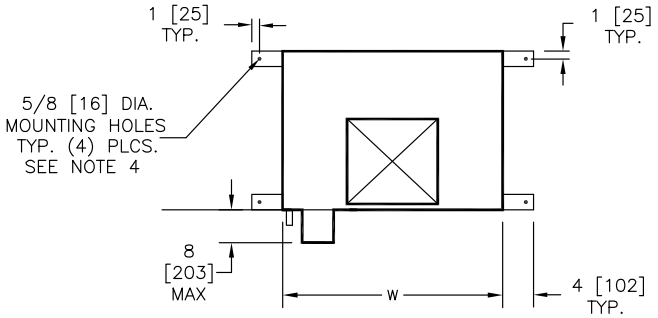
LD13907

FORM ET115.24-NOM6 (615)

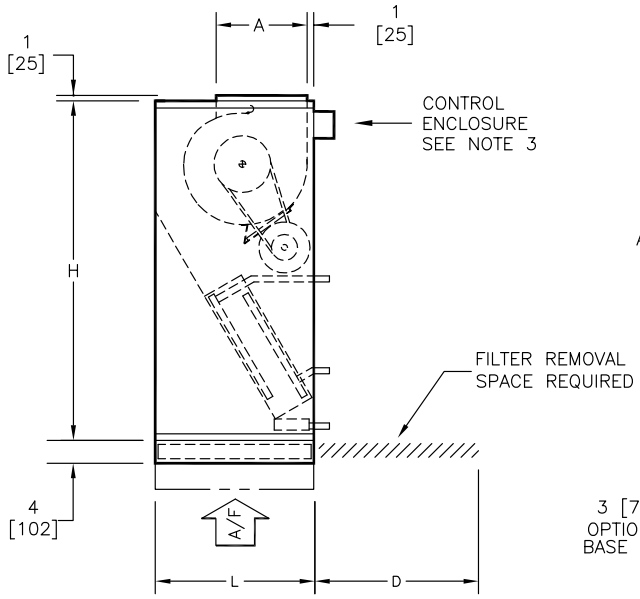
DIMENSIONS

Model VB Basic Unit - Discharge Arrangement 2

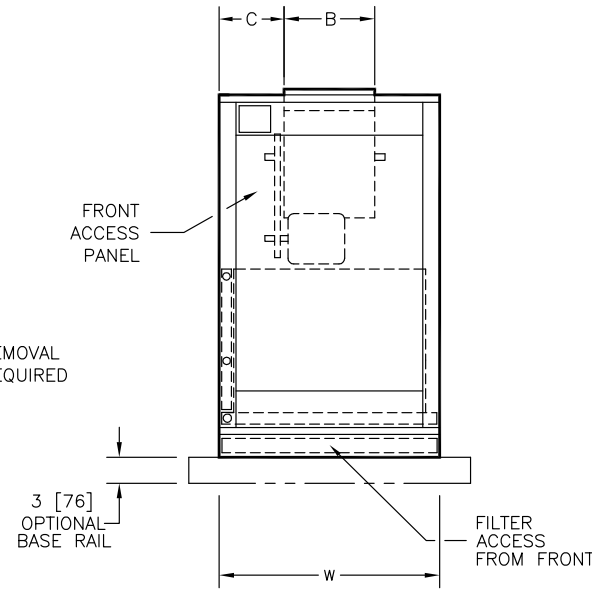
NOTES:
1. All dimensions are Inches [millimeters]. All dimensions are ±1/4" [6mm]. Metric values are soft conversion.
2. Left hand unit shown. Motor/drive location may be specified Left or Right Hand. Standard control enclosure location matches motor/drive position. Enclosure size varies with options.
3. Provide sufficient clearance to access electrical controls and comply with all applicable codes and ordinances.
4. Optional base rail designed for use with floor mount vibration isolators.



TOP VIEW



SIDE VIEW



FRONT VIEW

DIMENSIONS - In [mm]

52-80004REV01

UNIT SIZE	FILTER SIZE	QTY	H	W	L	A	B	C	D
08	16 X 20 X 2 [406 X 508 X 51]	1	46 [1168]	26 [660]	19 [483]	6-1/2 [165]	6-7/8 [175]	9-9/16 [243]	16 [406]
12	20 X 20 X 2 [508 X 508 X 51]	1	46 [1168]	26 [660]	21 [533]	7-1/2 [190]	8-1/4 [210]	8-7/8 [225]	20 [508]
16	24 X 24 X 2 [610 X 610 X 51]	1	54 [1372]	29 [737]	25 [635]	7-1/2 [190]	10-1/4 [260]	9-3/8 [238]	24 [610]
20	24 X 24 X 2 [610 X 610 X 51]	1	54 [1372]	29 [737]	28 [711]	11-3/8 [289]	13-1/4 [337]	7-7/8 [200]	24 [610]
25	24 X 24 X 2 [610 X 610 X 51]	1 EACH	60 [1524]	39 [991]	28 [711]	16 [406]	12-7/8 [327]	13-1/16 [332]	24 [610]
30	12 X 24 X 2 [305 X 610 X 51]	1 EACH	60 [1524]	39 [991]	28 [711]	16 [406]	15 [381]	12 [305]	24 [610]

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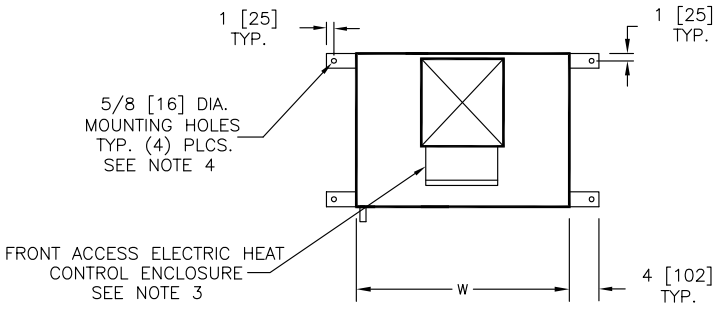
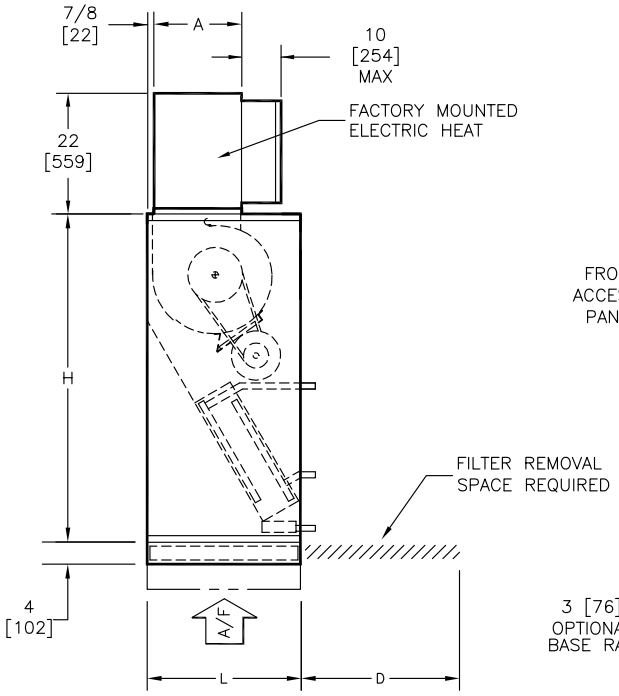
Model VB Basic Unit - Discharge Arrangement 1 with Blow-thru Electric Heat

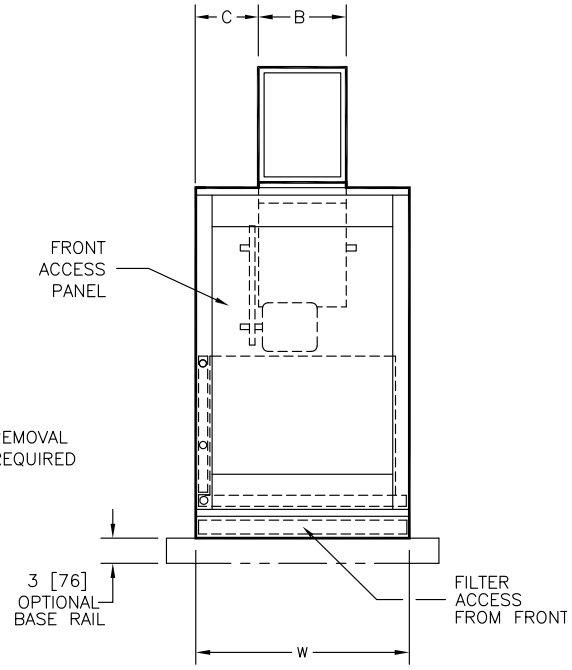
NOTES:
1. All dimensions are Inches [millimeters]. All dimensions are ±1/4" [6mm]. Metric values are soft conversion.
2. Left hand unit shown. Motor/drive location may be specified Left or Right Hand. Standard control enclosure location matches motor/drive position.
3. Provide sufficient clearance to access electrical controls and comply with all applicable codes and ordinances.
4. Optional base rail designed for use with floor mount vibration isolators.
5. Blow–thru electric heat may not be combined with supply plenum or discharge section.



TOP VIEW



SIDE VIEW



FRONT VIEW

52-80011REV01

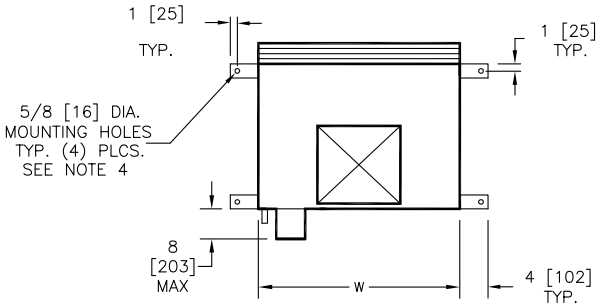
DIMENSIONS – In [mm]

UNIT SIZE	FILTER SIZE	QTY	H	W	L	A	B	C	D
08	16 X 20 X 2 [406 X 508 X 51]	1	46 [1168]	26 [660]	19 [483]	8–7/8 [226]	11–7/8 [302]	7–1/16 [180]	16 [406]
12	20 X 20 X 2 [508 X 508 X 51]	1	46 [1168]	26 [660]	21 [533]	8–7/8 [226]	11–7/8 [302]	7–1/16 [180]	20 [508]
16	24 X 24 X 2 [610 X 610 X 51]	1	54 [1372]	29 [737]	25 [635]	10–7/8 [277]	12 [305]	8–1/2 [216]	24 [610]
20	24 X 24 X 2 [610 X 610 X 51]	1	54 [1372]	29 [737]	28 [711]	13–7/8 [353]	14 [356]	7–1/2 [190]	24 [610]
25	24 X 24 X 2 [610 X 610 X 51]	1 EACH	60 [1524]	39 [991]	28 [711]	13–7/8 [353]	16–5/8 [422]	11–1/16 [281]	24 [610]
30	12 X 24 X 2 [305 X 610 X 51]	1 EACH	60 [1524]	39 [991]	28 [711]	15 5/8 [397]	16–5/8 [422]	11–1/16 [281]	24 [610]

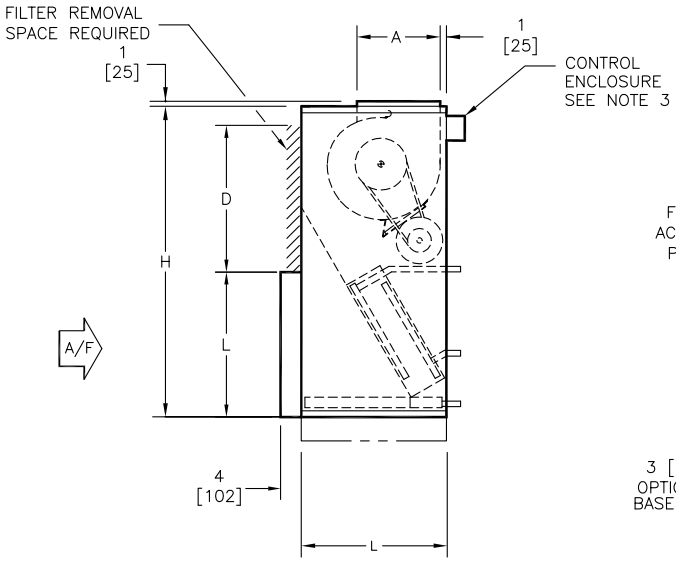
FORM ET115.24-NOM6 (615)

Model VR Basic Unit - Discharge Arrangement 2

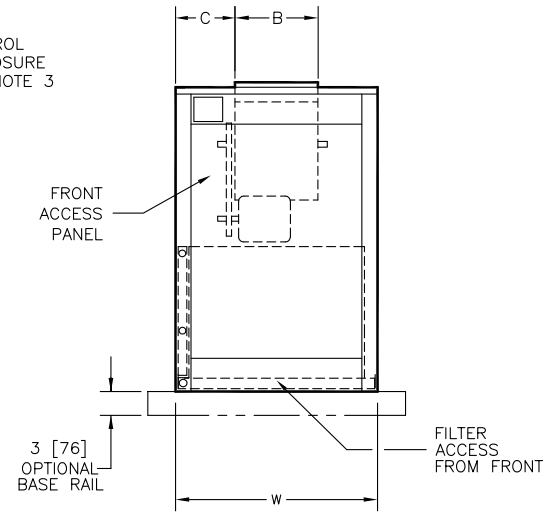
NOTES:
1. All dimensions are Inches [millimeters]. All dimensions are ±1/4" [6mm]. Metric values are soft conversion.
2. Left hand unit shown. Motor/drive location may be specified Left or Right Hand. Standard control enclosure location matches motor/drive position. Enclosure sizes varies with option.
3. Provide sufficient clearance to access electrical controls and comply with all applicable codes and ordinances.
4. Optional base rail designed for use with floor mount vibration isolators.



TOP VIEW



SIDE VIEW



FRONT VIEW

52-80007REV01

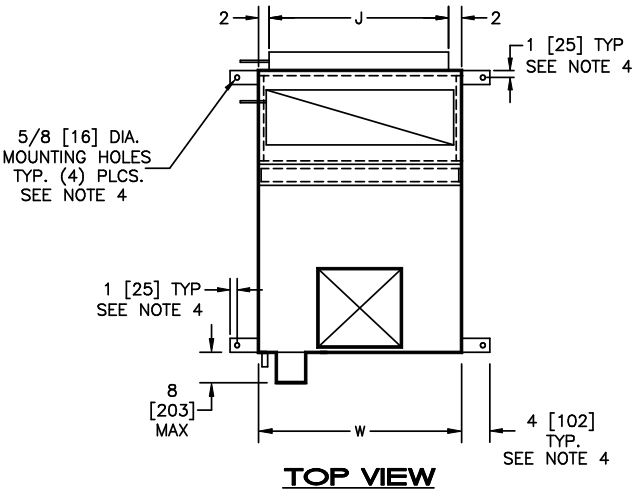
DIMENSIONS – In [mm]

UNIT SIZE	FILTER SIZE	QTY	H	W	L	A	B	C	D
08	16 X 20 X 2 [406 X 508 X 51]	1	46 [1168]	26 [660]	19 [483]	6–1/2 [165]	6–7/8 [175]	9–9/16 [243]	16 [406]
12	20 X 20 X 2 [508 X 508 X 51]	1	46 [1168]	26 [660]	21 [533]	7–1/2 [190]	8–1/4 [210]	8–7/8 [225]	20 [508]
16	24 X 24 X 2 [610 X 610 X 51]	1	54 [1372]	29 [737]	25 [635]	7–1/2 [190]	10–1/4 [260]	9–3/8 [238]	24 [610]
20	24 X 24 X 2 [610 X 610 X 51]	1	54 [1372]	29 [737]	28 [711]	11–3/8 [289]	13–1/4 [337]	7–7/8 [200]	24 [610]
25	24 X 24 X 2 [610 X 610 X 51]	1 EACH	60 [1524]	39 [991]	28 [711]	16 [406]	12–7/8 [327]	13–1/16 [332]	24 [610]
30	12 X 24 X 2 [305 X 610 X 51]	1 EACH	60 [1524]	39 [991]	28 [711]	16 [406]	15 [381]	12 [305]	24 [610]

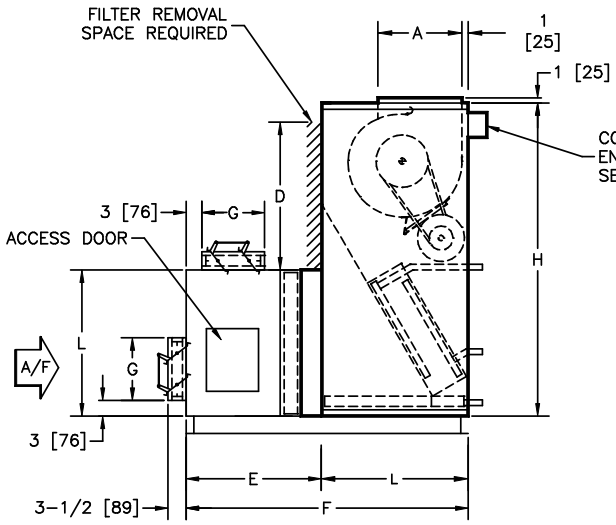
FORM ET115.24-NOM6 (615)

Model VMR with Inlet Damper Section (Requires Base rail) - Discharge Arrangement 2

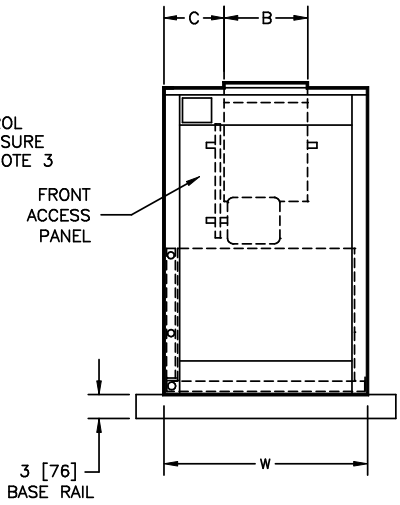
NOTES:
1. All dimensions are Inches [millimeters]. All dimensions are ±1/4" [6mm]. Metric values are soft conversion.
2. Left hand unit shown. Right hand unit opposite. Motor/drive location may be specified Left or Right Hand. Standard control enclosure location matches motor/drive position.
3. Provide sufficient clearance to access electrical controls and comply with all applicable codes and ordinances.
4. Base rail designed for use with floor mount vibration isolators. See page 16 for base rail details.



TOP VIEW



SIDE VIEW



FRONT VIEW

52-80020REV00

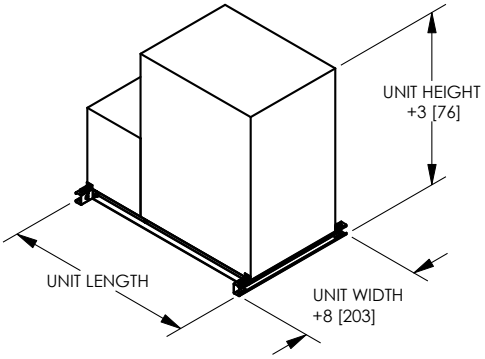
DIMENSIONS - In [mm]

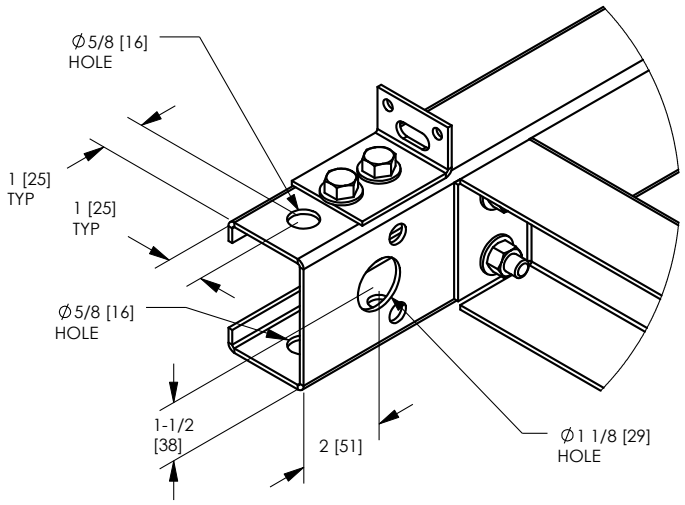
UNIT SIZE	FILTER SIZE	QTY	H	W	L	A	B	C	D	E	F	G	J
08	16 X 20 X 2 [406 X 508 X 51]	1	46 [1168]	26 [660]	19 [483]	6-1/2 [165]	6-7/8 [175]	9-9/16 [243]	16 [406]	15 [381]	35 [889]	6 [152]	22 [559]
12	20 X 20 X 2 [508 X 508 X 51]	1	46 [1168]	26 [660]	21 [533]	7-1/2 [190]	8-1/4 [210]	8-7/8 [225]	20 [508]	18 [457]	40 [1016]	9 [229]	22 [559]
16	24 X 24 X 2 [610 X 610 X 51]	1	54 [1372]	29 [737]	25 [635]	7-1/2 [190]	10-1/4 [260]	9-3/8 [238]	24 [610]	18 [457]	44 [1118]	9 [229]	25 [635]
20	24 X 24 X 2 [610 X 610 X 51]	1	54 [1372]	29 [737]	28 [711]	11-3/8 [289]	13-1/4 [337]	7-7/8 [200]	24 [610]	21 [533]	50 [1270]	12 [305]	25 [635]
25	24 X 24 X 2 [610 X 610 X 51]	1 EACH	60 [1524]	39 [991]	28 [711]	16 [406]	12-7/8 [327]	13-1/16 [332]	24 [610]	21 [533]	50 [1270]	12 [305]	35 [889]
30	12 X 24 X 2 [305 X 610 X 51]	1 EACH	60 [1524]	39 [991]	28 [711]	16 [406]	15 [381]	12 [305]	24 [610]	21 [533]	50 [1270]	12 [305]	35 [889]

FORM ET115.24-NOM6 (615)

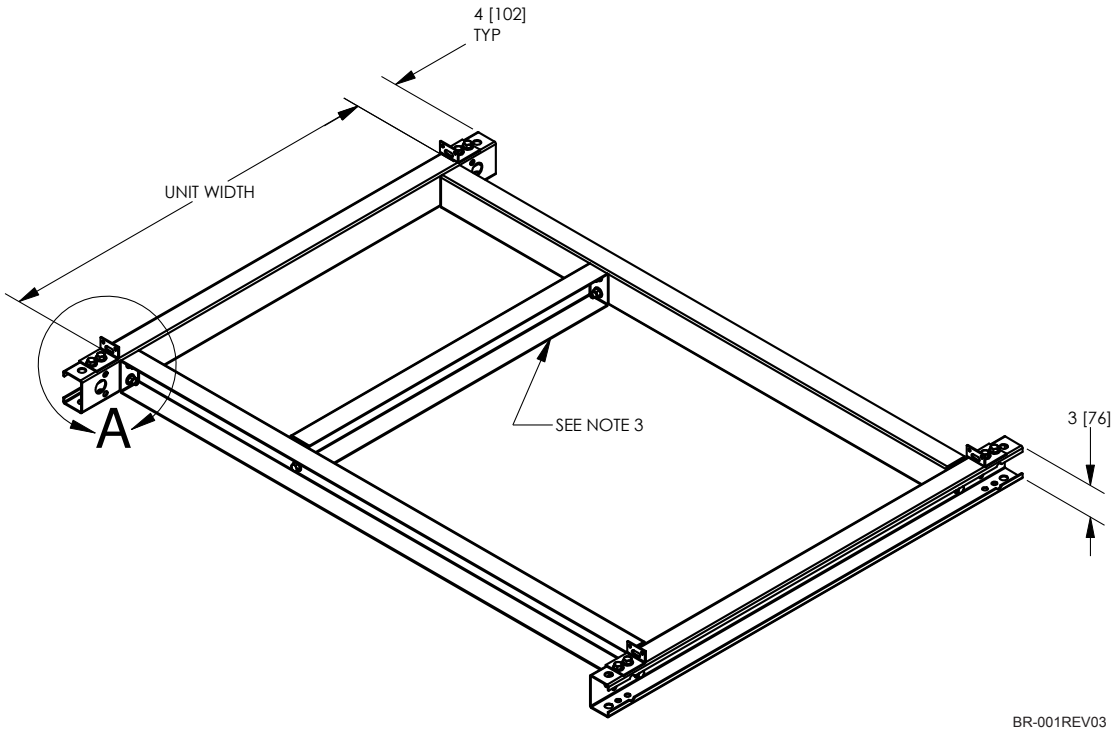
3 Inch Baserail Assembly

NOTES:
1. All dimensions are Inches [millimeters]. All dimensions ±1/4" [6mm].
2. Vertical unit shown, typical for both vertical and horizontal units.
3. Support used on units with length over 50 [1270].





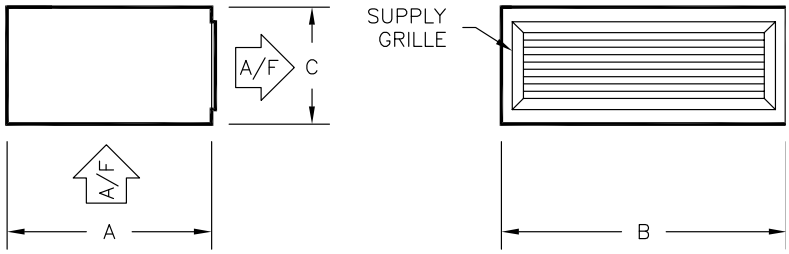
DETAIL A



BR-001REV03

FORM ET115.24-NOM6 (615)

Model VB/VR Discharge Plenum, Sizes 08-30



Side View

Front View

DIMENSIONS – In [mm]

UNIT SIZE	A	B	C	SUPPLY GRILLE
08	19 [483]	26 [660]	12 [305]	18 X 8 [457 X 203]
12	21 [533]	26 [660]	12 [305]	22 X 8 [559 X 203]
16	25 [635]	29 [737]	14 [356]	24 X 10 [610 X 254]
20	28 [711]	29 [737]	16 [406]	24 X 12 [610 X 305]
25	28 [711]	39 [991]	16 [406]	30 X 12 [762 X 305]
30	28 [711]	39 [991]	16 [406]	36 X 12 [914 X 305]

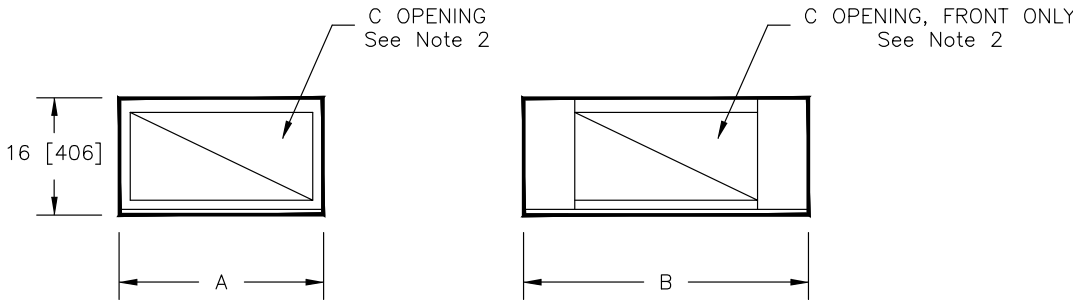
NOTES:

1. All dimensions are Inches [millimeters]. All dimensions are ±1/4" [6mm]. Metric values are soft conversion.
2. Discharge plenum shipped attached to unit.
3. Discharge plenum includes a double deflection discharge grille, location is front as shown.
4. Discharge plenum may not be combined with blow thru electric heat.

VBR-003REV02

FORM ET115.24-NOM6 (615)

Model VB Return Plenum, Sizes 08-30



Side View

Front View

DIMENSIONS – In [mm]

UNIT SIZE	A	B	C OPENING
08	19 [483]	26 [660]	9 X 16 [229 X 406]
12	21 [533]	26 [660]	9 X 18 [229 X 457]
16	25 [635]	29 [737]	9 X 22 [229 X 559]
20	28 [711]	29 [737]	12 X 22 [305 X 559]
25	28 [711]	39 [991]	12 X 25 [305 X 635]
30	28 [711]	39 [991]	12 X 25 [305 X 635]

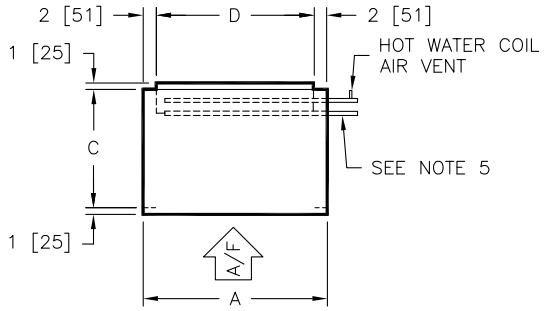
NOTES:
1. All dimensions are inches [millimeters]. All dimensions ± 1/4" [6mm]. Metric values are soft conversion.
2. Standard plenum is provided with removable covers on side openings, and plenum is installed on unit for front inlet. Covers may be relocated, and plenum may be rotated in the field for alternate inlet locations.

52-80017REV00

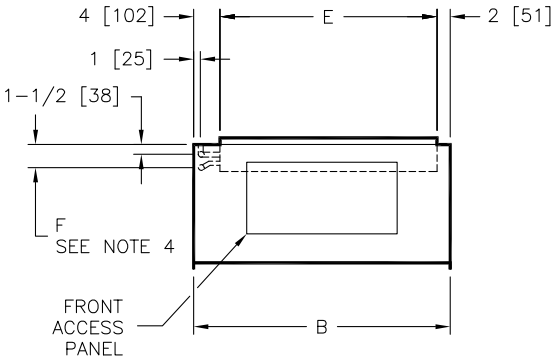
FORM ET115.24-NOM6 (615)

Model VB/VR Discharge Section w/ Heating Coil, Sizes 08-30

NOTES:
1. All dimensions ±1/4" [6mm].
2. This section required with 6 row cooling in conjunction with hot water and all steam heating.
3. Weight with 2 row dry coil.
4. Coil connection dimension ±1/2" [13mm].
5. Hot water coils: Supply – bottom, Return – top. Steam coils: Supply – top, Condensate – bottom.
6. Discharge section may not be combined with Blow–Thru Electric Heat.



Side View



Front View

DIMENSIONS – In [mm]

UNIT SIZE	A	B	C	D	E	F (4) HOT WATER 1 ROW	F (4) HOT WATER 2 ROW	F (4) STEAM 1 ROW	F (4) STEAM 2 ROW	WGT. (3) lbs. [kg]
08	19 [483]	26 [660]	12 [305]	15 [381]	20 [508]	2–3/4 [70]	2–3/4 [70]	2–3/4 [70]	2–3/4 [70]	35 [16]
12	21 [533]	26 [660]	12 [305]	17 [432]	20 [508]	2–3/4 [70]	2–3/4 [70]	2–3/4 [70]	2–3/4 [70]	37 [17]
16	25 [635]	29 [737]	14 [356]	21 [533]	23 [584]	2–3/4 [70]	3 [76]	2–3/4 [70]	3–1/4 [83]	49 [22]
20	28 [711]	29 [737]	14 [356]	24 [610]	23 [584]	2–3/4 [70]	3 [76]	3–1/4 [83]	3–1/4 [83]	53 [24]
25	28 [711]	39 [991]	18 [457]	24 [610]	33 [838]	2–3/4 [70]	3 [76]	3–1/4 [83]	3–3/4 [95]	76 [35]
30	28 [711]	39 [991]	18 [457]	24 [610]	33 [838]	3 [76]	3–1/4 [83]	3–3/4 [95]	3–3/4 [95]	80 [36]

COIL CONNECTION SIZES

UNIT SIZE	HOT WATER 1 ROW	HOT WATER 2 ROW	STEAM 1 ROW SUPPLY	STEAM 1 ROW CONDENSATE	STEAM 2 ROW SUPPLY	STEAM 2 ROW CONDENSATE
08	5/8 [16]	5/8 [16]	1–1/8 [29]	7/8 [22]	1–1/8 [29]	7/8 [22]
12	5/8 [16]	5/8 [16]	1–1/8 [29]	7/8 [22]	1–1/8 [29]	7/8 [22]
16	5/8 [16]	5/8 [16]	1–1/8 [29]	7/8 [22]	1–3/8 [35]	1–1/8 [29]
20	5/8 [16]	5/8 [16]	1–3/8 [35]	1–1/8 [29]	1–3/8 [35]	1–1/8 [29]
25	5/8 [16]	7/8 [22]	1–3/8 [35]	1–1/8 [29]	1–5/8 [41]	1–1/8 [29]
30	7/8 [22]	7/8 [22]	1–5/8 [41]	1–1/8 [29]	1–5/8 [41]	1–1/8 [29]

VBR-004REV2

Catalog: ET115.24-NOM6 (615) Supersedes ET115.24-NOM6 (908)

www.enviro-tec.com

Installation and Maintenance Manual

IM 970-2

Group: **Applied Air Handling**
Part Number: **920102421-20**
Date: **May 2017**

Maverick® I

Heating & Cooling
Models MPSA03 – A05, 14 SEER
Models MPSH03 – H05, 15 SEER
3 to 5 Tons
R-410A Refrigerant

General

This manual contains the installation and operating instructions for your packaged rooftop unit. There are some precautions that should be taken to derive maximum satisfaction from it. Improper installation can result in unsatisfactory operation or dangerous conditions.

Read this manual and any instructions packaged with separate equipment prior to installation. Give this manual to the owner and explain its provisions. The owner should retain this manual for future reference.

This product line does have an optional DDC controller. For operation and information on using and programming the MicroTech® III unit controller, refer to the appropriate operation manual (see Table 1).

For a description of operation and information on using the keypad to view data and set parameters, refer to the appropriate program-specific operation manual (see Table 1).

Table 1: Operation, Installation and Maintenance Resources

Unit	Manual
Rooftop Unit Control Configuration	Operation Manual Bulletin Number
DDC Unit Controller	OM 1077
BACnet Communication Module	IM 1000
LonWorks Communication Module	IM 999

Checking Product Received

Upon receiving the unit, inspect for any damage from shipment. Claims for damage, either shipping or concealed, should be filed immediately with the shipping company.

Important: Check the unit model number, heating size, electrical characteristics, and accessories to determine if they are correct.

Hazardous Information Messages

⚠ DANGER

The manufacturer's warranty does not cover any damage or defect to the air conditioner caused by the attachment or use of any components, accessories or devices (other than those authorized by the manufacturer) into, onto, or in conjunction with the air conditioner. you should be aware that the use of unauthorized components, accessories or devices may adversely affect the operation of the air conditioner and may also endanger life and property. The manufacturer disclaims any responsibility for such loss or injury resulting from the use of such unauthorized components, accessories or devices.

⚠ WARNING

Provide adequate combustion and ventilation air to the unit space as specified in the combustion and ventilation air section of these instructions.

⚠ CAUTION

Install this unit only in a location and position as specified in the "Mechanical Installation" section of these instructions. Provide adequate combustion and ventilation air to the unit space as specified in the venting section of these instructions.

⚠ WARNING

Combustion products must be discharged outdoors. Connect this unit to an approved vent system only, as specified in "Mechanical Installation" section of these instructions.

⚠ NOTICE

Use only with type of gas approved for this unit. Refer to the unit rating plate.

⚠ DANGER

Never test for gas leaks with an open flame. It can cause an explosion or fire resulting in property damage, personal injury or death. Use a commercially available soap solution made specifically for the detection of leaks to check all connections, as specified in the "Mechanical Installation" section of these instructions.

⚠ NOTICE

Always install unit to operate within the unit's intended temperature-rise range with a duct system which has an external static pressure within the allowable range, as specified in the "Mechanical Installation" section of these instructions. See also unit rating plate.

⚠ DANGER

Units are not design certified to be installed inside the structure. Doing so can cause inadequate unit performance as well as property damage and carbon monoxide poisoning resulting in personal injury or death.

General

⚠ WARNING

When a unit is installed so that supply ducts carry air circulated by the unit to areas outside the space containing the unit, the return air shall also be handled by duct(s) sealed to the unit casing and terminating outside the space containing the unit.

Install this unit in accordance with The American National Standard Z223.1-latest edition manual entitled "National Fuel Gas Code," and the requirements or codes of the local utility or other authority having jurisdiction.

Additional helpful publications available from the "National Fire Protection Association" are: sNFPA-90A - Installation of Air Conditioning and Ventilating Systems 1985 or latest edition. NFPA-90B - Warm Air Heating and Air Conditioning Systems 1984.

These publications are available from:
National Fire Protection Association, Inc.
Batterymarch Park
Quincy, MA 02269

Major Components

The unit includes a hermetically-sealed refrigerating system (consisting of a scroll compressor, condenser coil, and evaporator coil with a thermal expansion valve), a circulation air blower, and a condenser fan. The cooling system of these units is factory-evacuated, charged and performance tested. Refrigerant amount and type are indicated on rating plate.

Heat options include natural gas fired furnace or a field installed electric resistance heater. The furnace assembly comes complete including a heat exchanger assembly, gas burner and control assembly, combustion air motor and fan, and all necessary internal electrical wiring.

Pre-Installation Check-Points

Before attempting any installation, carefully consider the following points:

A. Structural strength of supporting members (rooftop installation)
B. Clearances and provision for servicing power supply and wiring
C. Gas supply and piping
D. Air duct connections and sizing
E. Drain facilities and connections
F. Location for minimum noise and vibration - away from bedroom windows

Location Considerations

⚠ WARNING

This unit may be used to heat the building or structure during construction if the following installation requirements are met. Installation must comply with all installation instructions including:

- Proper vent installation
- Furnace operating under thermostatic control
- Return air duct sealed to the furnace
- Air filters in place
- Set furnace input rate and temperature rise per rating plate marking
- Means of providing outdoor air required for combustion
- Return air temperature maintained between 55°F (13°C) and 80°F (27°C)
- Installation of exhaust and combustion air inlet hoods completed
- Clean furnace, duct work and components upon substantial completion of the construction process, and verify furnace operating conditions including ignition, input rate, temperature rise and venting, according to the instructions.

The metal parts of this unit may be subject to rust or deterioration in adverse environmental conditions. This oxidation could shorten the equipment's useful life. Salt spray, fog or mist in seacoast areas, sulphur or chlorine from lawn watering systems, and various chemical contaminants from industries such as paper mills and petroleum refineries are especially corrosive.

If the unit is to be installed in an area where contaminants are likely to be a problem, give special attention to the equipment location and exposure.

1. Avoid having lawn sprinkler heads spray directly on the unit cabinet.
2. In coastal areas, locate the unit on the side of the building away from the waterfront.
3. Shielding by a fence or shrubs may give some protection.
4. Frequent washing of the cabinet, fan blade and coil with fresh water will remove most of the salt or other contaminants that build up on the unit.
5. Regular cleaning and waxing of the cabinet with a good automobile polish will provide some protection.
6. A good liquid cleaner may be used several times a year to remove matter that will not wash off with water.

Several different types of protective coatings are offered in some areas. These coatings may provide some benefit, but the effectiveness of such coating materials cannot be verified by the equipment manufacturer.

The best protection is frequent cleaning, maintenance, and minimal exposure to contaminants.

Outside Slab Installation

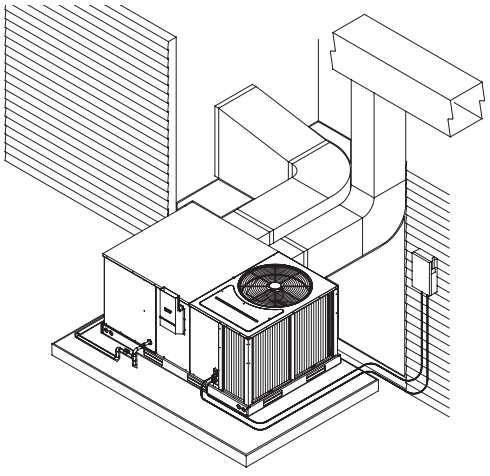
⚠ DANGER

These units are designed certified for outdoor installation only. Installation inside any part of a structure can result in inadequate unit performance as well as property damage. Installation inside can also cause recirculation of flue products into the conditioned space resulting in personal injury or death.

Typical outdoor slab installation is shown in Figure 1.

1. Select a location where external water drainage cannot collect around unit.
2. Provide a level slab sufficiently high enough above grade to prevent surface water from entering the unit
3. The location of the unit should be such as to provide proper access for inspection and servicing as shown in Figure 3 on page 6.
4. Locate unit where operating sounds will not disturb owner or neighbors.
5. Locate unit so roof runoff water does not pour directly on the unit. Provide gutter or other shielding at roof level. Do not locate unit in an area where excessive snow drifting may occur or accumulate.
6. Where snowfall is anticipated, the height of the unit above the ground level must be considered. Mount unit high enough to be above anticipated maximum area snowfall and to allow combustion air to enter the combustion air inlet.
7. Select an area which will keep the areas of the vent, air intake, and A/C condenser fins free and clear of obstructions such as weeds, shrubs, vines, snow, etc. Inform the user accordingly.
8. Remove compressor shipping supports (if so equipped) after installation.

Figure 1: Outside Slab Installation



Attaching Exhaust and Combustion Air Inlet Hoods

⚠ IMPORTANT

Do not operate this unit without the exhaust/ combustion air inlet hood properly installed. This hood is shipped in a carton in the blower compartment inside the unit and must be attached when the unit is installed. See Figure 29 on page 29.

To attach exhaust/combustion air inlet hood:

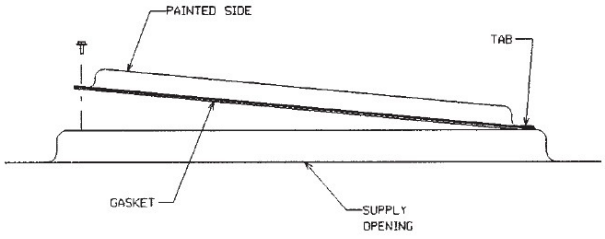
1. Remove screws securing blower access panel and remove access panel. For location of blower access panel, see Figure 28 on page 29.
2. Remove exhaust/combustion air inlet hood from the carton, located inside the blower compartment.
3. Attach blower access panel.
4. Attach the combustion air inlet/exhaust hood with screws. Reference Figure 29 on page 29 for proper location. Screws are in carton with the hood.
5. Vent the unit using the flue exhaust hood, as supplied from the factory, without alteration or addition.

Cover Panel Installation/ Conversion

Downflow to Horizontal

1. Remove the screws and covers from the outside of the supply and return sections.
2. Install the covers in the bottom supply and return openings with the painted side up (Figure 2). Use the existing gasket to seal the covers.
3. Secure the supply cover to the base of the unit with one screw, engaging prepunched tab in unit base.
4. Secure the return cover to the base of the unit with screws engaging prepunched holes in the unit base.

Figure 2: Cover Gasket Detail–Down-Flow to Horizontal



This unit is provided with 2 - 25" × 16" × 1" disposable filters. When replacing filters, ensure they are inserted fully to the back to prevent bypass.

Clearances

The following minimum clearances (Table 2) must be observed for proper unit performance and serviceability (also reference Figure 3).

NOTE: Supply duct may be installed with 0" clearance to combustible materials, provided 1" minimum Fiberglass insulation is applied either inside or outside of the duct.

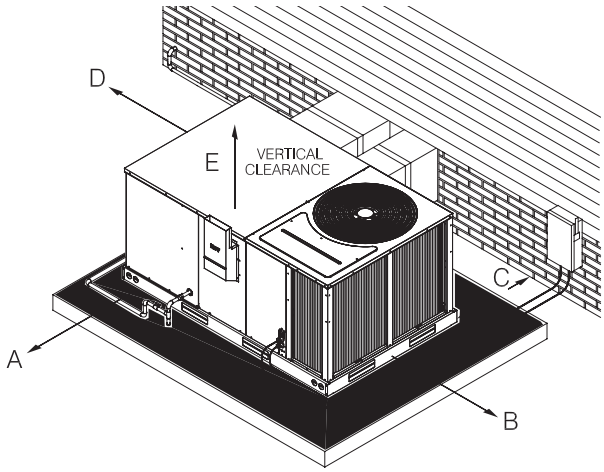
Rooftop Installation

⚠ NOTICE

If unit will not be put into service immediately, block off supply and return air openings to prevent excessive condensation.

1. Before locating the unit on the roof, make sure that the roof structure is adequate to support the weight involved (see "Unit Capacity and Physical Data" on page 25). THIS IS VERY IMPORTANT AND THE INSTALLER'S RESPONSIBILITY.
2. For rigging and roofcurb details, see Figure 5, Figure 6 and Figure 7.
3. The location of the unit on the roof should be such as to provide proper access for inspection and servicing.
4. Remove compressor shipping supports (if so equipped) after installation.

Figure 3: Clearances



Ductwork

⚠ DANGER

Never connect return ductwork to any other heat producing device such as fireplace insert, stove, etc. Unauthorized use of such devices may result in fire, carbon monoxide poisoning, explosion, personal injury, property damage or death.

The installing contractor should fabricate ductwork in accordance with local codes. Use industry manuals as a guide when sizing and designing the duct system. Contact Air Conditioning Contractors of America, 1513 16th St. N.W., Washington, D.C. 20036.

Place the unit as close to the conditioned space as possible allowing clearances as indicated. Run ducts as directly as possible to supply and return outlets. Use of non-flammable weatherproof flexible connectors on both supply and return connections at unit to reduce noise transmission is recommended.

On ductwork exposed to outside temperature and humidity, use a minimum of 2" of insulation and a vapor barrier. Distribution system in attic, furred space or crawl space should be insulated with at least 2" of insulation. ½" to 1" thick insulation is usually sufficient for ductwork inside the air conditioned space.

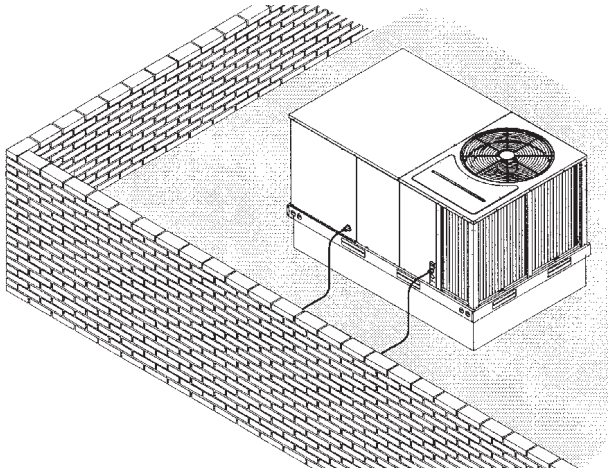
Provide balancing dampers for each branch duct in the supply system. Properly support ductwork from the structure.

Table 2: Recommended Clearances

Location	Clearance
A - Front	48"
B - Condenser Coil	18"
C - Duct Side	12"*
D - Evaporator End	36"
E - Above	60"

NOTE: *without Economizer. 57" with Economizer.

Figure 4: Unit Mounted on Roof Curb



Return Air

⚠ DANGER

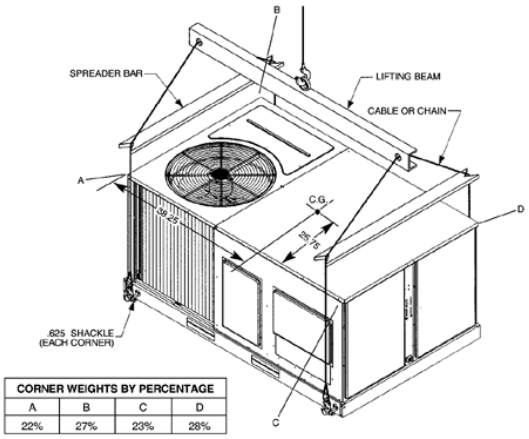
Never allow products of combustion or the flue products to enter the return air ductwork or the circulating air supply. All return ductwork must be adequately sealed and secured to the furnace with sheet metal screws and joints must be taped. All other duct joints must be secured with approved connections and sealed airtight.

Failure to prevent products of combustion from being circulated into the living space can create potentially hazardous conditions, including carbon monoxide poisoning that could result in personal injury or death.

In the event that the return air ducts must be run through an "unconfined" space containing other fuel burning equipment, it is imperative that the user be informed against future changes in construction which might change this to a "confined space." Also, caution the user against any future installation of additional equipment (such as power ventilators, clothes dryers, etc.) within the existing unconfined and/or confined space which might create a negative pressure within the vicinity of other solid, liquid, or gas fueled units.

Rigging and Roof Curb

Figure 5: Rigging Detail



CORNER WEIGHTS BY PERCENTAGE			
A	B	C	D
22%	27%	23%	28%

Figure 6: Roof Curb

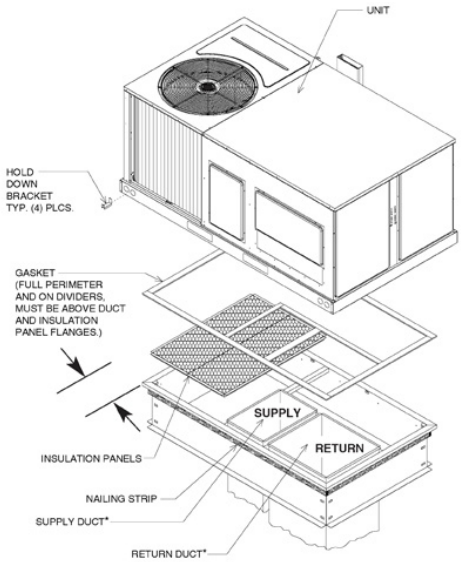
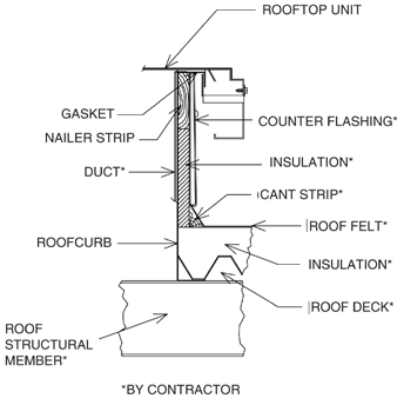


Figure 7: Roof Curb Detail



Gas Supply, Condensate Drain and Piping

Gas Connection

⚠ WARNING

Connect this unit only to gas supplied by a commercial utility.

⚠ DANGER

Never test for gas leaks with an open flame. It can cause an explosion or fire resulting in property damage, personal injury or death. Use a commercially available soap solution made specifically for the detection of leaks to check all connections, as specified in the "Mechanical Installation" section of these instructions.

⚠ CAUTION

Any additions, changes or conversions required for the furnace to satisfactorily meet the application should be made by a qualified installer, service agency or the gas supplier, using factory-specified or approved parts. In the commonwealth of Massachusetts, installation must be performed by a licensed plumber or gas fitter for appropriate fuel.

⚠ CAUTION

Disconnect the furnace and its individual shutoff valve from the gas supply piping during any pressure testing of that system at test pressures in excess of 1/2 pound per square inch gauge or isolate the system from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of this gas supply system at pressures equal to or less than 1/2 PSIG.

⚠ NOTICE

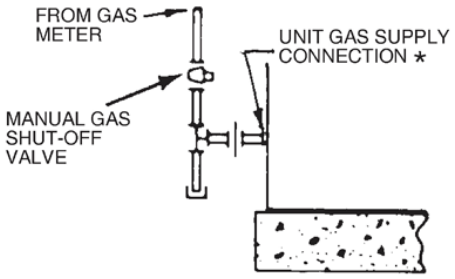
Check the rating plate to make certain the unit is equipped to burn the type of gas supplied. Care should be taken after installation of this equipment that the gas control valve not be subjected to high gas supply line pressure.

1. Install gas piping in accordance with local codes and regulations of the local utility company. In the absence of local codes, the installation must conform to the specifications of the National Fuel Gas Code, ANSI Z223. 1 - latest edition.
2. Connect the gas line to the gas pipe inlet opening provided into the ½" inlet valve. See Figure 1 on page 5 or Figure 4 on page 6 for typical piping.
3. Size the gas line to the furnace adequate enough to prevent undue pressure drop and never less than ½".
4. Install a drip leg or sediment trap in the gas supply line as close to the unit as possible.
5. Install an outside ground joint union to connect the gas supply to the control assembly at the burner tray.
6. Gas valves have been factory installed. Install a manual gas valve where local codes specify a shut-off valve outside the unit casing (see Figure 8).
7. Make sure piping is tight. A pipe compound resistant to the action of liquefied petroleum gases must be used at all threaded pipe connections.

NOTE: The use of flexible gas connectors is not permitted.

The Commonwealth of Massachusetts requires the gas shut-off valve to be a T-handle gas lock.

Figure 8: Suggested Gas Piping



*Factory supplied grommet must be utilized.

Table 3: Gas Pipe Capacity Table (Cu. Ft./Hr.)

Nominal Iron Pipe	Equivalent Length of Pipe, Feet							
Size	10	20	30	40	50	60	70	80
1/2"	132	92	73	63	56	50	46	43
3/4"	278	190	152	130	115	105	96	90
1"	520	350	285	245	215	195	180	170
1-1/4"	1,050	730	590	500	440	400	370	350
1-1/2"	1,600	1,100	890	760	670	610	560	530

In making gas connections, avoid strains as they may cause noise and damage the controls. A backup wrench is required to be used on the valve to avoid damage.

The capacities of gas pipe of different diameters and lengths in cu. ft. per hr. with pressure drop of 0.3 in. and specific gravity of 0.60 (natural gas) are shown in Table 3.

After determining the pipe length, select the pipe size which will provide the minimum cubic feet per hour required for the gas input rating of the furnace. By formula:

$$\textit{Cu. Ft. Per Hr. Required} = \frac{\textit{Gas Input of Furnace (BTU/Hr.)}}{\textit{Heating Value of Gas (BTU/Ft.)}}$$

The gas input of the furnace is marked on the furnace rating plate. The heating value of the gas (BTU/FT^3) may be determined by consulting the local natural gas utility or the L.P. gas supplier.

LP Conversion

⚠ DANGER

This unit is equipped at the factory for use with natural gas only. Conversion to LP gas requires a special kit supplied by the distributor or manufacturer. Mailing addresses are listed on the furnace rating plate, parts list and warranty. Failure to use the proper conversion kit can cause fire, carbon monoxide poisoning, explosion, personal injury, property damage, or death.

⚠ NOTICE

To remove the gas valve, remove the four screws securing the manifold pipe to the burner tray. Remove the manifold pipe with gas valve attached. See Figure 10.

Convert the valve to use liquefied petroleum (LP) gas by replacing the pressure regulator spring with the conversion kit spring. This LP kit spring allows the regulator to maintain the proper manifold pressure for LP gas. The correct burner LP orifices are included in the kit. See Figure 9.

NOTE: Order the correct LP conversion kit from the furnace manufacturer. See Conversion Kit Index shipped with unit for proper LP kit number. Furnace conversion to LP gas must be performed by a qualified technician.

NOx Models

When converting units equipped with NOx inserts to LP gas, the stainless steel screen mesh inserts in the entrance of the tubular exchangers are not required to meet SCAQMD NOx emission levels. These inserts and 1/8" diameter retaining rod should be carefully removed before firing this furnace on LP gas. **Important:** This furnace is not designed to operate on LP gas with the NOx inserts in place.

Step by step instructions on removing the NOx inserts and retaining rod are included in the Conversion Kit Installation Instructions.

Table 4: LP Gas Pipe Capacity Table (Cu. Ft./Hr.)

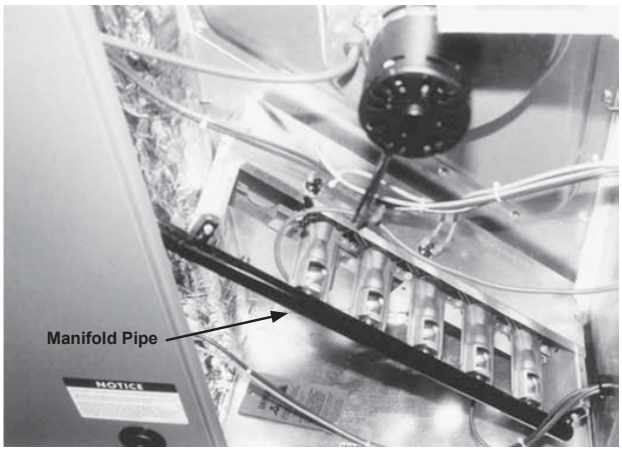
Maximum capacity of pipe in thousands of BTU/hour of undiluted liquified petroleum gases at 11 inches water column inlet pressure (Based on a pressure drop of 0.5 inch water column).

Nominal Iron Pipe Size (in.)	Length of Pipe (ft.)											
	10	20	30	40	50	60	70	80	90	100	125	150
1/2	275	189	152	129	114	103	96	89	83	78	69	63
3/4	567	393	315	267	237	217	196	182	173	162	146	132
1	1071	732	590	504	448	409	378	346	322	307	275	252
1-1/4	2205	1496	1212	1039	913	834	771	724	677	630	567	511
1-1/2	3307	2299	1858	1559	1417	1275	1181	1086	1023	976	866	787
2	6221	4331	3465	2992	2646	2394	2205	2047	1921	1811	1606	1496

Example (LP): Input BTU requirement of unit, 150,000
Equivalent lenght of pipe, 60 ft. = 3/4" IPS required

Figure 9: NOx Inserts

Figure 10: Manifold Pipe



Adjusting or Checking Furnace Input

- Natural Gas Line Pressure 5" – 10.5" W.C.
- LP Gas Line Pressure 11" – 13" W.C.
- Natural Gas Manifold Pressure – 3.5" W.C
- LP Gas Manifold Pressure – 10" W.C.

Supply and manifold pressure taps are located on the gas valve body ⅛" N.P.T. and on the manifold.

Use a properly calibrated manometer gauge for accurate gas pressure readings.

Only small variations in the gas flow should be made by means of the pressure regulator adjustment. Furnaces functioning on LP gas must be set by means of the tank or branch supply regulators. The furnace manifold pressure should be set at 10" W.C. at the gas control valve.

To adjust the pressure regulator, remove the regulator cap and turn the adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure. **Then replace the regulator cap securely.**

Any necessary major changes in the gas flow rate should be made by changing the size of the burner orifices. To change orifice spuds, shut off the manual main gas valve and remove the gas manifold.

For elevations up to 2,000 feet, rating plate input ratings apply. For high altitudes (elevations over 2,000 ft.), contact Daikin Applied Parts.

Check of input is important to prevent over-firing of the furnace beyond its design-rated input. NEVER SET INPUT ABOVE THAT SHOWN ON THE RATING PLATE. Use the following table or formula to determine input rate.

$$\text{Cu. Ft. Per Hr. Required} = \frac{\text{Heating Value of Gas (BTU/Cu. Ft.)} \times 3600}{\text{Time in Seconds (for 1 Cu. Ft.) of Gas}}$$

Start the furnace and measure the time required to burn one cubic foot of gas. Prior to checking the furnace input, make certain that all other gas units are shut off, with the exception of pilot burners. Time the meter with only the furnace in operation.

Important note for altitudes above 2,000 feet (610 meters): The main burner orifices in your furnace and in these kits are sized for the nameplate input and intended for installations at elevations up to 2,000 feet in the USA or Canada, or for elevations of 2,000 – 4,500 feet (610 – 1,373 meters) in Canada if the unit has been derated at the factory. For elevations above 2,000 feet (610 meters) **in the USA only** (see ANSI-Z223.1), the burner orifices must be sized to reduce the input 4% for each 1,000 feet (305 meters) above sea level.

Table 5: Meter Times

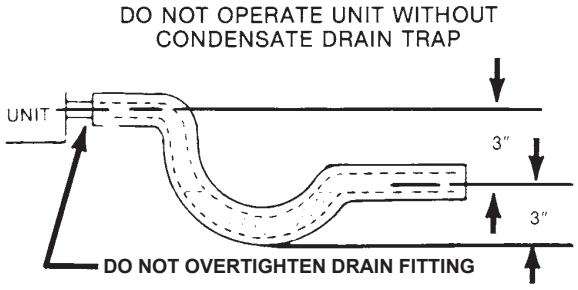
Meter time, in minutes and seconds, for normal input rating of furnaces equipped for natural or LP gas						
Input BTU/hr	Meter Size Cu.Ft.	Heating value of gas BTU per cu. ft.				
		900	1000	1040	1100	2500
40,000	1	1:21	1:30	1:34	1:39	3:45
	10	13:30	15:00	15:36	16:30	37:30
60,000	1	0:54	1:00	1:03	1:06	2:30
	10	9:00	10:00	10:24	11:00	25:00
80,000	1	0:41	0:45	0:47	0:50	1:53
	10	6:45	7:30	7:48	8:15	18:45
100,000	1	0:33	0:36	0:38	0:40	1:30
	10	5:24	6:00	6:15	6:36	15:00

Important notice: Derating of the heating input for high altitude in the field is unlawful in Canada (refer to CAN/ CGA 2.17). Units installed in altitudes greater than 2,000 feet (610 meters) must be shipped from the factory or from a factory authorized conversion station with the heating input derated by 10% so as to operate properly in altitudes from 2,000 – 4,500 feet (610 – 1,373 meters).

Condensate Drain

The condensate drain connection of the evaporator is threaded ¾" nominal P.V.C. pipe. Install a condensate trap to ensure proper condensate drainage (Figure 11)

Figure 11: Condensate Drain



Power Supply

⚠ DANGER

Power supply to the unit must be disconnected before making field connections. To avoid electrical shock, personal injury or death, be sure to rigorously adhere to field wiring procedures regarding proper lockout and tagout of components.

⚠ NOTICE

This unit is approved for use with copper conductors only connected to unit contactor. Warranty may be jeopardized if aluminum wire is connected to unit contactor.

Special instructions apply for power wiring with aluminum conductors: Warranty is void if connections are not made per instructions.

1. **All wiring should be made in accordance with the National Electrical Code.** Consult the local power company to determine the availability of sufficient power to operate the unit. Check the voltage at power supply to make sure it corresponds to the unit's RATED VOLTAGE REQUIREMENT. Install a branch circuit disconnect (refer to Figure 12 and Figure 13) near the rooftop, in accordance with the N.E.C., C.E.C. or local codes. A bracket is provided with the unit for mounting of the disconnect.
2. It is important that proper electrical power is available at the unit. Voltage should not vary more than 10% from that stamped on the unit nameplate. On three phase units, phases must be balanced within 3%.
3. For branch circuit wiring (main power supply to unit disconnect), the minimum wire size for the length of run can be determined from Table 6 using the circuit ampacity found on the unit rating plate. Use the smallest wire size allowable from the unit disconnect to the unit.
4. For through the base wiring entry, all fittings and conduit are field supplied for this application (Figure 14 on page 12). Reference Table 8 on page 13 for proper hole and conduit size.

Figure 12: Recommended Branch Circuit Disconnect Location – Gas Heat Units

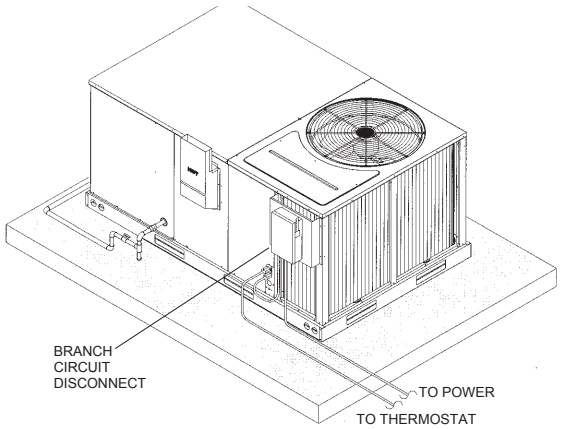


Figure 13: Recommended Branch Circuit Disconnect Location – Electric Heat or Cooling Only Units

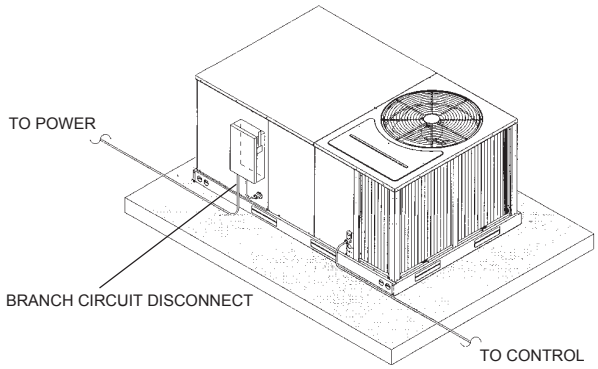


Table 6: Branch Circuit Copper Wire Size (Based on 1% Voltage Drop)*

Supply Wire Length (ft.)	Branch Circuit Ampacity							
	15	20	25	30	35	40	45	50
50	14	12	10	10	8	8	6	6
100	10	8	8	6	6	6	4	4
150	8	6	6	4	4	4	3	3
200	6	4	4	4	3	3	2	2

* Credit: National Electric Code

NOTE: Wire size based on 60°C rated wire insulation and 30°C ambient temp. (86°F).

For more than 3 conductors in a raceway or cable, see the N.E.C. for derating the ampacity of each conductor.

When installed, the unit must be electrically grounded in accordance with local codes or, in the absence of local codes, with the National Electrical Code, ANSI/NFPA 70, if an external electrical source is utilized.

Attach a length (6" or more) of recommended size copper wire to the unit contactor terminals L1 and L3 for single phase, L1, L2 and L3 for three phase.

Select the equivalent aluminum wire size from the tabulation Table 7.

Table 7: Equivalent Aluminum Wire Size

AWG Copper Wire Size	AWG Aluminum Wire Size	Connector Type and Size (or equivalent)
#12	#10	T & B Wire Nut PT2
#10	#8	T & B Wire Nut PT3
#8	#6	Sherman Split Bolt TSP6
#6	#4	Sherman Split Bolt TSP4
#4	#2	Sherman Split Bolt TSP2

Splice copper wire pigtails to aluminum wire with U.L. recognized connectors for copper-aluminum splices. Please exercise the following instructions very carefully to obtain a positive and lasting connection:

1. Strip insulation from aluminum conductor.
2. Coat the stripped end of the aluminum wire with the recommended inhibitor, and wire brush the aluminum surface through inhibitor. INHIBITORS: Brundy-Pentex “A”; Alcoa-No. 2EJC; T & B-KPOR Shield.
3. Clean and re-coat aluminum conductor with inhibitor.
4. Make the splice using the above listed wire nuts or split bolt connectors.
5. Coat the entire connection with inhibitor and wrap with electrical insulating tape.

Figure 14: Electrical Conduit Installation

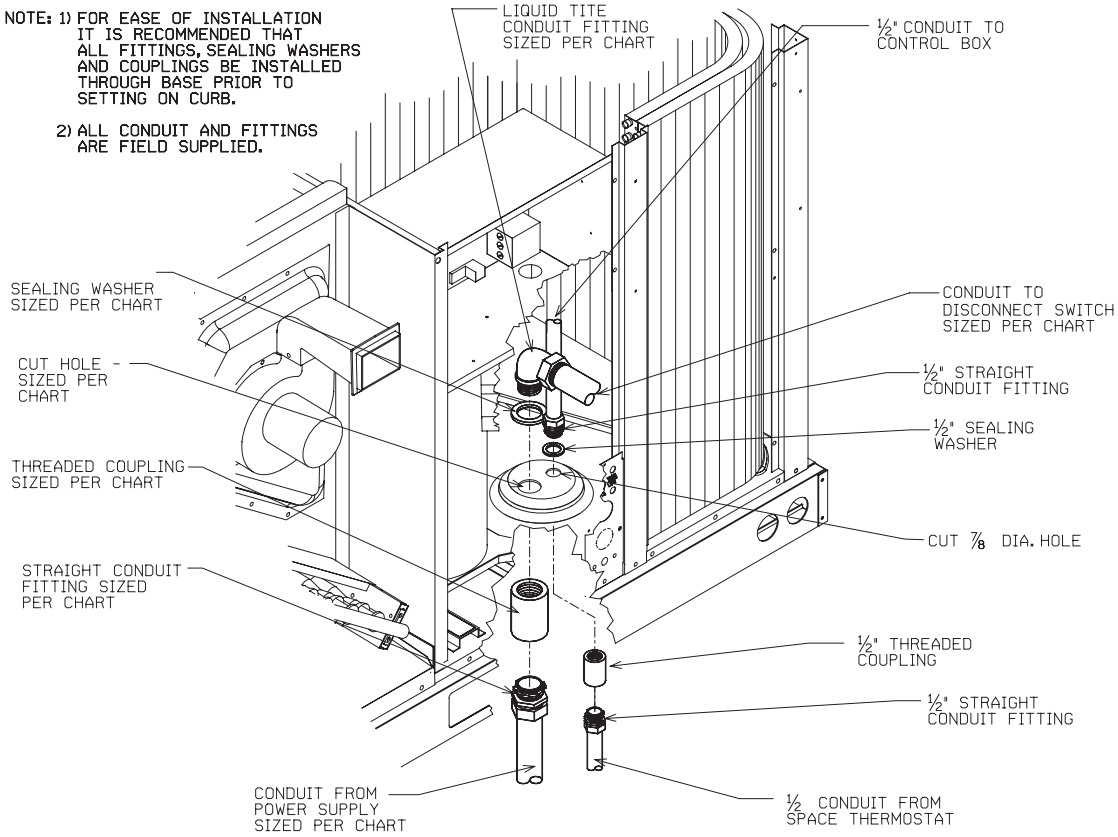


Table 8: Recommended Wire Sizes For Given Conduit and Hole Size

Wire Size, AWG	14	12	10	8	6	4	3	2	1	0	00	000
Conduit Size	1/2"	1/2"	1/2"	3/4"	1"	1"	1-1/4"	1-1/4"	1-1/2"	1-1/2"	2"	2"
Hole Size	7/8"	7/8"	7/8"	1-31/32"	1-23/64"	1-23/64"	1-23/32"	1-23/32"	1-31/32"	1-31/32"	2-15/32"	2-15/32"

Hook-Up

To wire unit, refer to the following hook-up diagram. Refer to Figure 27 on page 29 and Figure 14 for location of wiring entrances.

Wiring to be done in the field between the unit and devices not attached to the unit, or between separate devices which are field installed and located, shall conform with the temperature limitation for Type T wire [63°F rise (35°C)] when installed in accordance with the manufacturer's instructions.

Internal Wiring

NOTICE

Some single phase units are equipped with a single pole contactor. Caution must be exercised when servicing as only one leg of the power supply is broken with the contactor.

Some models are equipped with electronically commutated blower motors which are constantly energized, unless the main unit disconnect is in the OFF position.

A diagram of the internal wiring of this unit is located under the electrical box cover and this manual. If any of the original wire as supplied with the unit must be replaced, the wire gauge and insulation must be same as original wiring.

Transformer is factory wired for 230 volts on 208/230 volt models and must be changed for 208 volt applications. See unit wiring diagram for 208 volt wiring.

Customer Supplied Thermostat

The customer supplied room thermostat must be compatible with the spark ignition control on the unit. Generally, all thermostats that are not of the “current robbing” type are compatible with the integrated furnace control. The low voltage wiring should be sized as shown in Table 9.

Table 9: Field Wire Size for 24 Volt Thermostat Circuits

	Solid Copper Wire – AWG.					
3.0	16	14	12	10	10	10
2.5	16	14	12	12	12	10
2.0	18	16	14	12	12	10
	50	100	150	200	250	300
	Length of Run – Feet[a]					

a. The total wire length is the distance from the furnace to the thermostat and back to the furnace.

NOTE: Do not use control wiring smaller than No. 18 AWG.

Install the room thermostat in accordance with the instruction sheet packed in the box with the thermostat. See Figure 16 for an example of a typical customer supplied wiring diagram.

Optional Factory Supplied Thermostat

The optional factory supplied, touch screen, commercial setback digital thermostat (Figure 15) uses microcomputer technology to provide precise time and temperature control. This thermostat offers the flexibility to design heating and cooling programs that fit building needs (Table 10). This thermostat is adaptable to most residential 24 volt forced air multi-stage systems with electric or fossil fuel auxiliary and is the ultimate for comfort, convenience, and performance. See Figure 17 for an optional factory supplied thermostat wiring diagram.

Figure 15: Optional Thermostat

Table 10: Optional Factory Supplied Thermostat Specifications

Electrical Rating Single Stage:	mV to 30 V (ac), NEC Class II, 50/60 Hz or DC
Electrical Rating Staging:	20 to 30 V (ac), NEC Class II
Terminal Load:	1.5 A per terminal, 2.5 A max. combined
Setpoint Range:	45° to 99°F (7° to 37°C)
Anticipation, Heating:	Adjustable
Anticipation, Cooling:	Adjustable
Rated Differential Single Stage:	Heat 0.6°F, Cool 1.2°F
Rated Differential Staging:	Heat 0.6°F, Cool 1.2°F
Operating Ambient:	32° to +105°F (0° to +41°C)
Operating Humidity:	90% non-condensing max.
Shipping Temperature Range:	-4° to 150°F (-20° to 65°C)
Dimensions (H × W × D):	4.6" × 5.9" × 1.2"

Table 11: Thermostat Terminal Functions

Y2	2nd Stage Compressor
Y	Compressor Relay
G	Fan Relay
RC	Power for Cooling
RH	Power for Heating
C	Common wire from secondary side of cooling (Optional). Required for fault indication, continuous backlight operation or remote temperature sensor operation
L	Malfunction indicator for systems with malfunction connection
W/E	Heat Relay/Emergency Heat Relay (Stage 1)
W2	2nd Stage Heat (3rd Stage Heat in HP2)
Blank	Blank
-	Common (DC) for wired remote temperature sensor
S	Frequency signal from remote temperature sensor
+	Power (DC) to remote temperature sensor

Figure 16: Typical Customer Supplied Thermostat Wiring Diagram

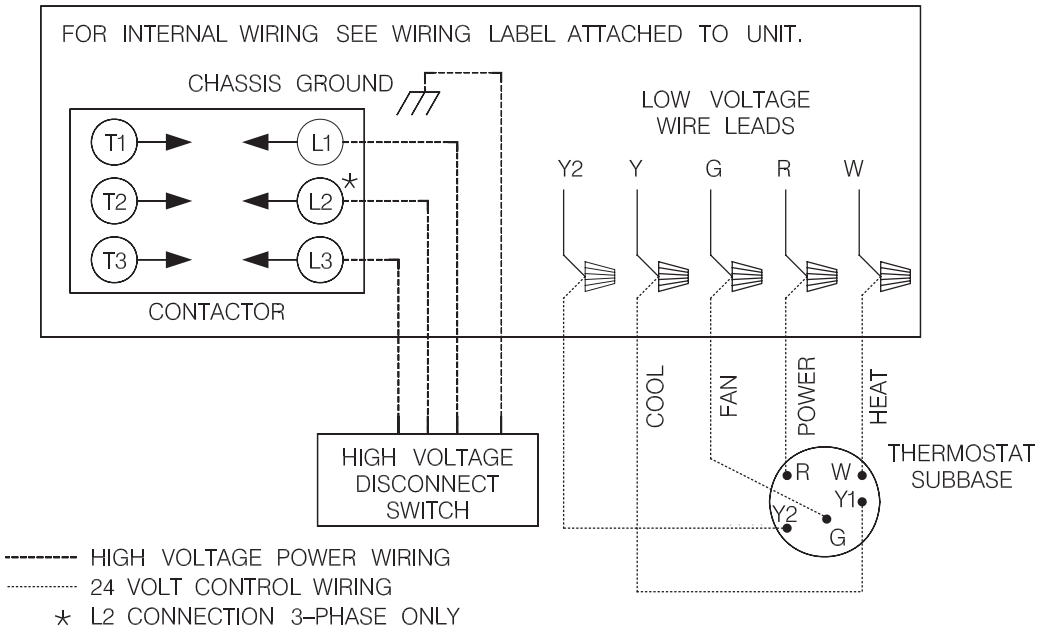
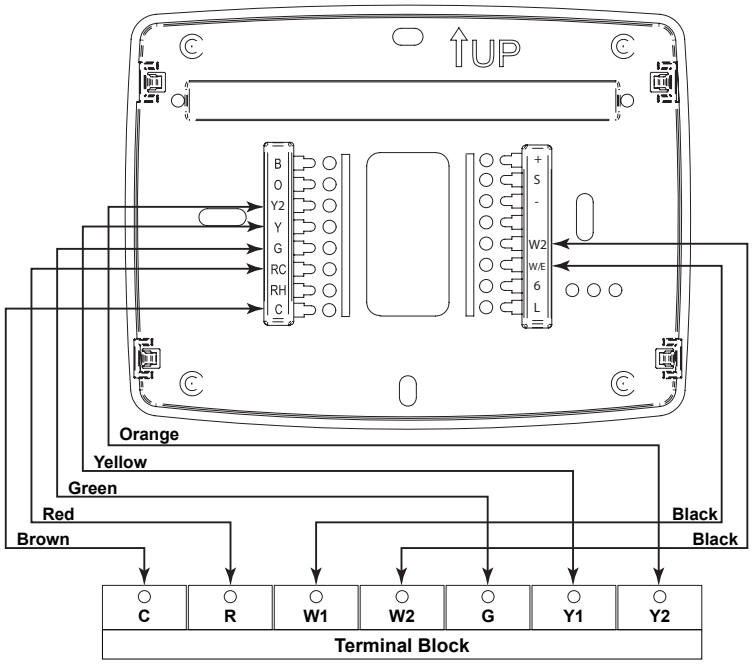


Figure 17: Optional Factory Supplied 7-170 Thermostat Wiring Diagram



1. On 3 to 5 ton units, a terminal block is not supplied. Use a wirenut to extend from the leads provided in the unit to the thermostat. W1, W2, and Y2 are optional depending upon the size and selected options of the unit. Colors shown above are typical for the MPS I.
2. For wiring with DDC control option, see OM 1077 for wiring instructions.

Figure 18: Wiring Diagram: MPS A03C to A04C, 208/230 Volt

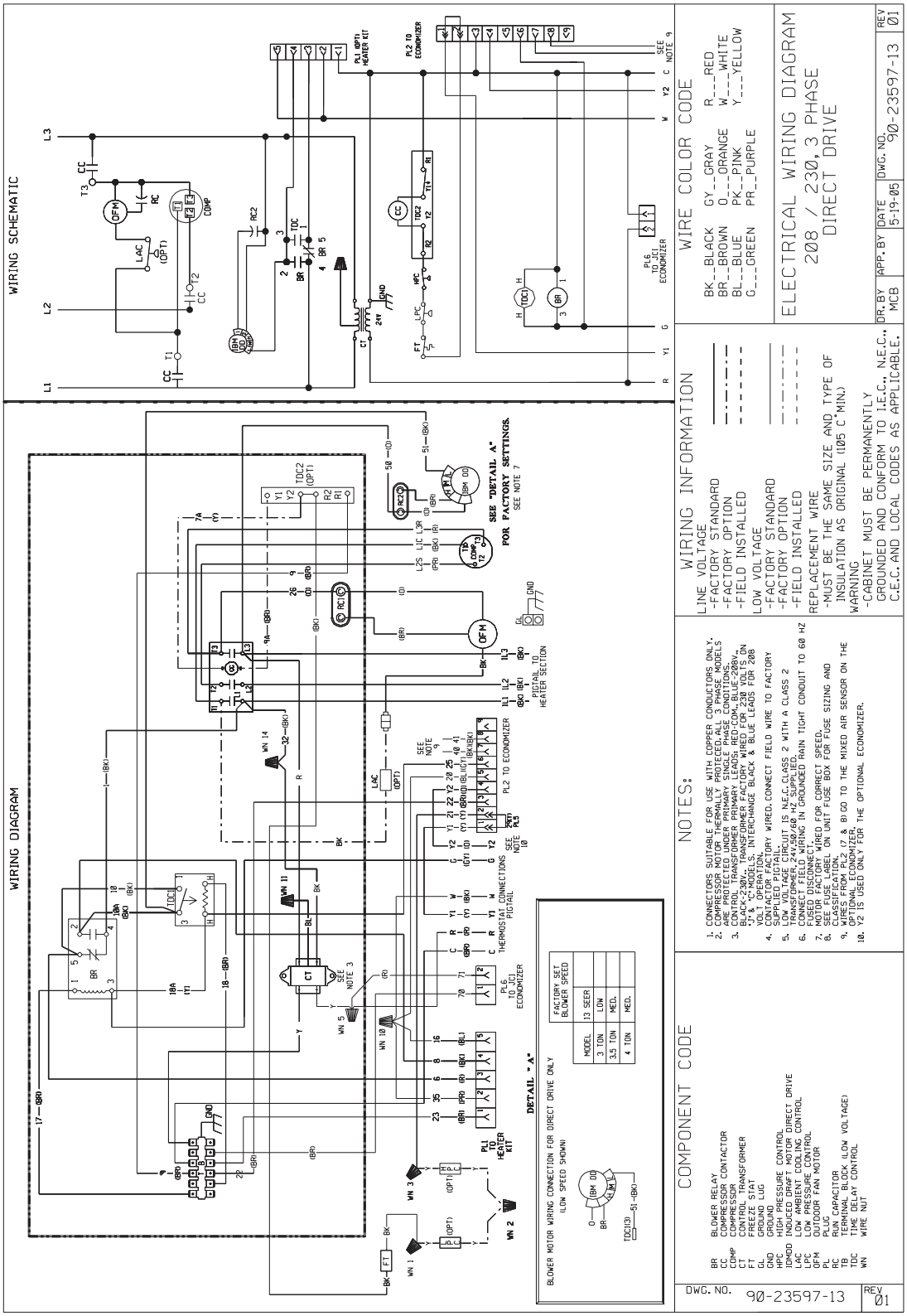


Figure 19: Wiring Diagram: MPS A03C to A04C, 460 Volt

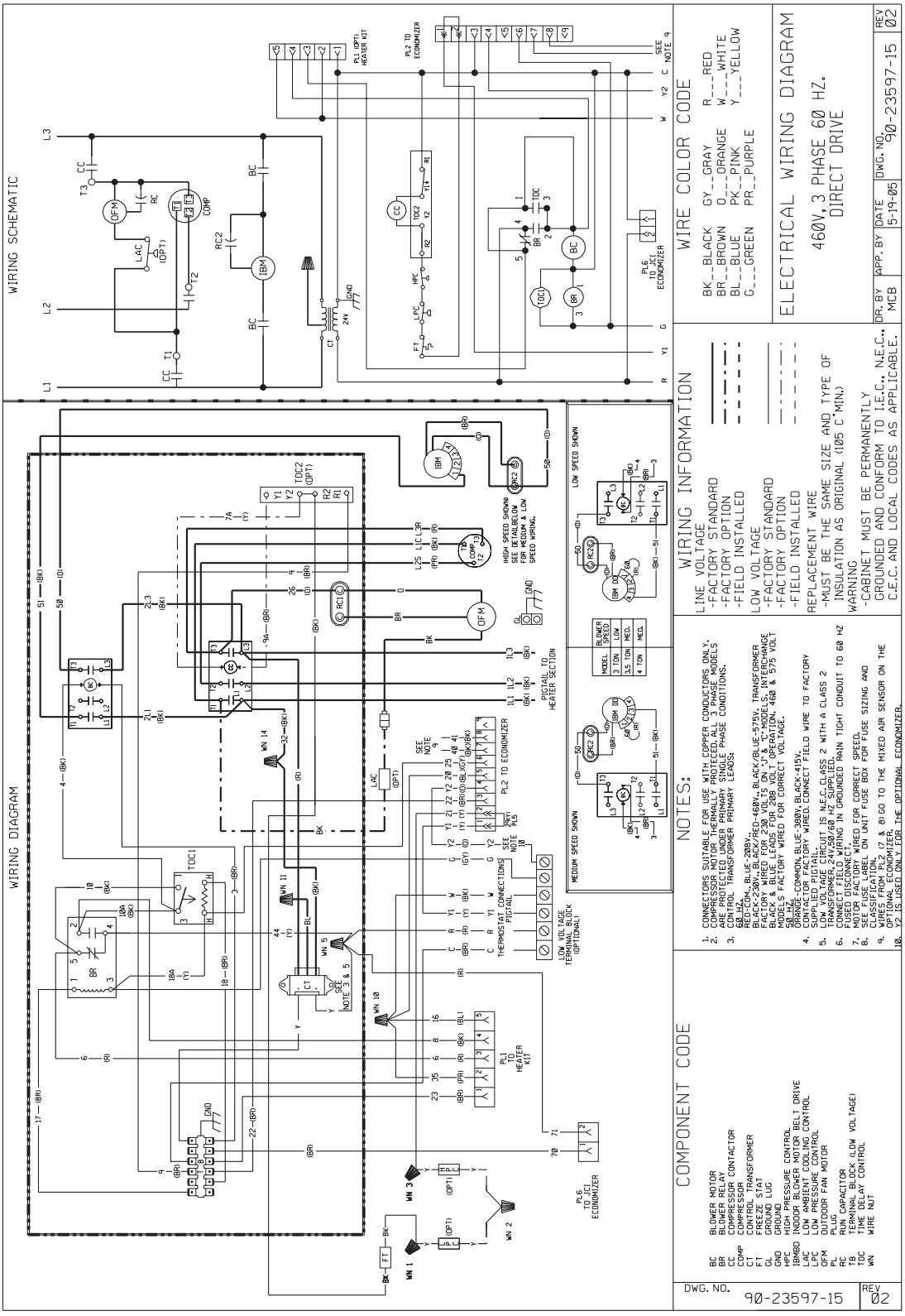


Figure 20: Wiring Diagram: MPS A03C to A04C with Gas Heat

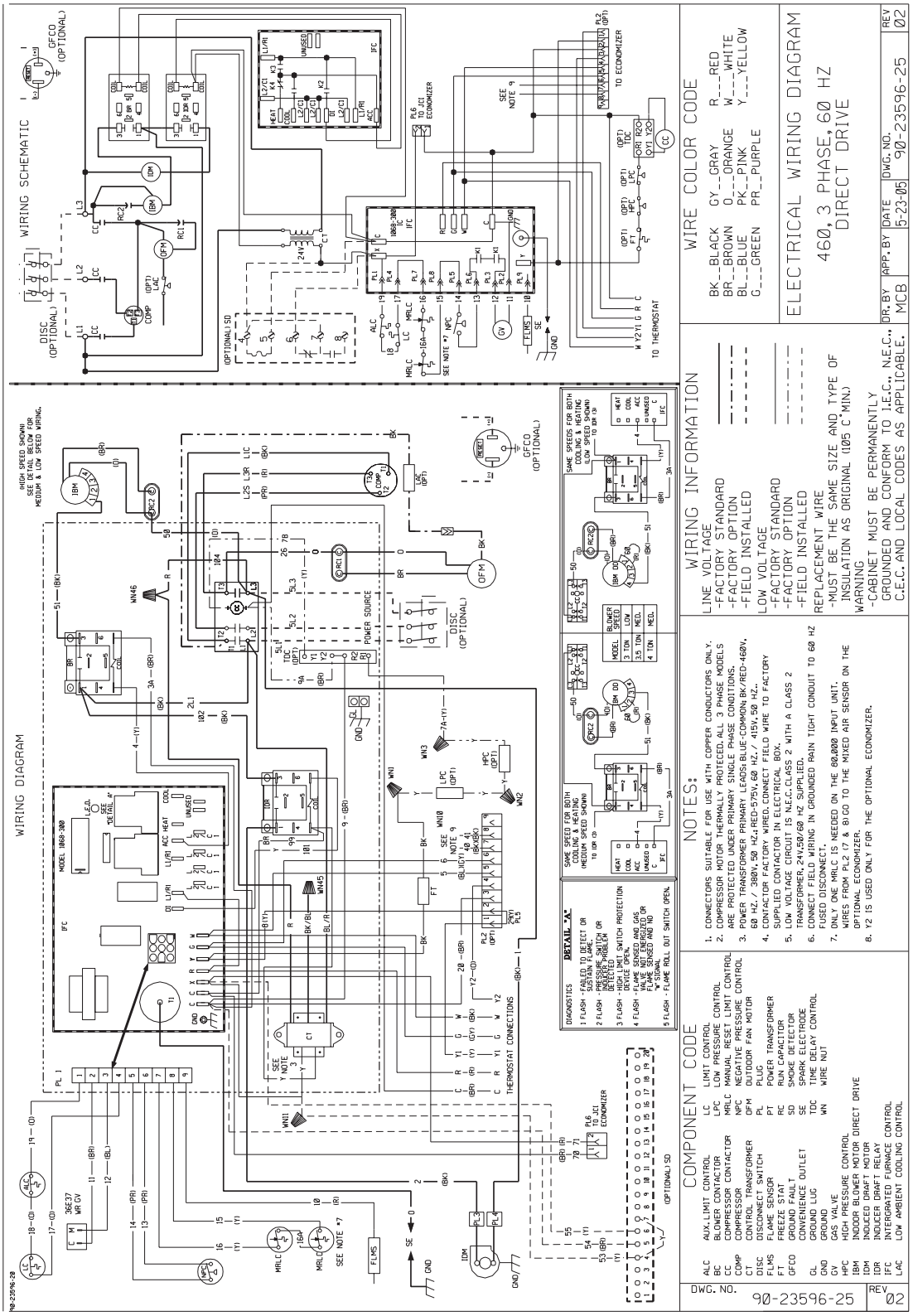


Figure 21: MPS A03C to A05C, 208-230/460V, 3Ø, Gas Heat

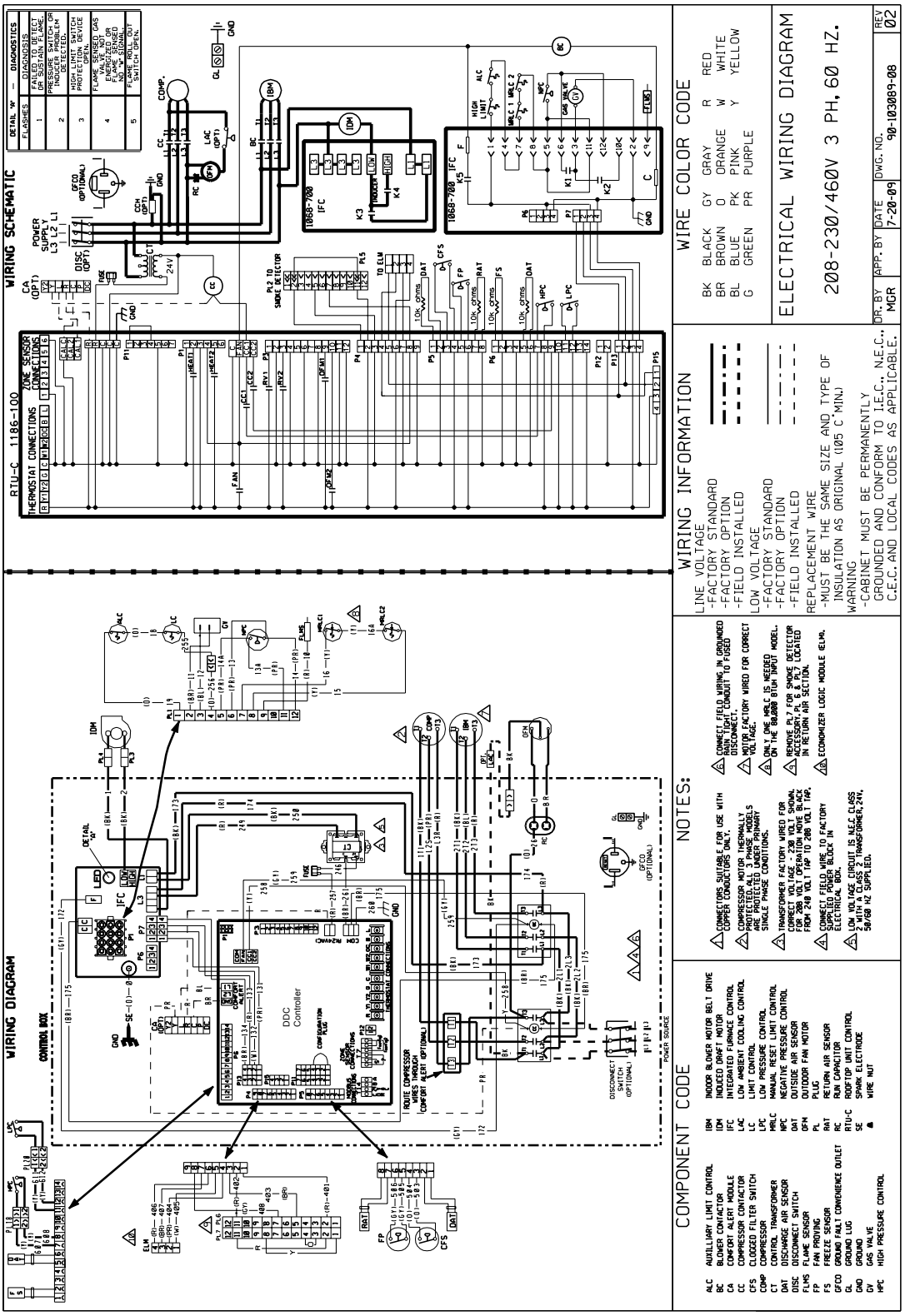


Figure 22: MPS A03C to A05C, 208-230/460V, 3Ø, Cooling Only

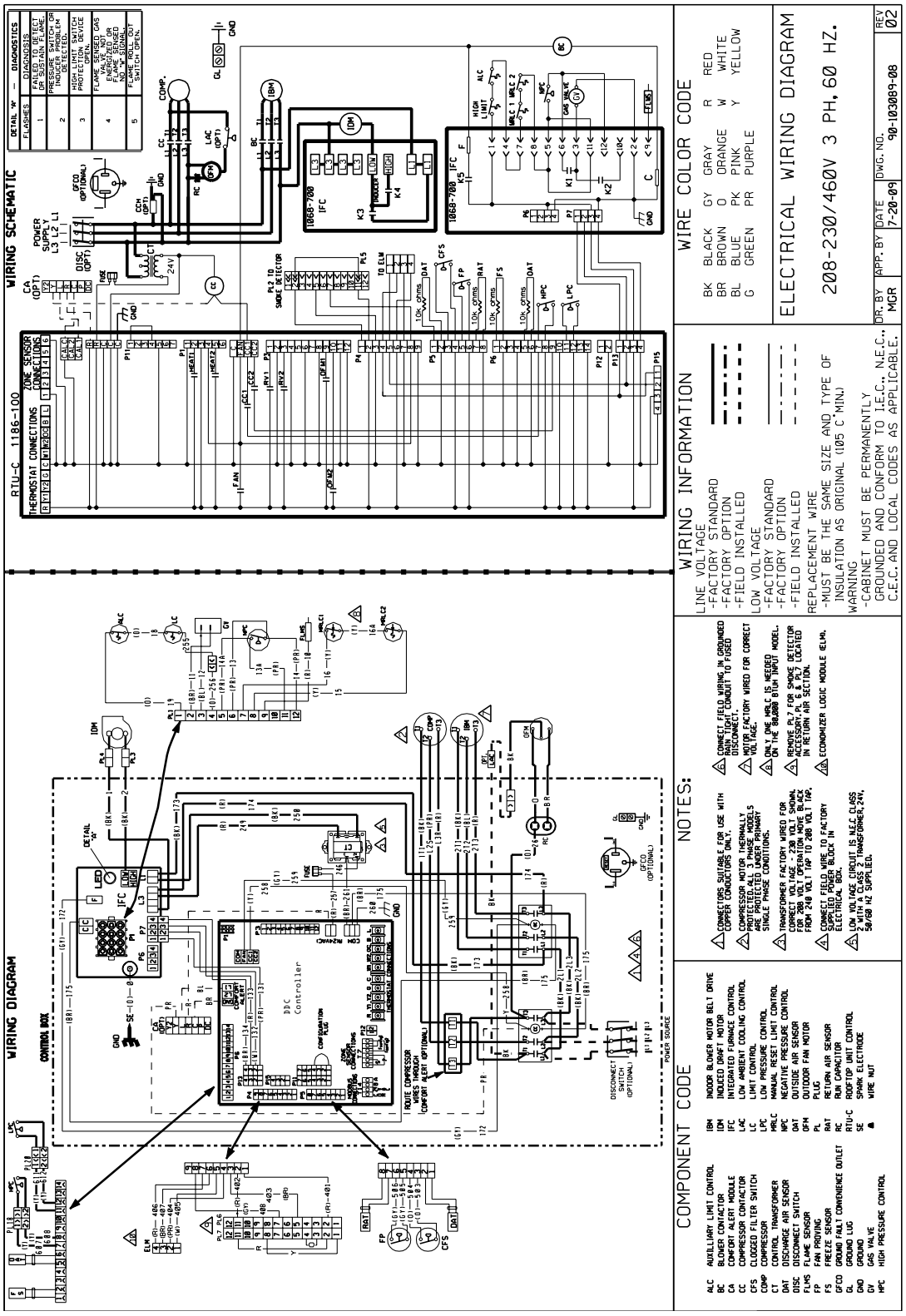


Figure 23: Wiring Diagram: MPS A05C

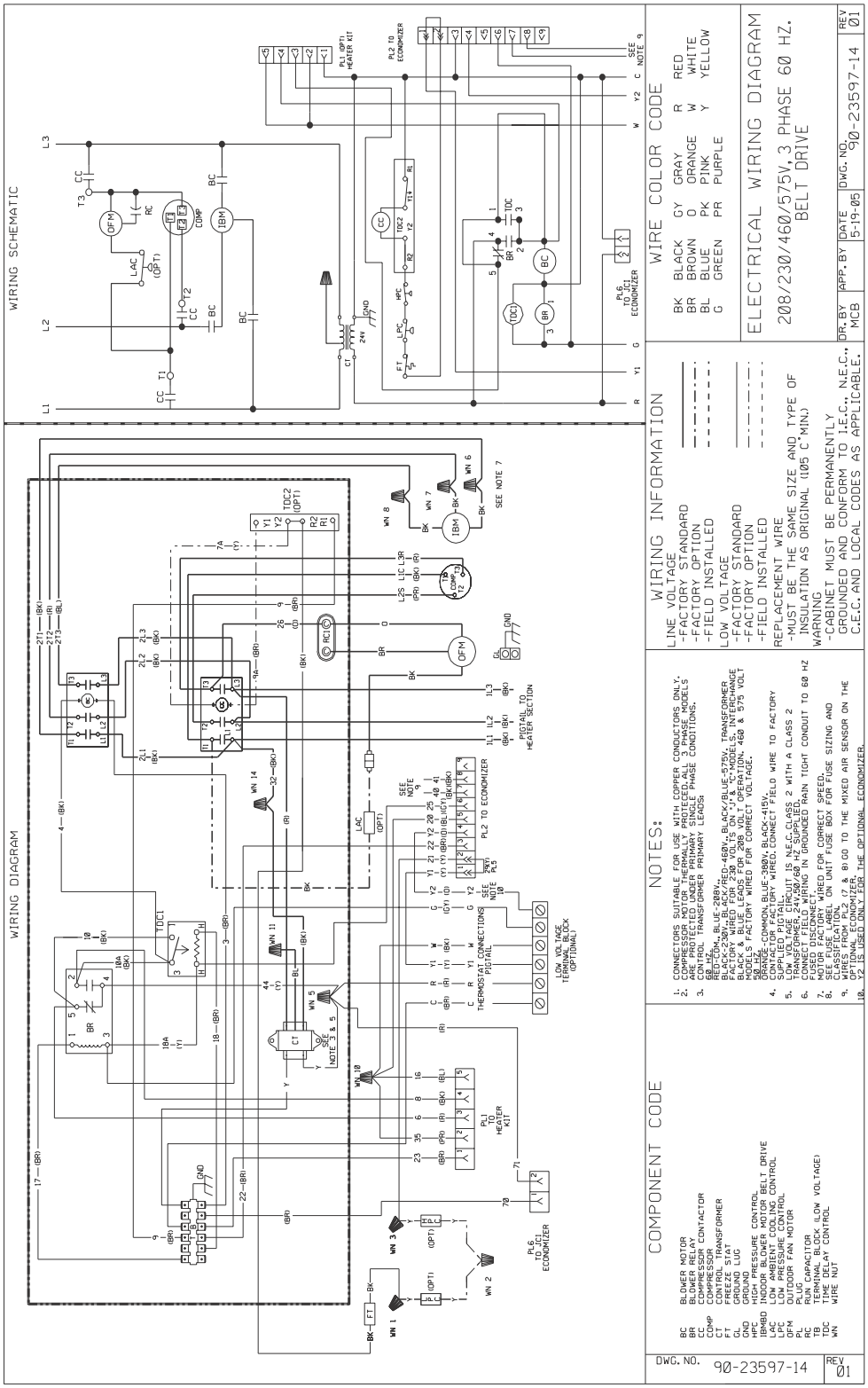


Figure 24: Wiring Diagram: MPS A05C with Gas Heat, 208/230 Volt, Belt Drive

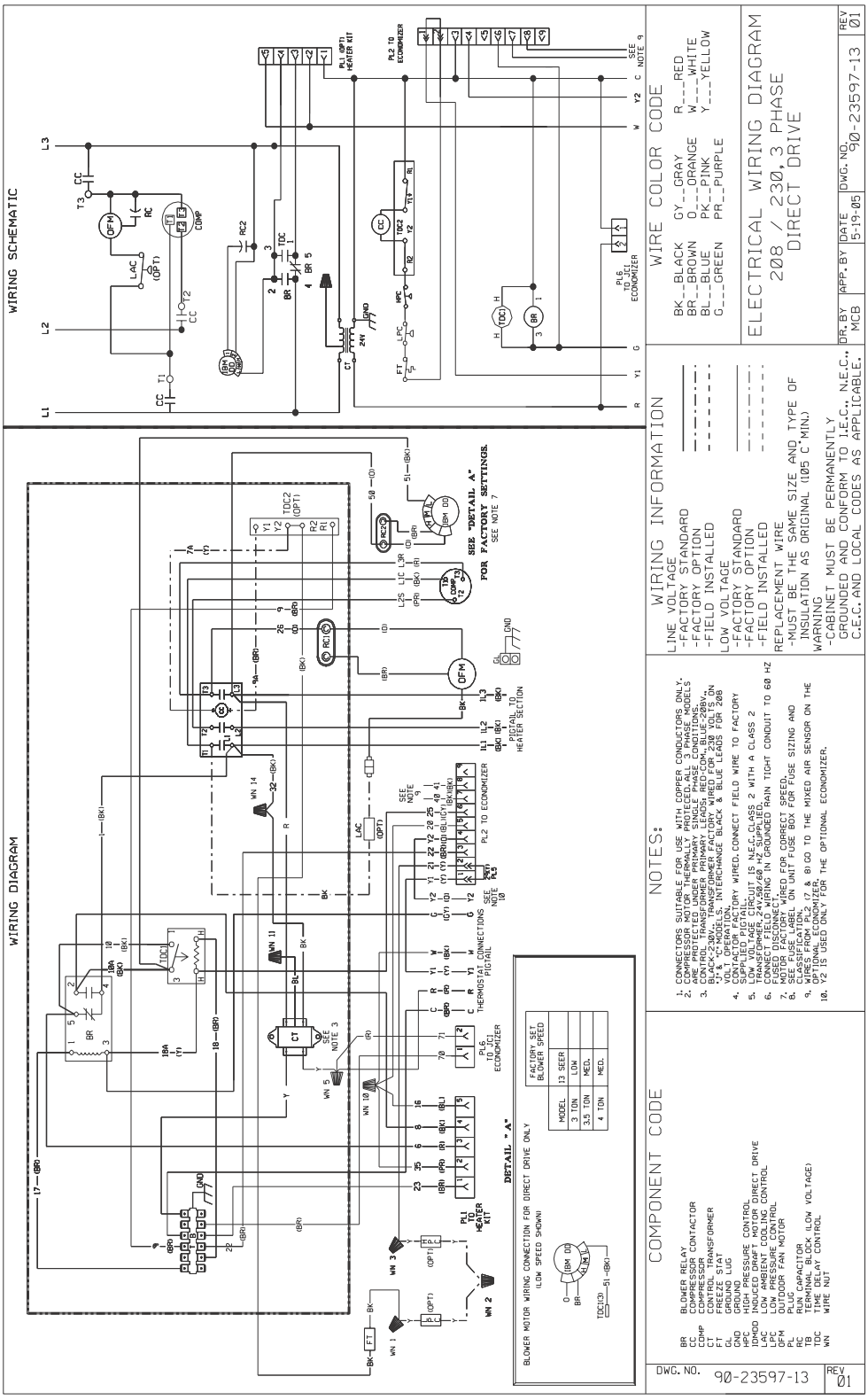


Figure 25: Wiring Diagram: MPS A05C with Gas Heat, 208/230 Volt, Direct Drive

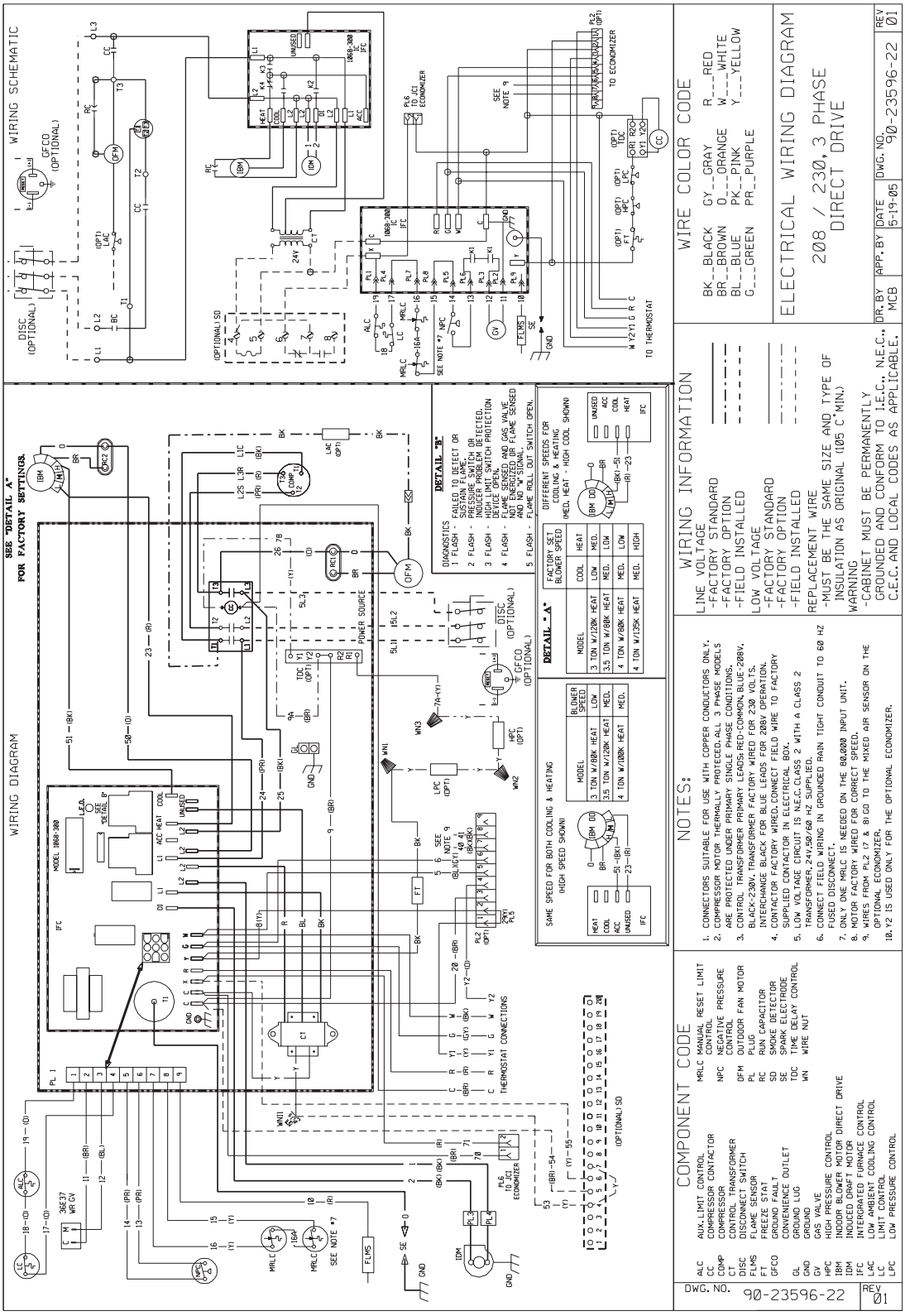
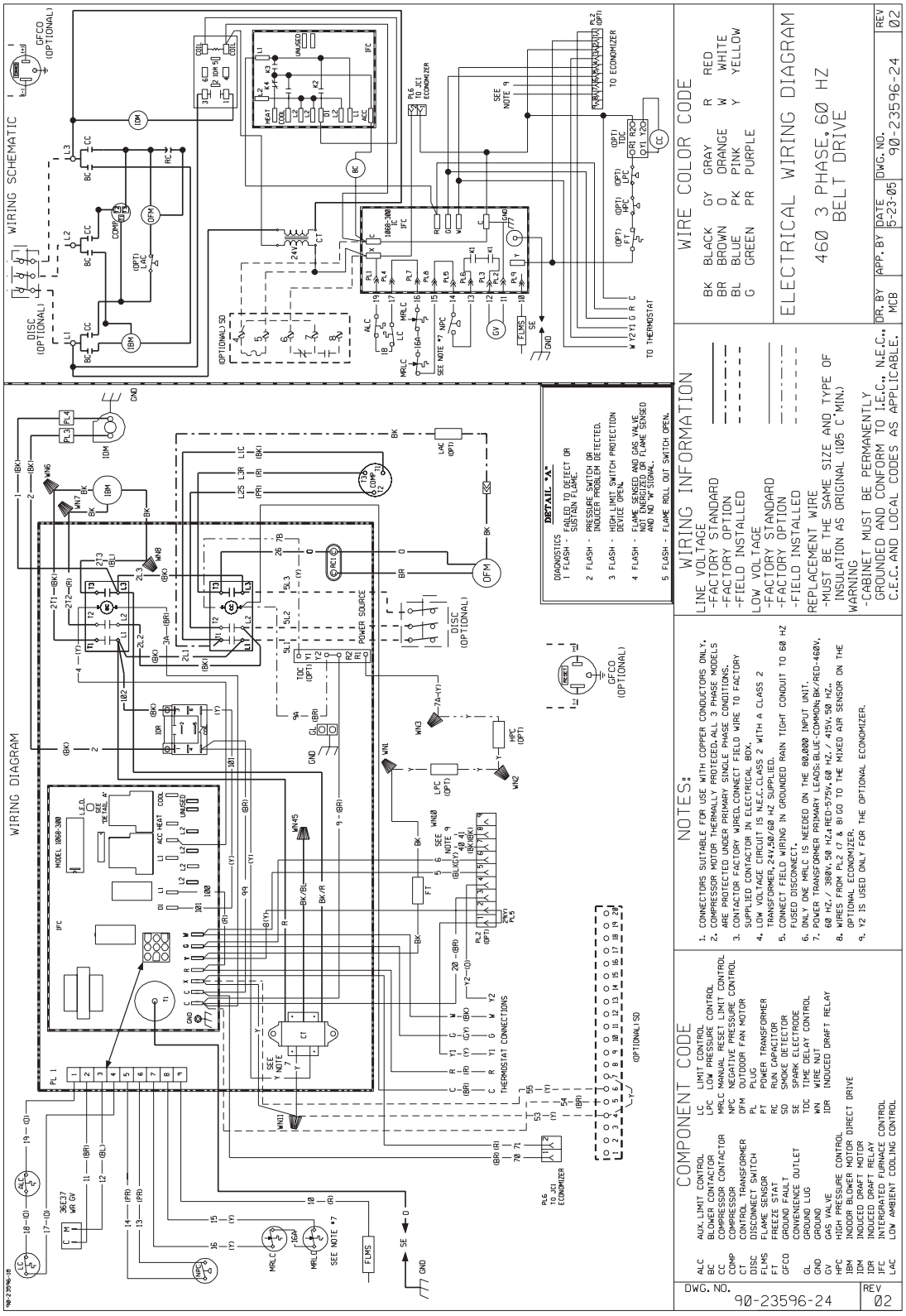


Figure 26: Wiring Diagram: MPS A05C with Gas Heat, 460 Volt, Belt Drive



Unit Capacity and Physical Data

Table 12: MPS A03C – A05C

Model	A03C	A04C	A05C
Cooling Performance[1]			
Gross Cooling Capacity Btu (kW)	36,200 (10.61)	48,000 (14.06)	60,00 (17.58)
EER/SEER[2]	11.6/14	11.6/14	11.6/14
Nominal CFM/AHRI Rated CFM (L/s)	1200/1250 (566/590)	1600/1500 (755/708)	2000/1800 (944/849)
AHRI Net Cooling Capacity Btu (kW)	34,600 (10.14)	46,000 (13.48)	58,500 (17.14)
Net Sensible Capacity Btu (kW)	25,300 (7.41)	34,000 (9.96)	41,700 (12.22)
Net Latent Capacity Btu (kW)	9,300 (2.72)	12,000 (3.52)	17,500 (5.13)
Net System Power kW	2.95	3.93	4.95
Compressor			
No./Type	1/Scroll	1/Scroll	1/Scroll
Gas Heating Performance			
AFUE %	80	80	80
Steady stage efficiency %	81	81	81
No. stages	1	1	1
Gas connection size	1/2"	1/2"	1/2"
Heating input (BtuH) low/medium/high	80,000/120,000	80,000/100,000/135,000	100,000/135,000
Heating output (BtuH)	64,800/97,200	64,800/81,000/109,400	81,000/109,400
Temperature rise °F	30–80	30–80	30–70
Sound[4]			
Outdoor Rating (dB)	78	78	83
Outdoor Coil			
Fin Type	Louvered	Louvered	Louvered
Tube Type	Microchannel	Microchannel	Microchannel
Microchannel Depth in. (mm)	0.7 (18)	0.7 (18)	0.7 (18)
Face Area sq. ft. (sq. m)	13.9 (1.29)	16.4 (1.52)	16.4 (1.52)
Rows / FPI (FPcm)	1 / 23 (9)	1 / 23 (9)	1 / 23 (9)
Indoor Coil - Fin Type			
Fin Type	Louvered	Louvered	Louvered
Tube Type	Microchannel	Microchannel	Microchannel
Microchannel Depth in. (mm)	1 (25)	1.3 (32)	1.3 (32)
Face Area sq. ft. (sq. m)	4.8 (0.45)	4.8 (0.45)	4.8 (0.45)
Rows / FPI (FPcm)	1/20 (8)	1/20 (8)	1/20 (8)
Refrigerant Control	TX Valves	TX Valves	TX Valves
Drain Connection No./Size in. (mm)	1/0.75 (19.05)	1/0.75 (19.05)	1/0.75 (19.05)
Outdoor Fan			
Type	Propeller	Propeller	Propeller
No. Used/Diameter in. (mm)	1/24 (609.6)	1/24 (609.6)	1/24 (609.6)
Drive Type/No. Speeds	Direct/1	Direct/1	Direct/1
CFM (L/s)	3680 (1737)	3680 (1737)	3930 (1855)
No. Motors/HP	1 at 1/3 HP	1 at 1/3 HP	1 at 1/3 HP
Motor RPM	1075	1075	1075
Indoor Fan			
Type	FC Centrifugal	FC Centrifugal	FC Centrifugal
No. Used/Diameter in. (mm)	1/10×10 (254×254)	1/10×10 (254×254)	1/11×10 (279×254)
Drive Type/No. Speeds	Direct/1 or Belt/Adjustable	Direct/1 or Belt/Adjustable	Belt/Adjustable
No. Motors	1	1	1
Motor HP	1/2 or 3/4	1/2 or 3/4	3/4 or 1
Motor RPM Direct Drive/Belt Drive	1075/1725	1075/1725	1725
Motor Frame Size5	48 or 56	48 or 56	56
Filter			
Type	Disposable	Disposable	Disposable
Furnished	Yes	Yes	Yes
[NO.] Size Recommended in. (mm × mm × mm)	[1] 1×16×25 (25×406×635) [1] 1×16×25 (25×406×635)	[1] 1×16×25 (25×406×635) [1] 1×16×25 (25×406×635)	[1] 1×16×25 (25×406×635) [1] 1×16×25 (25×406×635)
Refrigerant Charge Oz. (g)			
Charge Oz. (g)	54 (1531)	68 (1928)	63

NOTES:
( ) Designates Metric Conversions
1. Cooling Performance is rated at 95° F ambient, 80° F entering dry bulb, 67° F entering wet bulb. Gross capacity does not include the effect of fan motor heat. AHRI capacity is net and includes the effect of fan motor heat. Units are suitable for operation to ±20% of nominal CFM. Units are certified in accordance with the Unitary Air Conditioner Equipment certification program, which is based on AHRI Standard 210/240 or 360.
2. EER and/or SEER are rated at AHRI conditions and in accordance with DOE test procedures.
3. Integrated Energy Efficiency Ratio (IEER) is rated in accordance with AHRI Standard 340/360.
4. Outdoor Sound Rating shown is tested in accordance with AHRI Standard 270.
5. Greater value indicates larger HP indoor fan motor
6. Heating Performance limit settings and rating data were established and approved under laboratory test conditions using ANSI standards.

Table 13: MPS H03C – H05C, High Efficiency

Model	H03C	H04C	H05C
Cooling Performance[1]			
Gross Cooling Capacity Btu (kW)	36,200 (10.61)	48,000 (14.06)	59,00 (17.29)
EER/SEER[2]	12.5/15	12.5/15	11.6/14
EER (1st Stage/2nd Stage)	N/A	N/A	19.9/11.6
Nominal CFM/AHRI Rated CFM (L/s)[7]	1200/1250 (566/590)	1600/1600 (755/755)	1375/1800 (649/849)
AHRI Net Cooling Capacity Btu (kW)[7]	35,400 (10.37)	46,500 (13.62)	49,000/57,000 (14.3/16.7)
Net Sensible Capacity Btu (kW)[7]	26,200 (7.68)	35,700 (10.46)	34/,800/40,800 (10.2/12.0)
Net Latent Capacity Btu (kW)[7]	9,200 (2.72)	10,800 (3.52)	17,500 (5.13)
Net System Power kW[7]	2.72	3.69	2.1/4.8
Compressor			
No./Type	1/Scroll	1/Scroll	1/Scroll
Gas Heating Performance			
AFUE %	81	81	81
Steady stage efficiency %	82	82	82
No. stages	1	1	1
Gas connection size	1/2"	1/2"	1/2"
Heating input (BtuH) low/medium/high	80,000/120,000	80,000/100,000/135,000	100,000/135,000
Heating output (BtuH)	64,800/97,200	64,800/81,000/109,400	81,000/109,400
Temperature rise °F	25-70	25-70	30 - 70
Sound[4]			
Outdoor Rating (dB)	78	78	83
Outdoor Coil			
Fin Type	Louvered	Louvered	Louvered
Tube Type	Microchannel	Microchannel	Microchannel
Microchannel Depth in. (mm)	0.7 (18)	0.7 (18)	0.7 (18)
Face Area sq. ft. (sq. m)	13.9 (1.29)	16.4 (1.52)	16.4 (1.52)
Rows / FPI (FPcm)	1 / 23 (9)	1 / 23 (9)	1 / 23 (9)
Indoor Coil - Fin Type			
Fin Type	Louvered	Louvered	Louvered
Tube Type	Microchannel	Microchannel	Microchannel
Microchannel Depth in. (mm)	1 (25)	1.3 (32)	1.3 (32)
Face Area sq. ft. (sq. m)	4.8 (0.45)	4.8 (0.45)	4.8 (0.45)
Rows / FPI (FPcm)	1/20 (8)	1/20 (8)	1/20 (8)
Refrigerant Control	TX Valves	TX Valves	TX Valves
Drain Connection No./Size in. (mm)	1/0.75 (19.05)	1/0.75 (19.05)	1/0.75 (19.05)
Outdoor Fan			
Type	Propeller	Propeller	Propeller
No. Used/Diameter in. (mm)	1/24 (609.6)	1/24 (609.6)	1/24 (609.6)
Drive Type/No. Speeds	Direct/1	Direct/1	Direct/1
CFM (L/s)	3680 (1737)	3680 (1737)	3930 (1855)
No. Motors/HP	1 at 1/3 HP	1 at 1/3 HP	1 at 1/3 HP
Motor RPM	1075	1075	1075
Indoor Fan			
Type	FC Centrifugal	FC Centrifugal	FC Centrifugal
No. Used/Diameter in. (mm)	1/10×10 (254×254)	1/10×10 (254×254)	1/11×10 (279×254)
Drive Type/No. Speeds	Direct/1 or Belt/Adjustable	Direct/1 or Belt/Adjustable	Belt/Adjustable
No. Motors	1	1	1
Motor HP	1/2	1/2 or 3/4	1
Motor RPM Direct Drive/Belt Drive	1075/1725	1075/1725	1725
Motor Frame Size5	48 or 56	48 or 56	56
Filter			
Type	Disposable	Disposable	Disposable
Furnished	Yes	Yes	Yes
[NO.] Size Recommended in. (mm × mm × mm)	[1] 1×16×25 (25×406×635) [1] 1×16×25 (25×406×635)	[1] 1×16×25 (25×406×635) [1] 1×16×25 (25×406×635)	[1] 1×16×25 (25×406×635) [1] 1×16×25 (25×406×635)
Refrigerant Charge Oz. (g)			
Charge Oz. (g)	54 (1531)	68 (1928)	63

NOTES:

[ ] Designates Metric Conversions

1. Cooling Performance is rated at 95°F ambient, 80°F entering dry bulb, 67°F entering wet bulb. Gross capacity does not include the effect of fan motor heat. AHRI capacity is net and includes the effect of fan motor heat. Units are suitable for operation to ±20% of nominal CFM. Units are certified in accordance with the Unitary Air Conditioner Equipment certification program, which is based on AHRI Standard 210/240 or 360.
2. EER and/or SEER are rated at AHRI conditions and in accordance with DOE test procedures.
3. Integrated Energy Efficiency Ratio (IEER) is rated in accordance with AHRI Standard 340/360.
4. Outdoor Sound Rating shown is tested in accordance with AHRI Standard 270.
5. Greater value indicates larger HP indoor fan motor
6. Heating Performance limit settings and rating data were established and approved under laboratory test conditions using ANSI standards.
7. Values shown for H05C model are both AHRI rated. (1st stage/2nd stage)

Motor Data

Table 14: Compressor and Condenser Motor Data – 208/230 Volt

Data	Electrical Data (208/230 V)*			Electrical Data (460 V)*			Electrical Data (575 V)*		
	MPS A03C	MPS A04C	MPS A05C	MPS A03C	MPS A04C	MPS A05C	MPS A03C	MPS A04C	MPS A05C
Compressor Motor									
No.	1			1			1		
Phase	3			3			3		
RPM	3450			3450			3450		
HP, Compressor 1	3	4	5	3	4	5	3	4	5
Amps (RLA), Comp. 1	10.4	13.7	15.6	5.8	6.2	7.5	3.8	4.8	5.8
Amps (LRA), Comp. 1	88	83.1	110	38	41	52	36.5	33	38.9
HP, Compressor 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amps (RLA), Comp. 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amps (LRA), Comp. 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Condenser Motor									
No.	1			1			1		
Phase	1			1			1		
HP	1/3			1/3			1/3		
Amps (FLA, each)	1.2/1.2			1.4			1.0		
Amps (LRA, each)	4.7/4.7			2.4			1.8		

NOTE: *Unit operating voltage range is 187 – 253 for 208/230V; 414 – 506 for 460V; 518 – 632 for 575 V.

MCA and MCOP Data

Table 15: Unit MCA and MCOP Data

MPS Model		Voltage					
		208/230		460		575	
		Low*	High	Low*	High	Low*	High
A03C	MCA	19.0	N/A	11.0	N/A	N/A	N/A
	MCOP	25.0	N/A	15.0	N/A	N/A	N/A
A04C	MCA	23.0	N/A	11.0	N/A	N/A	N/A
	MCOP	35.0	N/A	15.0	N/A	N/A	N/A
A05C	MCA	N/A	26.0	N/A	13.0	N/A	10.0
	MCOP	N/A	30.0	N/A	20.0	N/A	15.0

NOTE: *Low static option is a direct drive motor for models A03C and A04C.

Table 16: Miscellaneous Data

Electrical Data												
	A03				A04				A05			
Unit Information												
Unit Operating Voltage Range	187-253	187-253	414-506	414-506	187-253	187-253	414-506	414-506	187-253	187-253	414-506	414-506
Volts	208/230	208/230	460	460	208/230	208/230	460	460	208/230	208/230	460	460
Minimum Circuit Ampacity	16/16	16/16	10	10	21/21	22/22	11	11	26/26	27/27	13	13
Minimum Overcurrent Protection Device Size	20/20	20/20	15	15	25/25	25/25	15	15	30/30	35/35	15	15
Maximum Overcurrent Protection Device Size	20/20	20/20	15	15	30/30	30/30	15	15	40/40	40/40	20	20
Compressor Motor												
No.	1	1	1	1	1	1	1	1	1	1	1	1
Volts	208/230	208/230	460	460	208/230	208/230	460	460	208/230	208/230	460	460
Phase	3	3	3	3	3	3	3	3	3	3	3	3
RPM	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
HP, Compressor 1	3	3	3	3	4	4	4	4	5	5	5	5
Amps (RLA), Comp. 1	9/9	9/9	5.6	5.6	13.1/13.1	13.1/13.1	6.1	6.1	16/16	16/16	7.8	7.8
Amps (LRA), Comp. 1	71/71	71/71	38	38	83.1/83.1	83.1/83.1	41	41	110/110	110/110	52	52
Condenser Motor												
No.	1	1	1	1	1	1	1	1	1	1	1	1
Volts	208/230	208/230	460	460	208/230	208/230	460	460	208/230	208/230	460	460
Phase	1	1	1	1	1	1	1	1	1	1	1	1
HP	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Amps (FLA, each)	1.5/1.5	1.5/1.5	1	1	1.5/1.5	1.5/1.5	1	1	2.2/2.2	2.2/2.2	1	1
Amps (LRA, each)	3/3	3/3	1.9	1.9	3/3	3/3	1.9	1.9	4.9/4.9	4.9/4.9	1.9	1.9
Evaporator Fan												
No.	1	1	1	1	1	1	1	1	1	1	1	1
Volts	208/230	208/230	460	460	208/230	208/230	460	460	208/230	208/230	460	460
Phase	3	3	3	3	3	3	3	3	3	3	3	3
HP	1/2	1/2	1/2	1/2	1/2	3/4	1/2	3/4	3/4	1	3/4	1
Amps (FLA, each)	2.8/2.8	2.8/2.8	1.4	1.4	2.8/2.8	3.4/3.4	1.4	1.6	3.4/3.4	4.1/4.1	1.6	2
Amps (LRA, each)	11.3/11.3	11.3/11.3	6.2	6.2	11.3/11.3	16.8/16.8	6.2	8.4	16.8/16.8	24/24	8.4	12

Unit Dimensions MPS A03C – A05C

Figure 27: Bottom View

Important: This unit must be mounted level in both directions to allow water to drain from the condenser section and condensate pan.

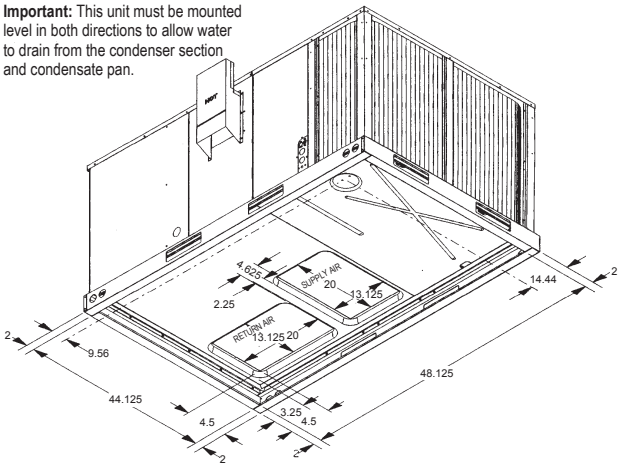


Figure 28: Cabinet Dimensions and Access Locations

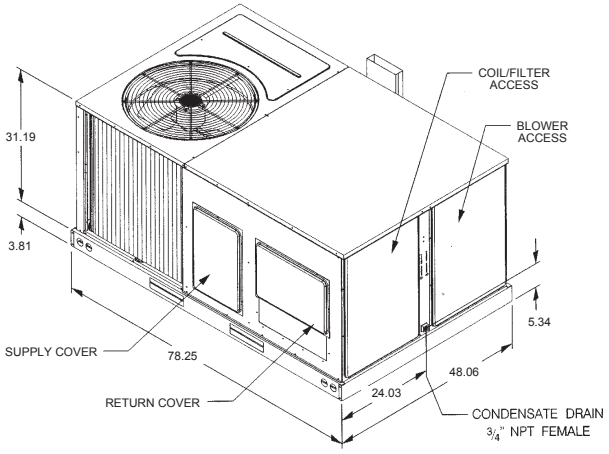


Figure 29: Cabinet Dimensions and Access Locations – Gas Heat Units

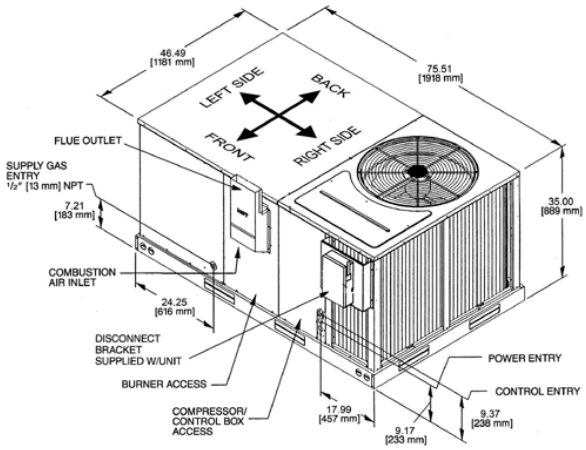


Figure 30: Unit Dimensions

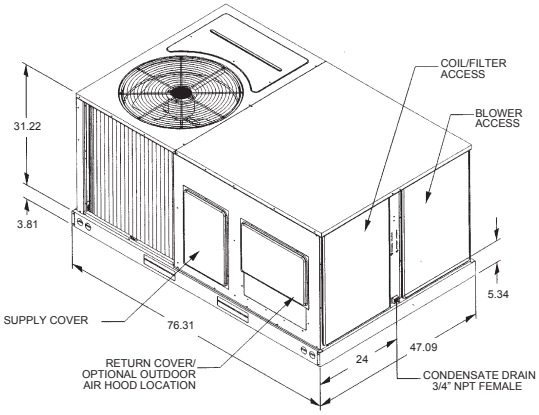


Figure 31: Supply and Return Dimensions – Back View

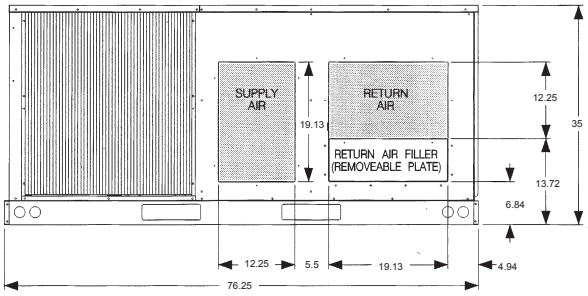
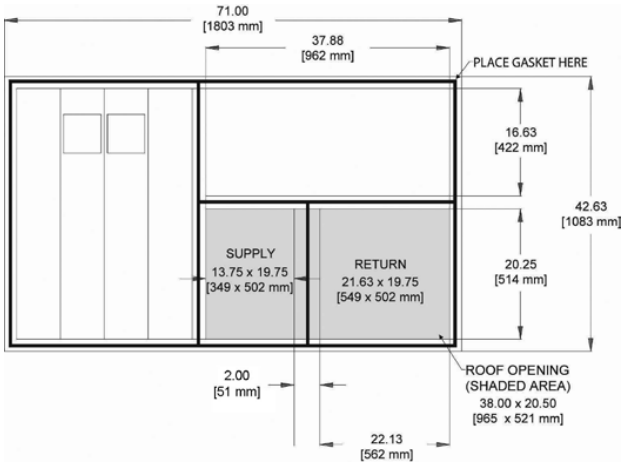


Figure 32: MPS A03C – A05C Curb Dimensions



System Performance – Standard Efficiency

Table 17: Gross System Performance—MPS A03C, 3 Tons Gas Heat

Entering Indoor Air @ 80°F (26.7°C) dbE[1]										
wbE			71°F (21.7°C)			67°F (19.4°C)			63°F (17.2°C)	
CFM (L/s)			1375 (649)	1250 (590)	1062 (501)	1375 (649)	1250 (590)	1062 (501)	1375 (649)	1250 (590)	1062 (501)
DR[1]			0.2	0.18	0.15	0.2	0.18	0.15	0.2	0.18	0.15
Outdoor Dry Bulb Temperature °F (°C)	75 (23.9)	Total BTUH (kW)	44.7 (13.1)	43.9 (12.9)	42.7 (12.5)	41.5 (12.2)	40.7 (11.9)	39.6 (11.6)	38.5 (11.3)	37.8 (11.1)	36.8 (10.8)
		Sens BTUH (kW)	23.8 (7.0)	22.8 (6.7)	21.2 (6.2)	29.7 (8.7)	28.4 (8.3)	26.4 (7.7)	33.2 (9.7)	31.7 (9.3)	29.5 (8.6)
		Power (kW)	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.0	1.9
	80 (26.7)	Total BTUH (kW)	43.6 (12.8)	42.9 (12.6)	41.7 (12.2)	40.4 (11.8)	39.7 (11.6)	38.6 (11.3)	37.4 (11.0)	36.7 (10.8)	35.7 (10.5)
		Sens BTUH (kW)	23.7 (6.9)	22.6 (6.6)	21.0 (6.2)	29.5 (8.6)	28.2 (8.3)	26.2 (7.7)	33.0 (9.7)	31.6 (9.3)	29.4 (8.6)
		Power (kW)	2.0	2.0	2.0	2.1	2.0	2.0	2.1	2.1	2.0
	85 (29.4)	Total BTUH (kW)	42.5 (12.5)	41.7 (12.2)	40.6 (11.9)	39.3 (11.5)	38.6 (11.3)	37.5 (11.0)	36.3 (10.6)	35.6 (10.4)	34.6 (10.2)
		Sens BTUH (kW)	23.4 (6.8)	22.3 (6.5)	20.8 (6.1)	29.2 (8.6)	27.9 (8.2)	26.0 (7.6)	32.8 (9.6)	31.3 (9.2)	29.1 (8.5)
		Power (kW)	2.2	2.2	2.1	2.2	2.2	2.1	2.2	2.2	2.2
	90 (32.2)	Total BTUH (kW)	41.4 (12.1)	40.6 (11.9)	39.5 (11.6)	38.1 (11.2)	37.4 (11.0)	36.4 (10.7)	35.1 (10.3)	34.5 (10.1)	33.5 (9.8)
		Sens BTUH (kW)	22.9 (6.7)	21.9 (6.4)	20.4 (6.0)	28.8 (8.4)	27.5 (8.1)	25.6 (7.5)	32.3 (9.5)	30.9 (9.1)	28.7 (8.4)
		Power (kW)	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.3	2.3
	95 (35)	Total BTUH (kW)	40.2 (11.8)	39.5 (11.6)	38.4 (11.2)	36.9 (10.8)	**36.3 (10.6)**	35.3 (10.3)	33.9 (9.9)	33.3 (9.8)	32.4 (9.5)
		Sens BTUH (kW)	22.4 (6.6)	21.4 (6.3)	19.9 (5.8)	28.2 (8.3)	**27.0 (7.9)**	25.1 (7.3)	31.8 (9.3)	30.3 (8.9)	28.2 (8.3)
		Power (kW)	2.5	2.4	2.4	2.5	**2.5**	2.4	2.5	2.5	2.5
	100 (37.8)	Total BTUH (kW)	39.0 (11.4)	38.3 (11.2)	37.2 (10.9)	35.7 (10.5)	35.1 (10.3)	34.1 (10.0)	32.7 (9.6)	32.2 (9.4)	31.3 (9.2)
		Sens BTUH (kW)	21.7 (6.4)	20.7 (6.1)	19.3 (5.6)	27.5 (8.1)	26.3 (7.7)	24.5 (7.2)	31.1 (9.1)	29.7 (8.7)	27.6 (8.1)
		Power (kW)	2.6	2.6	2.6	2.6	2.6	2.6	2.7	2.6	2.6
	105 (40.6)	Total BTUH (kW)	37.7 (11.1)	37.1 (10.9)	36.1 (10.6)	34.5 (10.1)	33.9 (9.9)	33.0 (9.7)	31.5 (9.2)	30.9 (9.1)	30.1 (8.8)
		Sens BTUH (kW)	20.9 (6.1)	19.9 (5.8)	18.5 (5.4)	26.7 (7.8)	25.5 (7.5)	23.7 (7.0)	30.2 (8.9)	28.9 (8.5)	26.9 (7.9)
		Power (kW)	2.8	2.7	2.7	2.8	2.8	2.7	2.8	2.8	2.8
	110 (43.3)	Total BTUH (kW)	36.5 (10.7)	35.8 (10.5)	34.9 (10.2)	33.2 (9.7)	32.7 (9.6)	31.8 (9.3)	30.3 (8.9)	29.7 (8.7)	28.9 (8.5)
		Sens BTUH (kW)	19.9 (5.8)	19.0 (5.6)	17.7 (5.2)	25.7 (7.5)	24.6 (7.2)	22.9 (6.7)	29.3 (8.6)	28.0 (8.2)	26.0 (7.6)
		Power (kW)	2.9	2.9	2.9	3.0	2.9	2.9	3.0	3.0	2.9
	115 (46.1)	Total BTUH (kW)	35.2 (10.3)	34.6 (10.1)	33.6 (9.9)	32.0 (9.4)	31.4 (9.2)	30.5 (8.9)	29.0 (8.5)	28.5 (8.3)	27.7 (8.1)
		Sens BTUH (kW)	18.8 (5.5)	18.0 (5.3)	16.7 (4.9)	24.7 (7.2)	23.6 (6.9)	21.9 (6.4)	28.2 (8.3)	26.9 (7.9)	25.0 (7.3)
		Power (kW)	3.1	3.1	3.1	3.1	3.1	3.1	3.2	3.1	3.1
	120 (48.9)	Total BTUH (kW)	33.9 (9.9)	33.3 (9.8)	32.4 (9.5)	30.7 (9.0)	30.1 (8.8)	29.3 (8.6)	27.7 (8.1)	27.2 (8.0)	26.4 (7.7)
		Sens BTUH (kW)	17.6 (5.1)	16.8 (4.9)	15.6 (4.6)	23.4 (6.9)	22.4 (6.6)	20.8 (6.1)	27.0 (7.9)	25.8 (7.5)	24.0 (7.0)
		Power (kW)	3.3	3.3	3.2	3.3	3.3	3.3	3.4	3.3	3.3
	125 (51.7)	Total BTUH (kW)	32.6 (9.5)	32.0 (9.4)	31.1 (9.1)	29.3 (8.6)	28.8 (8.4)	28.0 (8.2)	26.3 (7.7)	25.9 (7.6)	25.2 (7.4)
		Sens BTUH (kW)	16.2 (4.8)	15.5 (4.5)	14.4 (4.2)	22.1 (6.5)	21.1 (6.2)	19.6 (5.7)	25.6 (7.5)	24.5 (7.2)	22.7 (6.7)
		Power (kW)	3.5	3.5	3.4	3.5	3.5	3.4	3.6	3.5	3.5

Note: DR — Depression Ratio; dbE — Entering Air Dry Bulb; wbE — Entering Air Wet Bulb; Total — Total Capacity × 1000 BTUH; Sens — Sensible Capacity × 1000 BTUH Power–KW input

1. When the entering air dry bulb is other than 80°F (27°C), adjust the sensible capacity from the table by adding (1.10 × CFM × (1 – DR) × (dbE – 80))

Table 18: Gross System Performance—MPS A04C, 4 Tons Gas Heat

Entering Indoor Air @ 80°F (26.7°C) dbE[1]											
wbE			71°F (21.7°C)			67°F (19.4°C)			63°F (17.2°C)		
CFM (L/s)			1650 (779)	1500 (708)	1275 (602)	1650 (779)	1500 (708)	1275 (602)	1650 (779)	1500 (708)	1275 (602)
DR[1]			0.1	0.08	0.05	0.1	0.08	0.05	0.1	0.08	0.05
Outdoor Dry Bulb Temperature °F (°C)	75 (23.9)	Total BTUH (kW)	60.3 (17.7)	59.3 (17.4)	57.6 (16.9)	56.1 (16.4)	55.1 (16.1)	53.6 (15.7)	51.1 (15.0)	50.2 (14.7)	48.8 (14.3)
		Sens BTUH (kW)	31.2 (9.2)	29.8 (8.7)	27.7 (8.1)	39.8 (11.7)	38.1 (11.2)	35.4 (10.4)	43.9 (12.9)	41.9 (12.3)	39.0 (11.4)
		Power (kW)	2.6	2.6	2.5	2.6	2.6	2.5	2.6	2.5	2.5
	80 (26.7)	Total BTUH (kW)	58.5 (17.1)	57.4 (16.8)	55.9 (16.4)	54.2 (15.9)	53.2 (15.6)	51.8 (15.2)	49.2 (14.4)	48.4 (14.2)	47.0 (13.8)
		Sens BTUH (kW)	31.0 (9.1)	29.6 (8.7)	27.5 (8.1)	39.6 (11.6)	37.8 (11.1)	35.2 (10.3)	43.6 (12.8)	41.7 (12.2)	38.8 (11.4)
		Power (kW)	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	85 (29.4)	Total BTUH (kW)	56.7 (16.6)	55.7 (16.3)	54.2 (15.9)	52.4 (15.4)	51.5 (15.1)	50.1 (14.7)	47.5 (13.9)	46.6 (13.7)	45.3 (13.3)
		Sens BTUH (kW)	30.6 (9.0)	29.2 (8.6)	27.1 (8.0)	39.2 (11.5)	37.4 (11.0)	34.8 (10.2)	43.2 (12.7)	41.3 (12.1)	38.4 (11.3)
		Power (kW)	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
	90 (32.2)	Total BTUH (kW)	55.0 (16.1)	54.0 (15.8)	52.5 (15.4)	50.7 (14.9)	49.8 (14.6)	48.4 (14.2)	45.7 (13.4)	44.9 (13.2)	43.7 (12.8)
		Sens BTUH (kW)	30.0 (8.8)	28.6 (8.4)	26.6 (7.8)	38.6 (11.3)	36.9 (10.8)	34.3 (10.0)	42.6 (12.5)	40.7 (11.9)	37.9 (11.1)
		Power (kW)	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.0
	95 (35)	Total BTUH (kW)	53.3 (15.6)	52.3 (15.3)	50.9 (14.9)	49.0 (14.4)	**48.1 (14.1)**	46.8 (13.7)	44.1 (12.9)	43.3 (12.7)	42.1 (12.3)
		Sens BTUH (kW)	29.2 (8.6)	27.9 (8.2)	26.0 (7.6)	37.8 (11.1)	**36.1 (10.6)**	33.6 (9.9)	41.9 (12.3)	40.0 (11.7)	37.2 (10.9)
		Power (kW)	3.3	3.3	3.3	3.3	**3.3**	3.3	3.3	3.3	3.2
	100 (37.8)	Total BTUH (kW)	51.7 (15.2)	50.8 (14.9)	49.4 (14.5)	47.4 (13.9)	46.6 (13.7)	45.3 (13.3)	42.5 (12.4)	41.7 (12.2)	40.6 (11.9)
		Sens BTUH (kW)	28.3 (8.3)	27.0 (7.9)	25.2 (7.4)	36.9 (10.8)	35.3 (10.3)	32.8 (9.6)	41.0 (12.0)	39.2 (11.5)	36.4 (10.7)
		Power (kW)	3.6	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	105 (40.6)	Total BTUH (kW)	50.2 (14.7)	49.3 (14.4)	47.9 (14.0)	45.9 (13.5)	45.1 (13.2)	43.9 (12.9)	40.9 (12.0)	40.2 (11.8)	39.1 (11.5)
		Sens BTUH (kW)	27.2 (8.0)	26.0 (7.6)	24.2 (7.1)	35.8 (10.5)	34.3 (10.0)	31.9 (9.3)	39.9 (11.7)	38.1 (11.2)	35.5 (10.4)
		Power (kW)	3.8	3.8	3.7	3.8	3.7	3.7	3.8	3.7	3.7
	110 (43.3)	Total BTUH (kW)	48.7 (14.3)	47.8 (14.0)	46.5 (13.6)	44.4 (13.0)	43.6 (12.8)	42.5 (12.4)	39.5 (11.6)	38.8 (11.4)	37.7 (11.1)
		Sens BTUH (kW)	26.0 (7.6)	24.8 (7.3)	23.1 (6.8)	34.6 (10.1)	33.1 (9.7)	30.8 (9.0)	38.7 (11.3)	36.9 (10.8)	34.4 (10.1)
		Power (kW)	4.0	4.0	3.9	4.0	4.0	3.9	4.0	4.0	3.9
	115 (46.1)	Total BTUH (kW)	47.3 (13.9)	46.5 (13.6)	45.2 (13.2)	43.0 (12.6)	42.3 (12.4)	41.1 (12.0)	38.1 (11.2)	37.4 (11.0)	36.4 (10.7)
		Sens BTUH (kW)	24.6 (7.2)	23.5 (6.9)	21.8 (6.4)	33.2 (9.7)	31.7 (9.3)	29.5 (8.6)	37.3 (10.9)	35.6 (10.4)	33.1 (9.7)
		Power (kW)	4.3	4.2	4.2	4.3	4.2	4.2	4.3	4.2	4.2
	120 (48.9)	Total BTUH (kW)	46.0 (13.5)	45.2 (13.2)	43.9 (12.9)	41.7 (12.2)	41.0 (12.0)	39.8 (11.7)	36.7 (10.8)	36.1 (10.6)	35.1 (10.3)
		Sens BTUH (kW)	23.0 (6.7)	22.0 (6.4)	20.5 (6.0)	31.6 (9.3)	30.2 (8.9)	28.1 (8.2)	35.7 (10.5)	34.1 (10.0)	31.7 (9.3)
		Power (kW)	4.5	4.5	4.4	4.5	4.5	4.4	4.5	4.5	4.4
	125 (51.7)	Total BTUH (kW)	44.7 (13.1)	43.9 (12.9)	42.7 (12.5)	40.4 (11.8)	39.7 (11.6)	38.6 (11.3)	35.5 (10.4)	34.8 (10.2)	33.9 (9.9)
		Sens BTUH (kW)	21.3 (6.2)	20.3 (6.0)	18.9 (5.5)	29.9 (8.8)	28.6 (8.4)	26.6 (7.8)	34.0 (10.0)	32.4 (9.5)	30.2 (8.8)
		Power (kW)	4.8	4.8	4.7	4.8	4.8	4.7	4.8	4.7	4.7

Note: DR — Depression Ratio; dbE — Entering Air Dry Bulb; wbE — Entering Air Wet Bulb; Total — Total Capacity × 1000 BTUH; Sens — Sensible Capacity × 1000 BTUH Power–KW input
1. When the entering air dry bulb is other than 80°F (27°C), adjust the sensible capacity from the table by adding (1.10 × CFM × (1 – DR) × (dbE – 80))

Table 19: Gross System Performance—MPS A05C5 Tons Gas Heat

Entering Indoor Air @ 80°F (26.7°C) dbE[1]											
wbE			71°F (21.7°C)			67°F (19.4°C)			63°F (17.2°C)		
CFM (L/s)			1980 (934)	1800 (850)	1530 (722)	1980 (934)	1800 (850)	1530 (722)	1980 (934)	1800 (850)	1530 (722)
DR[1]			0.13	0.12	0.09	0.13	0.12	0.09	0.13	0.12	0.09
Outdoor Dry Bulb Temperature °F (°C)	75 (23.9)	Total BTUH (kW)	73.9 (21.6)	72.6 (21.3)	70.6 (20.7)	67.7 (19.8)	66.5 (19.5)	64.7 (19.0)	62.5 (18.3)	61.4 (18.0)	59.7 (17.5)
		Sens BTUH (kW)	37.0 (10.8)	35.3 (10.4)	32.9 (9.6)	46.2 (13.5)	44.2 (12.9)	41.1 (12.0)	52.3 (15.3)	50.0 (14.7)	46.5 (13.6)
		Power (kW)	3.6	3.6	3.6	3.6	3.6	3.5	3.6	3.6	3.5
	80 (26.7)	Total BTUH (kW)	72.5 (21.2)	71.2 (20.9)	69.2 (20.3)	66.3 (19.4)	65.1 (19.1)	63.3 (18.6)	61.1 (17.9)	60.0 (17.6)	58.3 (17.1)
		Sens BTUH (kW)	37.2 (10.9)	35.6 (10.4)	33.1 (9.7)	46.5 (13.6)	44.4 (13.0)	41.3 (12.1)	52.6 (15.4)	50.3 (14.7)	46.7 (13.7)
		Power (kW)	3.8	3.8	3.8	3.8	3.8	3.7	3.8	3.8	3.7
	85 (29.4)	Total BTUH (kW)	70.9 (20.8)	69.6 (20.4)	67.7 (19.8)	64.7 (19.0)	63.6 (18.6)	61.8 (18.1)	59.5 (17.4)	58.5 (17.1)	56.9 (16.7)
		Sens BTUH (kW)	37.2 (10.9)	35.5 (10.4)	33.0 (9.7)	46.5 (13.6)	44.4 (13.0)	41.3 (12.1)	52.6 (15.4)	50.2 (14.7)	46.7 (13.7)
		Power (kW)	4.1	4.0	4.0	4.0	4.0	3.9	4.0	4.0	3.9
	90 (32.2)	Total BTUH (kW)	69.2 (20.3)	68.0 (19.9)	66.1 (19.4)	63.0 (18.5)	61.9 (18.1)	60.2 (17.6)	57.8 (16.9)	56.8 (16.6)	55.3 (16.2)
		Sens BTUH (kW)	36.8 (10.8)	35.2 (10.3)	32.7 (9.6)	46.1 (13.5)	44.0 (12.9)	40.9 (12.0)	52.2 (15.3)	49.8 (14.6)	46.4 (13.6)
		Power (kW)	4.3	4.3	4.2	4.3	4.2	4.2	4.2	4.2	4.1
	95 (35)	Total BTUH (kW)	67.4 (19.8)	66.2 (19.4)	64.4 (18.9)	61.2 (17.9)	**60.1 (17.6)**	58.5 (17.1)	56.0 (16.4)	55.0 (16.1)	53.5 (15.7)
		Sens BTUH (kW)	36.1 (10.6)	34.5 (10.1)	32.1 (9.4)	45.4 (13.3)	**43.3 (12.7)**	40.3 (11.8)	51.5 (15.1)	49.2 (14.4)	45.7 (13.4)
		Power (kW)	4.5	4.5	4.4	4.5	**4.5**	4.4	4.5	4.4	4.4
	100 (37.8)	Total BTUH (kW)	65.5 (19.2)	64.3 (18.8)	62.5 (18.3)	59.3 (17.4)	58.2 (17.1)	56.6 (16.6)	54.1 (15.8)	53.1 (15.6)	51.7 (15.1)
		Sens BTUH (kW)	35.1 (10.3)	33.5 (9.8)	31.1 (9.1)	44.3 (13.0)	42.3 (12.4)	39.4 (11.5)	50.4 (14.8)	48.2 (14.1)	44.8 (13.1)
		Power (kW)	4.8	4.8	4.7	4.8	4.7	4.7	4.7	4.7	4.6
	105 (40.6)	Total BTUH (kW)	63.4 (18.6)	62.3 (18.2)	60.6 (17.7)	57.2 (16.8)	56.2 (16.5)	54.7 (16.0)	52.0 (15.2)	51.1 (15.0)	49.7 (14.6)
		Sens BTUH (kW)	33.7 (9.9)	32.2 (9.4)	29.9 (8.8)	42.9 (12.6)	41.0 (12.0)	38.2 (11.2)	49.0 (14.4)	46.9 (13.7)	43.6 (12.8)
		Power (kW)	5.1	5.0	5.0	5.0	5.0	4.9	5.0	5.0	4.9
	110 (43.3)	Total BTUH (kW)	61.2 (17.9)	60.1 (17.6)	58.5 (17.1)	55.0 (16.1)	54.0 (15.8)	52.6 (15.4)	49.8 (14.6)	48.9 (14.3)	47.6 (13.9)
		Sens BTUH (kW)	32.0 (9.4)	30.6 (9.0)	28.4 (8.3)	41.2 (12.1)	39.4 (11.5)	36.6 (10.7)	47.3 (13.9)	45.2 (13.3)	42.1 (12.3)
		Power (kW)	5.3	5.3	5.2	5.3	5.3	5.2	5.3	5.2	5.2
	115 (46.1)	Total BTUH (kW)	58.9 (17.3)	57.8 (16.9)	56.2 (16.5)	52.7 (15.4)	51.7 (15.2)	50.3 (14.8)	47.5 (13.9)	46.6 (13.7)	45.4 (13.3)
		Sens BTUH (kW)	30.0 (8.8)	28.6 (8.4)	26.6 (7.8)	39.2 (11.5)	37.5 (11.0)	34.8 (10.2)	45.3 (13.3)	43.3 (12.7)	40.3 (11.8)
		Power (kW)	5.6	5.6	5.5	5.6	5.6	5.5	5.6	5.5	5.5
	120 (48.9)	Total BTUH (kW)	56.4 (16.5)	55.4 (16.2)	53.9 (15.8)	50.2 (14.7)	49.3 (14.5)	48.0 (14.1)	45.0 (13.2)	44.2 (13.0)	43.0 (12.6)
		Sens BTUH (kW)	27.6 (8.1)	26.4 (7.7)	24.5 (7.2)	36.9 (10.8)	35.2 (10.3)	32.7 (9.6)	43.0 (12.6)	41.0 (12.0)	38.2 (11.2)
		Power (kW)	5.9	5.9	5.8	5.9	5.9	5.8	5.9	5.8	5.8
	125 (51.7)	Total BTUH (kW)	53.8 (15.8)	52.9 (15.5)	51.4 (15.1)	47.6 (14.0)	46.8 (13.7)	45.5 (13.3)	42.4 (12.4)	41.7 (12.2)	40.5 (11.9)
		Sens BTUH (kW)	24.9 (7.3)	23.8 (7.0)	22.1 (6.5)	34.2 (10.0)	32.6 (9.6)	30.4 (8.9)	40.3 (11.8)	38.5 (11.3)	35.8 (10.5)
		Power (kW)	6.3	6.2	6.1	6.2	6.2	6.1	6.2	6.2	6.1

Note: DR — Depression Ratio; dbE — Entering Air Dry Bulb; wbE — Entering Air Wet Bulb; Total — Total Capacity × 1000 BTUH; Sens — Sensible Capacity × 1000 BTUH Power–KW input

1. When the entering air dry bulb is other than 80°F (27°C), adjust the sensible capacity from the table by adding (1.10 × CFM × (1 – DR) × (dbE – 80))

System Performance – High Efficiency

Table 20: Gross System Performance—MPS H03C, 3 Tons Gas Heat

Entering Indoor Air @ 80°F (26.7°C) dbE[1]										
wbE			71°F (21.7°C)			67°F (19.4°C)			63°F (17.2°C)		
CFM (L/s)			1375 (649)	1250 (590)	1062 (501)	1375 (649)	1250 (590)	1062 (501)	1375 (649)	1250 (590)	1062 (501)
DR[1]			0.19	0.17	0.14	0.19	0.17	0.14	0.19	0.17	0.14
Outdoor Dry Bulb Temperature °F (°C)	75 (23.9)	Total BTUH (kW)	45.2 (13.3)	44.4 (13.0)	43.2 (12.7)	41.8 (12.2)	41.0 (12.0)	39.9 (11.7)	39.0 (11.4)	38.3 (11.2)	37.3 (10.9)
		Sens BTUH (kW)	24.2 (7.1)	23.1 (6.8)	21.5 (6.3)	29.9 (8.8)	28.6 (8.4)	26.6 (7.8)	33.7 (9.9)	32.2 (9.4)	29.9 (8.8)
		Power (kW)	1.9	1.9	1.8	1.9	1.9	1.9	1.9	1.9	1.9
	80 (26.7)	Total BTUH (kW)	44.0 (12.9)	43.2 (12.7)	42.1 (12.3)	40.6 (11.9)	39.8 (11.7)	38.8 (11.4)	37.8 (11.1)	37.1 (10.9)	36.1 (10.6)
		Sens BTUH (kW)	24.0 (7.0)	22.9 (6.7)	21.3 (6.2)	29.7 (8.7)	28.4 (8.3)	26.4 (7.7)	33.5 (9.8)	32.0 (9.4)	29.8 (8.7)
		Power (kW)	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.0
	85 (29.4)	Total BTUH (kW)	42.8 (12.5)	42.1 (12.3)	40.9 (12.0)	39.4 (11.5)	38.7 (11.3)	37.6 (11.0)	36.6 (10.7)	35.9 (10.5)	34.9 (10.2)
		Sens BTUH (kW)	23.7 (6.9)	22.6 (6.6)	21.0 (6.2)	29.4 (8.6)	28.1 (8.2)	26.1 (7.7)	33.2 (9.7)	31.7 (9.3)	29.5 (8.6)
		Power (kW)	2.2	2.1	2.1	2.2	2.2	2.1	2.2	2.2	2.2
	90 (32.2)	Total BTUH (kW)	41.6 (12.2)	40.9 (12.0)	39.8 (11.6)	38.1 (11.2)	37.5 (11.0)	36.4 (10.7)	35.4 (10.4)	34.7 (10.2)	33.8 (9.9)
		Sens BTUH (kW)	23.2 (6.8)	22.2 (6.5)	20.6 (6.0)	28.9 (8.5)	27.6 (8.1)	25.7 (7.5)	32.7 (9.6)	31.2 (9.2)	29.1 (8.5)
		Power (kW)	2.3	2.3	2.2	2.3	2.3	2.3	2.4	2.3	2.3
	95 (35)	Total BTUH (kW)	40.4 (11.8)	39.7 (11.6)	38.6 (11.3)	36.9 (10.8)	**36.3 (10.6)**	35.3 (10.3)	34.2 (10.0)	33.6 (9.8)	32.6 (9.6)
		Sens BTUH (kW)	22.6 (6.6)	21.6 (6.3)	20.1 (5.9)	28.4 (8.3)	**27.1 (7.9)**	25.2 (7.4)	32.1 (9.4)	30.7 (9.0)	28.5 (8.4)
		Power (kW)	2.5	2.4	2.4	2.5	**2.5**	2.4	2.5	2.5	2.5
	100 (37.8)	Total BTUH (kW)	39.2 (11.5)	38.5 (11.3)	37.5 (11.0)	35.8 (10.5)	35.1 (10.3)	34.2 (10.0)	33.0 (9.7)	32.4 (9.5)	31.5 (9.2)
		Sens BTUH (kW)	21.9 (6.4)	20.9 (6.1)	19.5 (5.7)	27.6 (8.1)	26.4 (7.7)	24.6 (7.2)	31.4 (9.2)	30.0 (8.8)	27.9 (8.2)
		Power (kW)	2.6	2.6	2.6	2.6	2.6	2.6	2.7	2.6	2.6
	105 (40.6)	Total BTUH (kW)	38.0 (11.1)	37.3 (10.9)	36.3 (10.6)	34.6 (10.1)	33.9 (9.9)	33.0 (9.7)	31.8 (9.3)	31.2 (9.1)	30.4 (8.9)
		Sens BTUH (kW)	21.1 (6.2)	20.1 (5.9)	18.7 (5.5)	26.8 (7.9)	25.6 (7.5)	23.8 (7.0)	30.6 (9.0)	29.2 (8.6)	27.2 (8.0)
		Power (kW)	2.8	2.8	2.7	2.8	2.8	2.8	2.8	2.8	2.8
	110 (43.3)	Total BTUH (kW)	36.8 (10.8)	36.2 (10.6)	35.2 (10.3)	33.4 (9.8)	32.8 (9.6)	31.9 (9.3)	30.6 (9.0)	30.1 (8.8)	29.2 (8.6)
		Sens BTUH (kW)	20.1 (5.9)	19.2 (5.6)	17.9 (5.2)	25.8 (7.6)	24.7 (7.2)	23.0 (6.7)	29.6 (8.7)	28.3 (8.3)	26.3 (7.7)
		Power (kW)	3.0	2.9	2.9	3.0	3.0	2.9	3.0	3.0	3.0
	115 (46.1)	Total BTUH (kW)	35.7 (10.4)	35.0 (10.3)	34.1 (10.0)	32.2 (9.4)	31.6 (9.3)	30.8 (9.0)	29.4 (8.6)	28.9 (8.5)	28.1 (8.2)
		Sens BTUH (kW)	19.0 (5.6)	18.2 (5.3)	16.9 (4.9)	24.7 (7.3)	23.6 (6.9)	22.0 (6.4)	28.5 (8.4)	27.2 (8.0)	25.3 (7.4)
		Power (kW)	3.2	3.1	3.1	3.2	3.2	3.1	3.2	3.2	3.1
	120 (48.9)	Total BTUH (kW)	34.5 (10.1)	33.9 (9.9)	32.9 (9.7)	31.0 (9.1)	30.5 (8.9)	29.6 (8.7)	28.2 (8.3)	27.7 (8.1)	27.0 (7.9)
		Sens BTUH (kW)	17.8 (5.2)	17.0 (5.0)	15.8 (4.6)	23.5 (6.9)	22.5 (6.6)	20.9 (6.1)	27.3 (8.0)	26.1 (7.6)	24.3 (7.1)
		Power (kW)	3.4	3.3	3.3	3.4	3.4	3.3	3.4	3.4	3.3
	125 (51.7)	Total BTUH (kW)	33.3 (9.8)	32.7 (9.6)	31.8 (9.3)	29.8 (8.7)	29.3 (8.6)	28.5 (8.4)	27.1 (7.9)	26.6 (7.8)	25.9 (7.6)
		Sens BTUH (kW)	16.4 (4.8)	15.7 (4.6)	14.6 (4.3)	22.2 (6.5)	21.2 (6.2)	19.7 (5.8)	26.0 (7.6)	24.8 (7.3)	23.1 (6.8)
		Power (kW)	3.6	3.5	3.5	3.6	3.6	3.5	3.6	3.6	3.5

Note: DR — Depression Ratio; dbE — Entering Air Dry Bulb; wbE — Entering Air Wet Bulb; Total — Total Capacity × 1000 BTUH; Sens — Sensible Capacity × 1000 BTUH Power–KW input

1. When the entering air dry bulb is other than 80°F (27°C), adjust the sensible capacity from the table by adding (1.10 × CFM × (1 – DR) × (dbE – 80))

Table 21: Gross System Performance—MPS H04C, 4 Tons Gas Heat

Entering Indoor Air @ 80°F (26.7°C) dbE[1]											
wbE			71°F (21.7°C)			67°F (19.4°C)			63°F (17.2°C)		
CFM (L/s)			1760 (831)	1600 (755)	1360 (642)	1760 (831)	1600 (755)	1360 (642)	1760 (831)	1600 (755)	1360 (642)
DR[1]			0.11	0.09	0.05	0.11	0.09	0.05	0.11	0.09	0.05
Outdoor Dry Bulb Temperature °F (°C)	75 (23.9)	Total BTUH (kW)	58.9 (17.3)	57.8 (16.9)	56.2 (16.5)	55.1 (16.1)	54.1 (15.9)	52.6 (15.4)	49.6 (14.5)	48.8 (14.3)	47.4 (13.9)
		Sens BTUH (kW)	31.1 (9.1)	29.7 (8.7)	27.6 (8.1)	40.2 (11.8)	38.4 (11.3)	35.7 (10.5)	43.7 (12.8)	41.8 (12.2)	38.9 (11.4)
		Power (kW)	2.6	2.6	2.5	2.6	2.5	2.5	2.6	2.5	2.5
	80 (26.7)	Total BTUH (kW)	57.3 (16.8)	56.3 (16.5)	54.7 (16.0)	53.5 (15.7)	52.6 (15.4)	51.1 (15.0)	48.1 (14.1)	47.2 (13.8)	45.9 (13.5)
		Sens BTUH (kW)	31.1 (9.1)	29.7 (8.7)	27.6 (8.1)	40.2 (11.8)	38.4 (11.3)	35.7 (10.5)	43.7 (12.8)	41.8 (12.2)	38.9 (11.4)
		Power (kW)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	85 (29.4)	Total BTUH (kW)	55.7 (16.3)	54.7 (16.0)	53.2 (15.6)	51.9 (15.2)	51.0 (15.0)	49.6 (14.5)	46.5 (13.6)	45.7 (13.4)	44.4 (13.0)
		Sens BTUH (kW)	30.9 (9.0)	29.5 (8.6)	27.4 (8.0)	40.0 (11.7)	38.2 (11.2)	35.5 (10.4)	43.5 (12.7)	41.6 (12.2)	38.7 (11.3)
		Power (kW)	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.8
	90 (32.2)	Total BTUH (kW)	54.1 (15.9)	53.2 (15.6)	51.7 (15.2)	50.4 (14.8)	49.5 (14.5)	48.1 (14.1)	44.9 (13.2)	44.1 (12.9)	42.9 (12.6)
		Sens BTUH (kW)	30.4 (8.9)	29.1 (8.5)	27.0 (7.9)	39.5 (11.6)	37.7 (11.1)	35.1 (10.3)	43.1 (12.6)	41.1 (12.1)	38.3 (11.2)
		Power (kW)	3.1	3.1	3.0	3.1	3.1	3.0	3.1	3.1	3.0
	95 (35)	Total BTUH (kW)	52.5 (15.4)	51.6 (15.1)	50.2 (14.7)	48.8 (14.3)	**47.9 (14.0)**	46.6 (13.7)	43.3 (12.7)	42.5 (12.5)	41.4 (12.1)
		Sens BTUH (kW)	29.7 (8.7)	28.4 (8.3)	26.4 (7.7)	38.8 (11.4)	**37.1 (10.9)**	34.5 (10.1)	42.4 (12.4)	40.5 (11.9)	37.7 (11.0)
		Power (kW)	3.3	3.3	3.2	3.3	**3.3**	3.2	3.3	3.3	3.2
	100 (37.8)	Total BTUH (kW)	50.9 (14.9)	50.0 (14.7)	48.7 (14.3)	47.2 (13.8)	46.3 (13.6)	45.1 (13.2)	41.7 (12.2)	41.0 (12.0)	39.9 (11.7)
		Sens BTUH (kW)	28.8 (8.4)	27.5 (8.1)	25.6 (7.5)	37.9 (11.1)	36.2 (10.6)	33.7 (9.9)	41.5 (12.2)	39.6 (11.6)	36.8 (10.8)
		Power (kW)	3.5	3.5	3.5	3.5	3.5	3.4	3.5	3.5	3.4
	105 (40.6)	Total BTUH (kW)	49.3 (14.5)	48.5 (14.2)	47.1 (13.8)	45.6 (13.4)	44.8 (13.1)	43.5 (12.8)	40.1 (11.8)	39.4 (11.5)	38.3 (11.2)
		Sens BTUH (kW)	27.7 (8.1)	26.5 (7.8)	24.6 (7.2)	36.8 (10.8)	35.1 (10.3)	32.7 (9.6)	40.1 (11.8)	38.5 (11.3)	35.8 (10.5)
		Power (kW)	3.8	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
	110 (43.3)	Total BTUH (kW)	47.7 (14.0)	46.9 (13.7)	45.6 (13.4)	44.0 (12.9)	43.2 (12.7)	42.0 (12.3)	38.5 (11.3)	37.8 (11.1)	36.8 (10.8)
		Sens BTUH (kW)	26.3 (7.7)	25.2 (7.4)	23.4 (6.9)	35.4 (10.4)	33.8 (9.9)	31.5 (9.2)	38.5 (11.3)	37.2 (10.9)	34.6 (10.1)
		Power (kW)	4.0	4.0	3.9	4.0	3.9	3.9	4.0	3.9	3.9
	115 (46.1)	Total BTUH (kW)	46.1 (13.5)	45.3 (13.3)	44.1 (12.9)	42.3 (12.4)	41.6 (12.2)	40.4 (11.9)	36.9 (10.8)	36.2 (10.6)	35.2 (10.3)
		Sens BTUH (kW)	24.7 (7.2)	23.6 (6.9)	22.0 (6.4)	33.8 (9.9)	32.3 (9.5)	30.1 (8.8)	36.9 (10.8)	35.7 (10.5)	33.2 (9.7)
		Power (kW)	4.2	4.2	4.1	4.2	4.2	4.1	4.2	4.2	4.1
	120 (48.9)	Total BTUH (kW)	44.5 (13.0)	43.7 (12.8)	42.5 (12.5)	40.7 (11.9)	40.0 (11.7)	38.9 (11.4)	35.3 (10.3)	34.6 (10.1)	33.7 (9.9)
		Sens BTUH (kW)	22.9 (6.7)	21.9 (6.4)	20.4 (6.0)	32.0 (9.4)	30.6 (9.0)	28.4 (8.3)	35.3 (10.3)	34.0 (10.0)	31.6 (9.3)
		Power (kW)	4.5	4.5	4.4	4.5	4.4	4.4	4.5	4.4	4.4
	125 (51.7)	Total BTUH (kW)	42.9 (12.6)	42.1 (12.3)	40.9 (12.0)	39.1 (11.5)	38.4 (11.2)	37.3 (10.9)	33.6 (9.9)	33.0 (9.7)	32.1 (9.4)
		Sens BTUH (kW)	20.9 (6.1)	19.9 (5.8)	18.5 (5.4)	30.0 (8.8)	28.6 (8.4)	26.6 (7.8)	33.5 (9.8)	32.0 (9.4)	29.8 (8.7)
		Power (kW)	4.8	4.7	4.7	4.8	4.7	4.7	4.7	4.7	4.6

Note: DR — Depression Ratio; dbE — Entering Air Dry Bulb; wbE — Entering Air Wet Bulb; Total — Total Capacity × 1000 BTUH; Sens — Sensible Capacity × 1000 BTUH Power–KW input

1. When the entering air dry bulb is other than 80°F (27°C), adjust the sensible capacity from the table by adding (1.10 × CFM × (1 – DR) × (dbE – 80))

Table 22: Gross System Performance—MPS H05C, 5 Tons Gas Heat

Entering Indoor Air @ 80°F (26.7°C) dbE[1]											
wbE			71°F (21.7°C)			67°F (19.4°C)			63°F (17.2°C)		
CFM (L/s)			1980 (934)	1800 (850)	1530 (722)	1980 (934)	1800 (850)	1530 (722)	1980 (934)	1800 (850)	1530 (722)
DR[1]			0.14	0.13	0.1	0.14	0.13	0.1	0.14	0.13	0.1
Outdoor Dry Bulb Temperature °F (°C)	75 (23.9)	Total BTUH (kW)	72.5 (21.2)	71.2 (20.9)	69.2 (20.3)	66.3 (19.4)	65.1 (19.1)	63.3 (18.6)	61.1 (17.9)	60.0 (17.6)	58.4 (17.1)
		Sens BTUH (kW)	36.2 (10.6)	34.6 (10.1)	32.1 (9.4)	45.4 (13.3)	43.4 (12.7)	40.4 (11.8)	51.5 (15.1)	49.2 (14.4)	45.8 (13.4)
		Power (kW)	3.5	3.5	3.4	3.5	3.4	3.4	3.4	3.4	3.4
	80 (26.7)	Total BTUH (kW)	71.1 (20.8)	69.8 (20.5)	67.9 (19.9)	64.9 (19.0)	63.7 (18.7)	62.0 (18.2)	59.7 (17.5)	58.6 (17.2)	57.0 (16.7)
		Sens BTUH (kW)	36.4 (10.7)	34.8 (10.2)	32.4 (9.5)	45.7 (13.4)	43.7 (12.8)	40.6 (11.9)	51.8 (15.2)	49.5 (14.5)	46.0 (13.5)
		Power (kW)	3.7	3.7	3.6	3.7	3.6	3.6	3.6	3.6	3.6
	85 (29.4)	Total BTUH (kW)	69.5 (20.4)	68.3 (20.0)	66.4 (19.5)	63.3 (18.6)	62.2 (18.2)	60.5 (17.7)	58.1 (17.0)	57.1 (16.7)	55.5 (16.3)
		Sens BTUH (kW)	36.4 (10.7)	34.8 (10.2)	32.3 (9.5)	45.7 (13.4)	43.6 (12.8)	40.6 (11.9)	51.8 (15.2)	49.4 (14.5)	46.0 (13.5)
		Power (kW)	3.9	3.9	3.8	3.9	3.8	3.8	3.8	3.8	3.8
	90 (32.2)	Total BTUH (kW)	67.8 (19.9)	66.6 (19.5)	64.8 (19.0)	61.7 (18.1)	60.6 (17.7)	58.9 (17.3)	56.4 (16.5)	55.4 (16.2)	53.9 (15.8)
		Sens BTUH (kW)	36.0 (10.6)	34.4 (10.1)	32.0 (9.4)	45.3 (13.3)	43.3 (12.7)	40.2 (11.8)	51.4 (15.1)	49.1 (14.4)	45.6 (13.4)
		Power (kW)	4.1	4.1	4.0	4.1	4.1	4.0	4.1	4.0	4.0
	95 (35)	Total BTUH (kW)	66.0 (19.3)	64.8 (19.0)	63.1 (18.5)	59.8 (17.5)	**58.8 (17.2)**	57.2 (16.8)	54.6 (16.0)	53.7 (15.7)	52.2 (15.3)
		Sens BTUH (kW)	35.3 (10.3)	33.7 (9.9)	31.4 (9.2)	44.6 (13.1)	**42.6 (12.5)**	39.6 (11.6)	50.7 (14.8)	48.4 (14.2)	45.0 (13.2)
		Power (kW)	4.4	4.3	4.3	4.3	**4.3**	4.3	4.3	4.3	4.2
	100 (37.8)	Total BTUH (kW)	64.1 (18.8)	62.9 (18.4)	61.2 (17.9)	57.9 (17.0)	56.9 (16.7)	55.3 (16.2)	52.7 (15.4)	51.8 (15.2)	50.3 (14.8)
		Sens BTUH (kW)	34.3 (10.0)	32.7 (9.6)	30.4 (8.9)	43.5 (12.8)	41.6 (12.2)	38.7 (11.3)	49.6 (14.5)	47.4 (13.9)	44.1 (12.9)
		Power (kW)	4.6	4.6	4.5	4.6	4.6	4.5	4.6	4.5	4.5
	105 (40.6)	Total BTUH (kW)	62.0 (18.2)	60.9 (17.8)	59.2 (17.4)	55.8 (16.4)	54.8 (16.1)	53.3 (15.6)	50.6 (14.8)	49.7 (14.6)	48.4 (14.2)
		Sens BTUH (kW)	32.9 (9.6)	31.4 (9.2)	29.2 (8.6)	42.1 (12.4)	40.3 (11.8)	37.4 (11.0)	48.2 (14.1)	46.1 (13.5)	42.9 (12.6)
		Power (kW)	4.9	4.9	4.8	4.9	4.8	4.8	4.8	4.8	4.7
	110 (43.3)	Total BTUH (kW)	59.8 (17.5)	58.7 (17.2)	57.1 (16.7)	53.6 (15.7)	52.7 (15.4)	51.2 (15.0)	48.4 (14.2)	47.6 (13.9)	46.3 (13.6)
		Sens BTUH (kW)	31.2 (9.1)	29.8 (8.7)	27.7 (8.1)	40.4 (11.9)	38.6 (11.3)	35.9 (10.5)	46.5 (13.6)	44.5 (13.0)	41.4 (12.1)
		Power (kW)	5.2	5.1	5.1	5.2	5.1	5.0	5.1	5.1	5.0
	115 (46.1)	Total BTUH (kW)	57.5 (16.8)	56.5 (16.5)	54.9 (16.1)	51.3 (15.0)	50.4 (14.8)	49.0 (14.4)	46.1 (13.5)	45.3 (13.3)	44.0 (12.9)
		Sens BTUH (kW)	29.2 (8.5)	27.9 (8.2)	25.9 (7.6)	38.4 (11.3)	36.7 (10.8)	34.1 (10.0)	44.5 (13.0)	42.5 (12.5)	39.5 (11.6)
		Power (kW)	5.5	5.4	5.4	5.5	5.4	5.3	5.4	5.4	5.3
	120 (48.9)	Total BTUH (kW)	55.0 (16.1)	54.0 (15.8)	52.6 (15.4)	48.8 (14.3)	48.0 (14.1)	46.7 (13.7)	43.6 (12.8)	42.9 (12.6)	41.7 (12.2)
		Sens BTUH (kW)	26.8 (7.9)	25.6 (7.5)	23.8 (7.0)	36.1 (10.6)	34.5 (10.1)	32.0 (9.4)	42.2 (12.4)	40.3 (11.8)	37.5 (11.0)
		Power (kW)	5.8	5.7	5.7	5.8	5.7	5.6	5.7	5.7	5.6
	125 (51.7)	Total BTUH (kW)	52.4 (15.4)	51.5 (15.1)	50.1 (14.7)	46.2 (13.6)	45.4 (13.3)	44.2 (12.9)	41.0 (12.0)	40.3 (11.8)	39.2 (11.5)
		Sens BTUH (kW)	24.1 (7.1)	23.0 (6.7)	21.4 (6.3)	33.4 (9.8)	31.9 (9.3)	29.7 (8.7)	39.5 (11.6)	37.7 (11.0)	35.1 (10.3)
		Power (kW)	6.1	6.1	6.0	6.1	6.0	5.9	6.1	6.0	5.9

Note: DR — Depression Ratio; dbE — Entering Air Dry Bulb; wbE — Entering Air Wet Bulb; Total — Total Capacity × 1000 BTUH; Sens — Sensible Capacity × 1000 BTUH Power–KW input
1. When the entering air dry bulb is other than 80°F (27°C), adjust the sensible capacity from the table by adding (1.10 × CFM × (1 – DR) × (dbE – 80))

Airflow Performance

Table 23: Airflow Performance—MPS A03C–A05C

Unit Model: MPS-	Motor Speed from Factory		Heating Input BTU/hr (kW)	Manufacturer Recommended Air-Flow Range (Min/Max) CFM	Blower Size/Motor HP (w) # of Speeds	Motor Speed		External Static Pressure—Inches W.C. (kPa)							
	Cool	Heat						0.1 (.02)	0.2 (.05)	0.3 (.07)	0.4 (.10)	0.5 (.12)	0.6 (.15)	0.7 (.17)	0.8 (.20)
CFM (L/s) Air Delivery/RPM/Watts—208 Volts															
A03C	Low	Low	80,000 (23.45)	1050/1350	10×10 1/2 HP (373) 3 Speed Motor	Low	CFM	1210 (571)	1193 (563)	1175 (555)	1155 (545)	1125 (531)	1075 (507)	1015 (479)	925 (437)
							Watts	450	400	395	385	380	375	370	360
		Med	120,000 (35.17)			Med	CFM	1515 (715)	1500 (708)	1475 (696)	1450 (684)	1405 (663)	1350 (637)	1275 (602)	1180 (557)
							Watts	525	515	510	505	490	475	460	445
						High	CFM	1680 (793)	1650 (779)	1625 (767)	1580 (746)	1530 (722)	1460 (689)	1390 (656)	1280 (604)
							Watts	650	640	630	610	580	560	545	515
A04C	Med			1400/1800	10×10 1/2 HP (373) 3 Speed Motor	Low	CFM	1210 (571)	1193 (563)	1175 (555)	1155 (545)	1125 (531)	1075 (507)	1015 (479)	925 (437)
							Watts	450	400	395	385	380	375	370	360
		Med	100,000 (29.31)			Med	CFM	1515 (715)	1500 (708)	1475 (696)	1450 (684)	1405 (663)	1350 (637)	1275 (602)	1180 (557)
							Watts	525	515	510	505	490	475	460	445
		High	135,000 (39.56)			High	CFM	1680 (793)	1650 (779)	1625 (767)	1580 (746)	1530 (722)	1460 (689)	1390 (656	1280 (604)
							Watts	650	640	630	610	580	560	545	515
A05C	Med	Low	100,000 (29.31)	1750/2250	10×10 1 HP (745 3 Speed Motor	Low	CFM	1575 (743)	1536 (725)	1496 (706)	1457 (688)	1417 (669)	1377 (650)	1338 (631)	1298 (613)
							Watts	297	314	330	347	364	381	397	414
						Med	CFM	1985 (937)	1954 (922)	1919 (906)	1876 (885)	1824 (861)	1759 (830)	1679 (792)	1581 (746)
							Watts	535	553	574	593	606	609	599	572
		High	135,00 (39.56)			High	CFM	2431 (1147)	2372 (1119)	2306 (1088)	2228 (1051)	2138 (1009)	2032 (959)	1907 (900)	1762 (832)
							Watts	970	981	964	926	872	806	736	665
CFM (L/s) Air Delivery/RPM/Watts—230 Volts															
A03C	Low	Low	80,000 (23.45)	1050/1350	10×10 1/2 HP (373) 3 Speed Motor	Low	CFM	1400 (661)	1375 (649)	1360 (642)	1335 (630)	1305 (616)	1255 (592)	1210 (571)	1100 (519)
							Watts	470	460	455	450	440	435	425	410
		Med	120,000 (35.17)			Med	CFM	1685 (795)	1620 (765)	1580 (746)	1550 (732)	1500 (708)	1430 (675)	1350 (637)	1230 (580)
							Watts	635	600	580	570	550	535	505	475
						High	CFM	1870 (883)	1830 (864)	1790 (845)	1730 (816)	1660 (783)	1580 (746)	1500 (708)	1375 (649)
							Watts	780	760	740	700	660	635	600	555
A04C	Med			1400/1800	10×10 1/2 HP (373) 3 Speed Motor	Low	CFM	1400 (661)	1375 (649)	1360 (642)	1335 (630)	1305 (616)	1255 (592)	1210 (571)	1100 (519)
							Watts	470	460	455	450	440	435	425	410
		Med	100,000 (29.31)			Med	CFM	1685 (795)	1620 (765)	1580 (746)	1550 (732)	1500 (708)	1430 (675)	1350 (637)	1230 (580)
							Watts	635	600	580	570	550	535	505	475
		High	135,000 (39.56)			High	CFM	1870 (883)	1830 (864)	1790 (845)	1730 (816)	1660 (783)	1580 (746)	1500 (708)	1375 (649)
							Watts	780	760	740	700	660	635	600	555
A05C	Med	Low	100,000 (29.31)	1750/2250	10×10 1 HP (745) 3 Speed Motor	Low	CFM	1575 (743)	1536 (725)	1496 (706)	1457 (688)	1417 (669)	1377 (650)	1338 (631)	1298 (613)
							Watts	297	314	330	347	364	381	397	414
						Med	CFM	1985 (937)	1954 (922)	1919 (906)	1876 (885)	1824 (861)	1759 (830)	1697 (792)	1581 (746)
							Watts	535	553	574	593	606	609	599	572
		High	135,000 (39.56)			High	CFM	2431 (1147)	2372 (1119)	2306 (1088)	2228 (1051)	2138 (1009)	2032 (959)	1907 (900)	1762 (832)
							Watts	970	981	964	926	872	806	736	665
CFM (L/s) Air Delivery/RPM/Watts—460 Volts															
A03C	Low	Low	80,000 (23.45)	1050/1350	10×10 1/2 HP (373) 3 Speed Motor	Low	CFM	1400 (661)	1375 (649)	1360 (642)	1335 (630)	1305 (616)	1255 (592)	1210 (571)	1100 (519)
							Watts	470	460	455	450	440	435	425	410
		Med	120,000 (35.17)			Med	CFM	1685 (795)	1620 (765)	1580 (746)	1550 (732)	1500 (708)	1430 (675)	1350 (637)	1230 (580)
							Watts	635	600	580	570	550	535	505	475
						High	CFM	1870 (883)	1830 (864)	1790 (845)	1730 (816)	1660 (783)	1580 (746)	1500 (708)	1375 (649)
							Watts	780	760	740	700	660	635	600	555
A04C	High			1400/1800	10×10 1/2 HP (373) 3 Speed Motor	Low	CFM	1400 (661)	1375 (649)	1360 (642)	1335 (630)	1305 (616)	1255 (592)	1210 (571)	1100 (519)
							Watts	470	460	455	450	440	435	425	410
		Med	100,000 (29.31)			Med	CFM	685 (795)	1620 (765)	1580 (746)	1550 (732)	1500 (708)	1430 (675)	1350 (637)	1230 (580)
							Watts	635	600	580	570	550	535	505	475
		High	135,000 (39.56)			High	CFM	1870 (883)	1830 (864)	1790 (845)	1730 (816)	1660 (783)	1580 (746)	1500 (708)	1375 (649)
							Watts	780	760	740	700	660	635	600	555

( ) Designates Metric Conversions

Table 24: Airflow Performance—MPS A03C, 208V, 230V, 460V

Airflow Performance – 3 Ton [10.55 Kw] Three Phase Belt Drive

Air Flow CFM [L/s]	Capacity 3 Ton [10.55 kW] / Voltage 208/230/460/575, 3-Phase / External Static Pressure - Inches of Water [kPa]																											
	0.1 [.02]		0.2 [.05]		0.3 [.07]		0.4 [.10]		0.5 [.12]		0.6 [.15]		0.7 [.17]		0.8 [.20]		0.9 [.22]		1.0 [.25]		1.1 [.27]		1.2 [.30]		1.3 [.32]		1.4 [.35]		1.5 [.37]	
	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W
900 [425]	—	—	—	—	699	223	765	261	827	292	886	318	941	338	993	352	1042	360	1087	362	1129	358	1168	348	1203	332	1235	310	1264	282
1000 [472]	—	—	662	228	717	258	781	293	842	323	899	346	952	364	1002	376	1049	381	1093	381	1133	374	1170	362	1203	344	1233	320	1260	289
1100 [519]	—	—	667	275	737	295	798	328	857	355	912	377	964	392	1012	401	1057	404	1099	402	1137	393	1172	378	1204	358	1232	331	1257	298
1200 [566]	643	278	693	298	756	334	817	365	873	390	927	409	976	422	1023	428	1066	429	1106	424	1143	413	1176	396	1205	373	1232	344	1255	309
1300 [614]	661	316	716	341	777	376	835	404	890	426	942	443	990	453	1035	458	1076	456	1114	449	1149	435	1180	416	1208	391	1232	359	1254	322
1400 [661]	669	352	739	387	799	419	855	445	908	465	958	479	1004	487	1047	489	1087	485	1123	475	1156	460	1185	438	1211	410	1234	377	1253	337
1500 [708]	702	399	763	434	821	464	876	487	927	505	975	517	1019	523	1060	522	1098	516	1132	504	1163	486	1191	462	1215	432	1236	396	1254	354

NOTE: L-DRIVE left of bold line, M-DRIVE right of bold line

Drive Package	L						M					
Motor H.P. [W]	1/2 [373]						1/2 [373]					
Blower Sheave	6.9" Pitch Diameter						6.4" Pitch Diameter					
Motor Sheave	2.4" – 3.4" Pitch Diameter						3.4" – 4.4" Pitch Diameter					
Turns Open	0	1	**2**	3	4	5	0	1	2	**3**	4	5
RPM	910	869	**818**	775	728	682	1176	1145	1108	**1060**	996	968

Component Air Resistance

Component	Standard Indoor Airflow – CFM [L/s]					
	1000 [472]	1200 [566]	1400 [661]	1600 [755]	1800 [850]	2000 [944]
	Resistance – Inches Water [kPa]					
Wet Coil	0.035	0.040	0.060	0.070	0.085	0.100
Downflow	0.055	0.060	0.066	0.072	0.080	0.086
R.S.I. Economizer	0.05	0.06	0.07	0.08	0.09	0.10
R.A. Damper						

NOTES:
1. Performance shown with dry coil & standard 2" [50.8 mm] filters.
2. Standard CFM @ .075 ibs./cu.ft.
3. Motor efficiency = 80%
4. BHP = Watts × Motor Efficiency/746.
5. Add component resistance to duct static to determine E.S.P as shown on charts

[ ] Designates Metric Conversions

Table 25: Airflow Performance—MPS A04C, 208V, 230V, 460V

Airflow Performance – 4 Ton [14.07 Kw] Three Phase Belt Drive

Air Flow CFM [L/s]	Capacity 4 Ton [14.07 kW] Voltage 208/230/460/575, 3-Phase External Static Pressure - Inches of Water [kPa]																											
	0.1 [.02]		0.2 [.05]		0.3 [.07]		0.4 [.10]		0.5 [.12]		0.6 [.15]		0.7 [.17]		0.8 [.20]		0.9 [.22]		1.0 [.25]		1.1 [.27]		1.2 [.30]		1.3 [.32]		1.4 [.35]		1.5 [.37]	
	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W
1200 [566]	—	—	—	—	—	—	817	425	879	440	940	456	999	475	1057	496	1113	519	1168	545	1221	572	1272	602	1322	634	1371	669	1420	704
1300 [614]	—	—	—	—	—	—	838	437	899	457	958	479	1015	503	1071	529	1126	558	1178	589	1230	622	1279	657	1327	695	1374	734	1421	773
1400 [661]	—	—	—	—	806	418	861	457	919	482	976	510	1032	539	1086	571	1138	605	1189	641	1239	680	1286	720	1333	763	1377	808	1421	853
1500 [708]	—	—	—	—	825	458	883	486	940	517	995	549	1048	584	1101	622	1151	661	1200	703	1248	746	1294	792	1338	841	1382	890	1426	939
1600 [755]	—	—	798	449	849	490	905	523	960	559	1013	598	1065	638	1115	681	1164	725	1211	772	1257	821	1301	873	1343	926	1385	979	1427	1032
1700 [802]	—	—	817	493	873	530	928	569	981	611	1032	654	1082	700	1130	748	1177	798	1222	851	1266	905	1308	962	1349	1021	1390	1080	1431	1139
1800 [850]	791	490	844	537	898	579	950	624	1002	670	1051	719	1099	771	1146	824	1190	880	1234	937	1276	997	1316	1059	1355	1124	1394	1189	—	—
1900 [897]	816	543	870	589	923	637	973	687	1023	739	1070	793	1116	850	1161	908	1204	969	1245	1033	1285	1098	1324	1166	1361	1235	1398	1304	—	—
2000 [944]	845	599	897	650	947	703	996	758	1044	816	1089	875	1134	937	1176	1002	1217	1068	1257	1137	1295	1207	1332	1280	1367	1355	—	—	—	—

NOTE: L-DRIVE left of bold line, M-DRIVE right of bold line

Drive Package	L						M					
Motor H.P. [W]	1/2 [373]						3/4 [559]					
Blower Sheave	6.9" Pitch Diameter						6.4" Pitch Diameter					
Motor Sheave	2.8" – 3.8" Pitch Diameter						3.4" – 4.4" Pitch Diameter					
Turns Open	0	1	**2**	3	4	5	0	1	2	**3**	4	5
RPM	1029	984	**950**	915	855	816	1281	1207	1174	**1141**	1111	1071

Component Air Resistance

Component	Standard Indoor Airflow – CFM [L/s]					
	1000 [472]	1200 [566]	1400 [661]	1600 [755]	1800 [850]	2000 [944]
	Resistance – Inches Water [kPa]					
Wet Coil	0.035	0.040	0.060	0.070	0.085	0.100
Downflow	0.055	0.060	0.066	0.072	0.080	0.086
R.S.I. Economizer	0.05	0.06	0.07	0.08	0.09	0.10

NOTES:
1. Performance shown with dry coil & standard 2" [50.8 mm] filters.
2. Standard CFM @ .075 ibs./cu.ft.
3. Motor efficiency = 80%
4. BHP = Watts × Motor Efficiency/746.
5. Add component resistance to duct static to determine E.S.P as shown on charts

[ ] Designates Metric Conversions

Table 26: Airflow Performance—MPS A05C, 208V, 230V, 460V

Airflow Performance – 5 Ton [17.6 Kw] Three Phase Belt Drive

Air Flow CFM [L/s]	Capacity 5 Ton [17.6 kW] 14 SEER Voltage 208/230/460/575, 3-Phase External Static Pressure - Inches of Water [kPa]																											
	0.1 [.02]		0.2 [.05]		0.3 [.07]		0.4 [.10]		0.5 [.12]		0.6 [.15]		0.7 [.17]		0.8 [.20]		0.9 [.22]		1.0 [.25]		1.1 [.27]		1.2 [.30]		1.3 [.32]		1.4 [.35]		1.5 [.37]	
	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W	RPM	W
1400 [661]	—	—	—	—	—	—	784	466	835	497	886	533	935	574	983	621	1030	674	1077	732	1122	795	1166	864	1209	939	1251	1019	1292	1104
1500 [708]	—	—	—	—	—	—	800	484	850	519	899	558	947	604	994	655	1040	711	1085	773	1129	841	1172	914	1214	992	1255	1076	1295	1166
1600 [755]	—	—	—	—	766	478	816	511	865	549	913	593	960	643	1006	698	1051	758	1095	824	1137	895	1179	972	1220	1055	1260	1143	1300	1231
1700 [802]	—	—	—	—	785	509	833	546	881	589	928	637	974	690	1018	749	1062	813	1105	883	1146	959	1187	1040	1227	1126	1265	1218	1303	1310
1800 [850]	—	—	755	505	804	550	851	591	898	637	943	689	988	747	1031	810	1074	878	1115	952	1156	1031	1195	1116	1234	1207	1271	1302	1308	1397
1900 [897]	716	491	776	560	823	600	869	645	915	695	959	751	1003	812	1045	879	1086	951	1127	1029	1166	1113	1204	1202	1242	1296	1278	1396	1314	1496
2000 [944]	745	562	797	615	843	658	889	707	933	762	976	821	1018	887	1059	958	1099	1034	1139	1116	1177	1203	1214	1296	1250	1394	1285	1498	1320	1602
2100 [991]	773	637	819	679	864	726	908	779	951	837	993	901	1034	970	1074	1045	1113	1125	1151	1211	1188	1303	1224	1399	1259	1502	1293	1609	—	—
2200 [1038]	797	706	842	751	886	803	929	860	971	922	1011	990	1051	1063	1090	1142	1128	1226	1165	1316	1200	1411	1235	1512	1269	1618	—	—	—	—
2300 [1085]	822	783	865	833	908	888	950	949	990	1015	1030	1087	1069	1164	1106	1247	1143	1335	1179	1429	1213	1528	1247	1633	1279	1743	—	—	—	—
2400 [1133]	847	870	889	924	931	983	971	1048	1011	1118	1049	1194	1087	1275	1123	1362	1159	1454	1193	1551	1227	1655	1259	1763	1291	1878	—	—	—	—
2500 [1179]	873	966	914	1023	954	1087	994	1155	1032	1229	1069	1309	1106	1394	1141	1485	1175	1581	1209	1683	1241	1790	1272	1903	—	—	—	—	—	—

NOTE: L-DRIVE left of bold line, M-DRIVE right of bold line

Drive Package	L						M					
Motor H.P. [W]	3/4 [559]						1 [746]					
Blower Sheave	6.9" Pitch Diameter						6.9" Pitch Diameter					
Motor Sheave	2.8" – 3.8" Pitch Diameter						4.0" – 5.0" Pitch Diameter					
Turns Open	0	1	**2**	3	4	5	0	1	2	**3**	4	5
RPM	967	936	**900**	855	816	769	1248	1203	1163	**1123**	1078	1042

Component Air Resistance

Component	Standard Indoor Airflow – CFM [L/s]					
	1600 [755]	1800 [850]	2000 [944]	2200 [1038]	2400 [1133]	2600 [1227]
	Resistance – Inches Water [kPa]					
Wet Coil	0.070	0.085	0.100	0.110	0.120	0.125
Downflow	0.072	0.080	0.086	0.093	0.100	0.107
R.S.I. Economizer	0.08	0.09	0.10	0.11	0.12	0.13
R.A. Damper						

NOTES:
1. Performance shown with dry coil & standard 2" [50.8 mm] filters.
2. Standard CFM @ .075 ibs./cu.ft.
3. Motor efficiency = 80%
4. BHP = Watts × Motor Efficiency/746.
5. Add component resistance to duct static to determine E.S.P as shown on charts

[ ] Designates Metric Conversions

Table 27: Accessory Weights

Accessory	Daikin Part Number	Shipping Weight lbs (kg)	Operating Weight lbs (kg)
Economizer, Analog Controls, 3–5 ton, Vert/Horiz	MXRD-01RECAM3	70 (32)	60 (27)
Economizer, DDC Controls, 3–5 ton, Vert/Horiz	MXRD-01RKCCM3	70 (32)	60 (27)
OA damper, 3–5 ton, Manual	MXRF-FGA1	11 (5)	9 (4)
OA damper, Analog Controls, 3–5 ton, Motorized	MXRF-FGB1	13 (6)	11 (5)
Power Exhaust Kit, 3–5 Ton 208/230V	MXRX-BGF06C	70 (32)	60 (27)
Power Exhaust Kit, 3–5 Ton 460V	MXRX-BGF06D	70 (32)	60 (27)
14" Roof Curb, 3–5 Ton	RXKG-CBH14	92 (42)	88 (40)
Receptacle Outlet	RXRX-AN01	N/A	N/A
Thermostat Guard	113130101	N/A	N/A
7-Day Programmable Stat	113129901	N/A	N/A
Ionization Smoke Detector	113126601	N/A	N/A
CO_2 Sensor	RXRX-AR02	N/A	N/A
Dual Enthalpy Kit	RXRX-AV02	N/A	N/A

Economizers

Economizers: 3–5 Tons [10.6–17.6 kW]

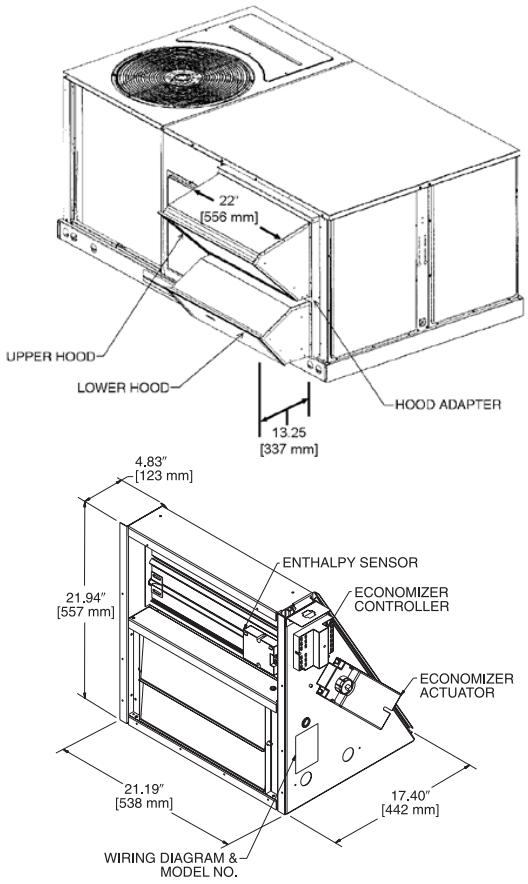
3-5 Ton [10.6-17.6 kW] Models Single Enthalpy with Barometric Relief

Dual Enthalpy Kit 3-5 Ton [1 0.6-1 7.6 kW] Models

3-5 Ton [1 0.6-1 7.6 kW] Models Optional CO_2 Sensor

- Features economizer controller
- Pre-configured—no field adjustments necessary
- Available factory installed or field accessory
- Standard barometric relief damper provided
- Gear driven direct drive actuator
- Single enthalpy with dual enthalpy upgrade kit
- Fully modulating (0-100%)
- CO_2 input sensor available (field installed)
- Low leakage dampers
- Economizer slips in complete for downflow or horizontal duct application
- Horizontal or downflow applications
- Field assembled hood ships with economizer
- Slip-in design for easy installations
- Field installed power exhaust available
- Plug-in polarized electrical connections

Figure 33: Economizer: MPS A03C – A05C

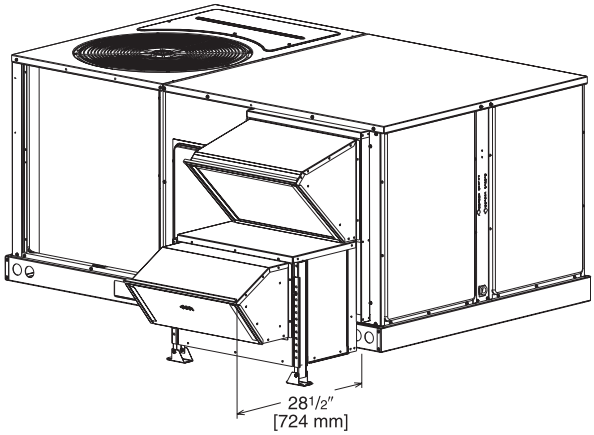


Fresh Air Dampers and Power Exhaust

Integral Power Exhaust For Economizer: 3–5 Tons [10.6–17.6 Kw] (Field Installed Only)

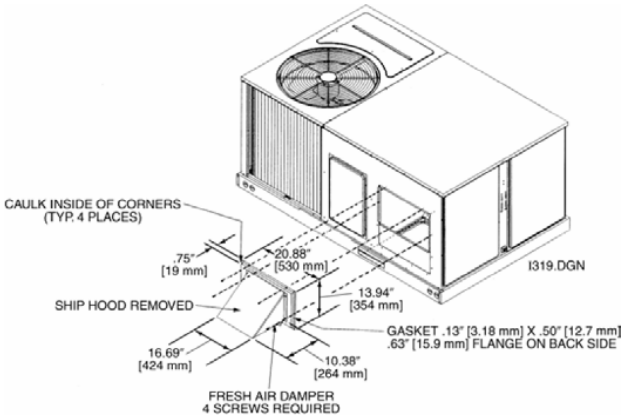
- For economizer controller
- Downflow or horizontal applications
- Requires separate power supply with disconnect
- Adjustable switch on economizer, factory preset to energize power exhaust at 95% outside air position
- Polarized plug connects power exhaust relay to economizer

Figure 34: Integral Power Exhaust Economizer: MPS A03C – A05C



Fresh Air Damper Kit for 3–5 Ton Units [10.6–17.6 Kw]

Figure 35: Damper Kit: MPS A03C – A05C

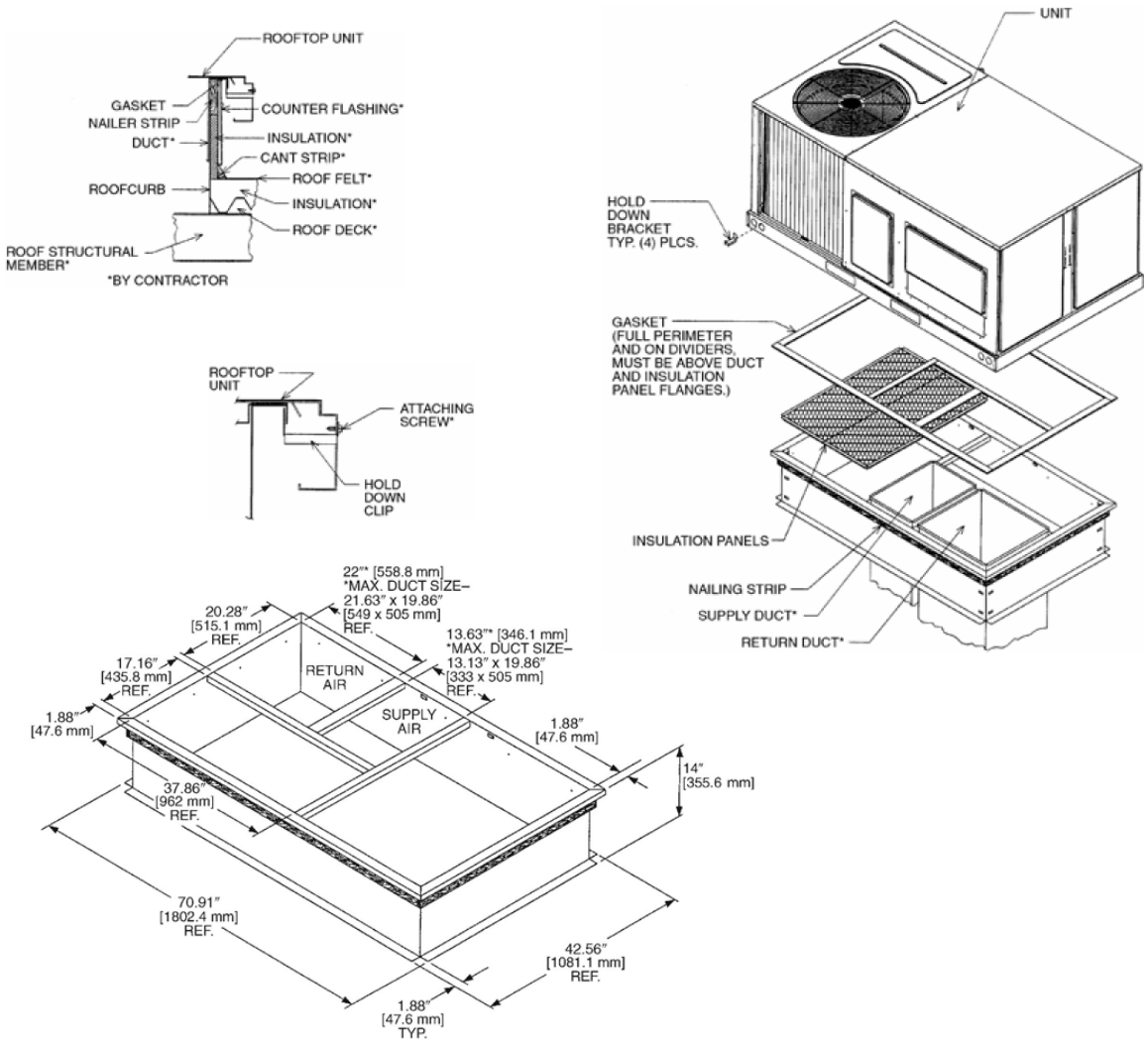


Roof Curbs

Roof Curbs (Full Perimeter): 3–5 Tons [10.6–17.6 kW]

- One available height (14" [356 mm]) for all models.
- 2" [51 mm] × 4" [102 mm] nailer provided
- Quick assembly corners for easy installation
- Insulating panels provided
- Opening provided in bottom pan to match the "Thru-the-Curb" electrical connection opening provided on the unit
- Sealing gasket (28" [711 mm]) provided with roof curb
- 18 gauge galvanized steel base pan

Figure 36: Typical Roof Curb Installation: MPS A03C – A05C



Furnace Section Controls and Ignition System

Normal Furnace Operating Sequence

This unit is equipped with an integrated direct spark ignition control.

1. The thermostat calls for heat.
2. The control board will run a self check to verify that the limit control and manual reset overtemperature control are closed and that the pressure switch is open.
3. Upon closure of the pressure switch, the control board energizes the induced draft blower for a 15 second prepurge.
4. After the 15 second prepurge, the gas valve opens and the spark is initiated for a seven second trial for ignition.
5. Burners ignite and flame sensor proves all burners have lit.
6. The circulating air blower is energized after 30 seconds.
7. The control board enters a normal operation loop in which all safety controls are monitored continuously.
8. Thermostat is satisfied and opens.
9. The gas valve is de-energized and closes, shutting down the burner flame.
10. The control board will de-energize the inducer after a five second post purge.
11. The circulating air blower is de-energized after 90 seconds.

The integrated control is a three ignition system.

After a total of three cycles without sensing main burner flame, the system goes into a 100% lockout mode. After one hour, the ignition control repeats the prepurge and ignition cycles for three tries and then goes into 100% lockout mode again. It continues this sequence of cycles and lockout each hour until ignition is successful or power is interrupted. During the lockout mode, neither the ignitor or gas valve will be energized until the system is reset by turning the thermostat to the “OFF” position or interrupting the electrical power to the unit for three seconds or longer. The induced draft blower and main burner will shut off when the thermostat is satisfied.

The circulating air blower will start and run on the heating speed if the thermostat fan switch is in the “ON” position.

The integrated furnace control is equipped with diagnostic LED. The LED is lit continuously when there is power to the control, with or without a call for heat. If the LED is not lit, there is either no power to the control or there is an internal component failure within the control, and the control should be replaced.

If the control detects the following failures, the LED will flash on for approximately 1/4 second, then off for 3/4 second for designated failure detections:

1. Flash: Failed to detect flame within the three tries for ignition.
2. Flash: Pressure switch or induced draft blower problem detected.
3. Flash: High limit or auxiliary limit open.
4. Flash: Flame sensed and gas valve not energized or flame sensed with no “W” signal.
5. Flash: Overtemperature switch open.

Operating Instructions

⚠ DANGER

Never test for gas leaks with an open flame. It can cause an explosion or fire resulting in property damage, personal injury or death. Use a commercially available soap solution made specifically for the detection of leaks to check all connections, as specified in the "Mechanical Installation" section of these instructions.

⚠ DANGER

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

This unit is equipped with integrated furnace control. This device lights the main burners each time the room thermostat (closes) calls for heat. See operating instructions on the back of the furnace/controls access panel.

To Start The Furnace

⚠ DANGER

The spark ignitor and ignition lead from the ignition control are high voltage. Keep hands or tools away to prevent electrical shock. Shut off electrical power before servicing any of the controls. Failure to adhere to this warning can result in personal injury or death.

1. STOP! Read the safety information on the Operating Instructions label located on this unit.
2. Set the thermostat to its lowest setting.
3. Turn OFF all electric power to the unit.
4. This unit does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do NOT try to light the burner by hand.
5. Remove control door/access panel.
6. Move switch to the "OFF" position.
7. Wait five minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP!
   - Do not try to light any unit.
   - Do not touch any electric switch; do not use any phone in your building.
   - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
   - If you cannot reach your gas supplier, call the fire department.

If you don't smell gas, go to the next step.

8. Move "OFF" position to "ON" position.
9. Replace the control door.
10. Turn ON all electric power to the unit.
11. Set the thermostat to the desired setting.
12. If the unit will not operate, follow the instructions below on how to shut down the furnace.

The initial start-up on a new installation may require the control system to be energized for some time until air has bled through the system and fuel gas is available at the burners.

To Shut Down Furnace

⚠ DANGER

Should overheating occur or the gas supply fail to shut off, shut off the manual gas valve to the unit before shutting off the electrical supply. Failure to do so can result in an explosion or fire causing property damage, severe personal injury

1. Set the thermostat to the lowest setting.
2. Turn OFF all electric power to the unit if service is to be performed.
3. Remove control door.
4. Move switch to the "OFF" position.
5. Replace control door.

Burners

Burners for these units have been designed so that field adjustment is not required. Burners are tray-mounted and accessible for easy cleaning when required.

Manual Reset Overtemperature Control

⚠ DANGER

Do not jumper this device! Do not reset the overtemperature control without taking corrective action to assure that an adequate supply of combustion air is maintained under all conditions of operation. Failure to do so can result in carbon monoxide poisoning or death. Replace this control only with the identical replacement part.

Two manual reset overtemperature controls (one on 80,000 Btuh) are located on the burner shield. These devices sense blockage in the heat exchanger or insufficient combustion air. This shuts off the main burners if excessive temperatures occur in the burner compartment.

Operation of this control indicates an abnormal condition. Therefore, the unit should be examined by a qualified installer, service agency, or the gas supplier before being placed back into operation.

Pressure Switch

This furnace has a pressure switch for sensing a blocked exhaust or a failed induced draft blower. It is normally open and closes when the induced draft blower starts, indicating air flow through the combustion chamber.

Limit Control

⚠ DANGER

Do not jumper this device! Doing so can cause a fire or explosion resulting in property damage, personal injury or death.

The supply air high temperature limit cut-off is set at the factory and cannot be adjusted. It is calibrated to prevent the air temperature leaving the furnace from exceeding the maximum outlet air temperature.

Important: Replace this control only with the identical replacement part.

Dehumidification Control

With the factory installed reheat option, in addition to a thermostat or space temperature sensor that is normally present, an indoor relative humidity sensor is installed in the occupied space and connected to the Rooftop Unit DDC Controller which (see illustration) then controls the capacity of the cooling coil to remove moisture from the supply air and maintain space relative humidity below an adjustable limit. The default value is the ASHRAE recommended limit of 60% RH.

With this option, a refrigerant reheat coil is installed downstream from the evaporator coil. When the space humidity is too high and reheat is energized, this coil uses some of the heat that is normally rejected to the outside by the condenser coil to instead reheat the cold air from the evaporator coil just enough to avoid overcooling the space. Providing “neutral air” to the occupied space extends the run-time of the unit to provide better dehumidification than an air conditioner without this option.

Because the demand for dehumidification can be different from the cooling demand, the unit will first satisfy the demand for cooling and then if the space humidity is still too high, reheat mode is energized. When in reheat mode, the supply air leaving the unit will be near the entering air temperature, but at a much lower humidity. The unit will exit the reheat mode when the humidity setpoint is satisfied; or if the load is increased, it will return to normal cooling mode. Reheat is not available during the gas heating mode. For two-stage units with independent refrigerant circuits, reheat is only available on the first stage.

Figure 37 shows the refrigerant path during the normal cooling mode. The liquid refrigerant leaves the TXV with the sudden pressure drop causing the liquid to expand to a vapor and absorbing the heat from the supply air going through the evaporator coil. The refrigerant vapor then travels to the compressor where it is elevated to a higher pressure and temperature. The superheated refrigerant vapor is then rejected and the refrigerant condenses into a subcooled liquid where the process repeats itself.

Figure 37: Refrigerant Path – Normal Cooling

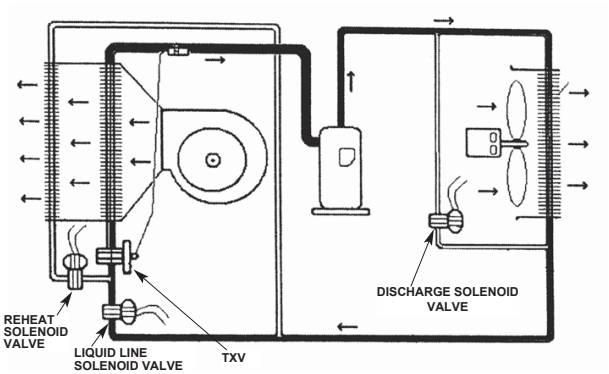
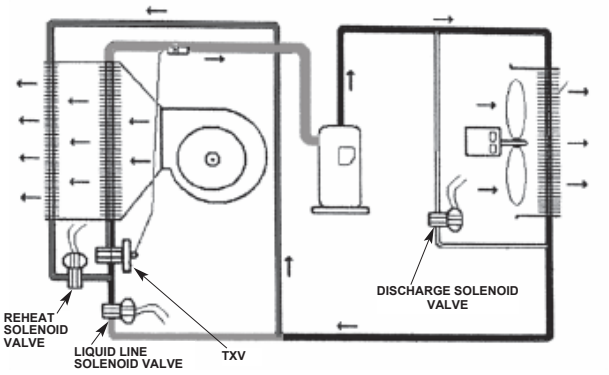


Figure 38 shows the refrigerant path during the reheat mode. When the reheat cycle is energized, a solenoid valve downstream of the reheat coil opens, a solenoid valve ahead of the TXV closes, and a solenoid valve in the compressor discharge line opens. The liquid refrigerant leaves the TXV with the sudden pressure drop causing the liquid to expand to a vapor and absorbing the heat from the supply air going through the evaporator coil. The refrigerant vapor then travels to the compressor where it is elevated to a higher pressure and temperature. The refrigerant next carries the heat to a parallel path between the outside condenser coil and a bypass circuit. Some of the heat is rejected outdoors. The ratio of heat rejected outdoors versus indoors is controlled by a variable frequency drive (OFMC) on the outdoor fan that monitors the liquid line temperature of the outdoor coil. This 2-phase refrigerant vapor is then sent to the reheat coil. As the refrigerant travels through the reheat coil it condenses into a subcooled liquid where the process repeats itself.

Figure 38: Refrigerant Path – Reheat Mode



During reheat mode the outdoor fan motor controller (OFMC) slows the outdoor fan(s) to increase the discharge pressure/ temperature to maintain an optimized amount of reheat required to provide neutral air to the occupied space. The factory setting for the outdoor fan motor controller is 90°F which will provide neutral air +1 to -5°F from the entering air temperature (example if the entering or return air temperature is 75°F the leaving or supply air temperature will be 76° to 70°F during the reheat mode. If field adjustment is required to raise or lower the leaving air temperature this may be accomplished by turning the temperature control dial on the outdoor fan motor controller (OFMC). Turning the dial to a higher temperature setting will raise the leaving or supply air temperature and turning the dial to a lower setting will reduce the leaving or supply temperature.

Figure 39: Dehumidification Controller

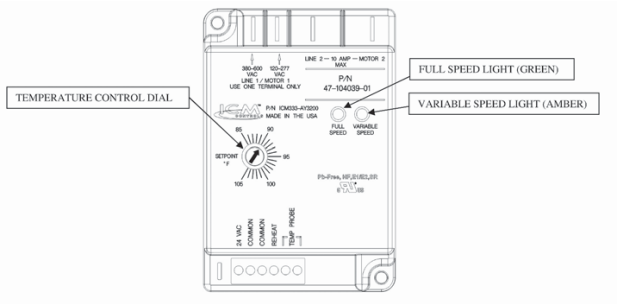
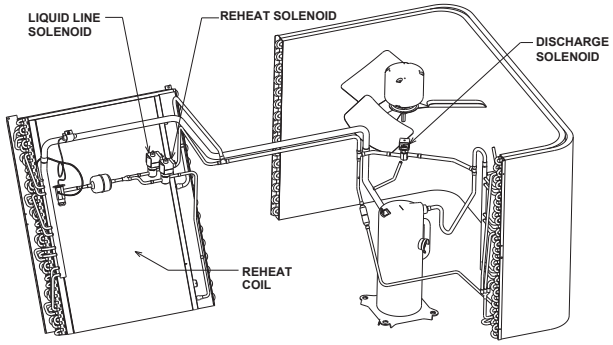


Figure 40: Solenoid Locations



General

Advise The Customer

1. Change the air filters regularly. The heating system operates better, more efficiently and more economically.
2. Except for the mounting platform, keep all combustible articles three feet from the unit and exhaust system.
3. **Important:** Replace all blower doors and compartment cover after servicing the unit. Do not operate the unit without all panels and doors securely in place.
4. Do not allow snow or other debris to accumulate in the vicinity of the unit.

Unit Maintenance

Furnace Section

⚠ DANGER

Power supply to unit must be disconnected before making field connections. To avoid electrical shock, personal injury or death, be sure to rigorously adhere to field wiring procedures regarding proper lockout and tagout of components.

⚠ DANGER

Holes in the exhaust transition or heat exchanger can cause toxic fumes to enter the building. The exhaust transition or heat exchanger must be replaced if they have holes or cracks in them. Failure to do so can cause carbon monoxide poisoning resulting in personal injury or death.

⚠ DANGER

Power supply to unit must be disconnected before making field connections. To avoid electrical shock, personal injury or death, be sure to rigorously adhere to field wiring procedures regarding proper lockout and tagout of components.

The unit's furnace should operate for many years without excessive scale build-up in flue passageways; however, it is recommended that a qualified installer, service agency, or the gas supplier annually inspect the flue passageways, the exhaust system and the burners for continued safe operation, paying particular attention to deterioration from corrosion or other sources.

If during inspection the flue passageways and exhaust system are determined to require cleaning, the following procedures should be followed (by a qualified installer, service agency, or gas supplier):

1. Turn OFF the electrical power to the unit and set the thermostat to the lowest temperature.
2. Shut OFF the gas supply to the unit either at the meter or at manual valve in the supply piping.
3. Remove the furnace controls access panel and the control box cover. Disconnect the gas supply piping from the gas valve.
4. Disconnect the gas supply piping from the gas valve.
5. Disconnect the wiring to the induced draft blower motor, gas valve, flame sensor, and flame roll-out control, and ignitor cable. Mark all wires disconnected for proper reconnection.
6. Remove the screws (4) connecting the burner tray to the heat exchanger mounting panel.
7. Remove the burner tray and the manifold assembly from the unit.
8. Remove the screws (5) connecting the induced draft blower to the collector box and screws (18) connecting the collector box to the heat exchanger center panel. Remove the induced draft blower and the collector box from the unit.
9. Remove the screws (3) connecting the divider plate to the heat exchanger center panel.
10. Remove the turbulators from inside the heat exchangers by inserting the blade of a screwdriver under the locking tabs. Pop the tabs out of the expanded grooves of the heat exchanger. Slide the turbulators out of the heat exchangers.
11. Direct a water hose into the outlet of the heat exchanger top. Flush the inside of each heat exchanger tube with water. Blow out each tube with air to remove excessive moisture.
12. Reassemble (steps 1 through 10 in reverse order). Be careful not to strip out the screw holes used to mount the collector box and inducer blower. Replace inducer blower gasket and collector box gasket with factory replacements if damaged.

The manufacturer recommends that a qualified installer, service agency or the gas supplier visually inspect the burner flames for the desired flame appearance at the beginning of the heating season and approximately midway in heating season.

The manufacturer also recommends that a qualified installer, service agency or the gas supplier clean the flame sensor with steel wool at the beginning of the heating season.

Lubrication

The blower motor and induced draft blower motor are prelubricated by the manufacturer and do not require further attention.

A qualified installer, service agency or the gas supplier must periodically clean the motors to prevent the possibility of overheating due to an accumulation of dust and dirt on the windings or on the motor exterior. And, as suggested elsewhere in these instructions, the air filters should be kept clean because dirty filters can restrict air flow and the motor depends upon sufficient air flowing across and through it to prevent overheating.

Cooling Section

⚠ DANGER

Power supply to unit must be disconnected before making field connections. To avoid electrical shock, personal injury or death, be sure to rigorously adhere to field wiring procedures regarding proper lockout and tagout of components.

It is recommended that at the beginning of each cooling season a qualified installer or service agency inspect and clean the cooling section of this unit. The following areas should be addressed: evaporator coil. condenser coil, condenser fan motor and venturi area.

To Inspect the Evaporator Coil

⚠ DANGER

Label all wires prior to disconnection when servicing the unit. Wiring errors can cause improper and dangerous operation resulting in fire, electrical shock, property damage, severe personal injury or death.

1. Remove the filter access panel and the blower/ evaporator coil access panel. Remove the filters.
2. Shine a flashlight on the evaporator coil (both sides) and inspect for accumulation of lint, insulation, etc.
3. If coil requires cleaning, follow the steps shown below.

Cleaning Evaporator Coil

1. The coil should be cleaned when it is dry. If the coil is coated with dirt or lint, vacuum it with a soft brush attachment. Be careful not to bend the coil fins.
2. If the coil is coated with oil or grease, clean it with a mild detergent-and-water solution. Rinse the coil thoroughly with water. **Important: Do not** use excessive water pressure. Excessive water pressure can bend the fins and tubing of the coil and lead to inadequate unit performance. Be careful not to splash water excessively into unit.
3. Inspect the drain pan and condensate drain at the same time the evaporator coil is checked. Clean the drain pan by flushing with water and removing any matters of obstructions which may be present.
4. Go to next section for cleaning the condenser coil.

Cleaning Condenser Coil, Condenser Fan, Circulation Air Blower and Venturi

1. Remove the compressor access panel. Disconnect the wires to the condenser fan motor in the control box (see wiring diagram). Remove the wires from the opening in the bottom of the control box.
2. Remove the screws securing the condenser top panel and remove the panel with condenser fan motor and grille attached.
3. The coil should be cleaned when it is dry. If the coil is coated with dirt or lint, vacuum it with a soft brush attachment. Be careful not to bend the coil fins.
4. If the coil is coated with oil or grease, clean it with a mild detergent-and-water solution. Rinse the coil thoroughly with water. **Important: Do not** use excessive water pressure. Excessive water pressure can bend the fins and tubing of the coil and lead to inadequate unit performance. Be careful not to splash water excessively into unit.
5. The venturi should also be inspected for items of obstruction such as collections of grass, dirt or spider webs. Remove any that are present.
6. Inspect the circulating air blower wheel and motor for accumulation of lint, dirt or other obstruction and clean it as necessary. Inspect the blower motor mounts and the blower housing for loose mounts or other damage. Repair or replace if necessary.

Re-Assembly

1. Place the condenser top panel back on the unit and replace all screws.
2. Run the fan motor wires through the hole in the bottom of the control box. Reconnect fan motor wires per the wiring diagram attached to the back of the cover.
3. Replace the filter and blower/evaporator coil access panels.
4. Replace the control box cover and controls access panel.
5. Restore electrical power to the unit and check for proper operation, especially the condenser fan motor.

System Charge Charts

Figure 41: System Charging Chart: MPS A03C Cooling

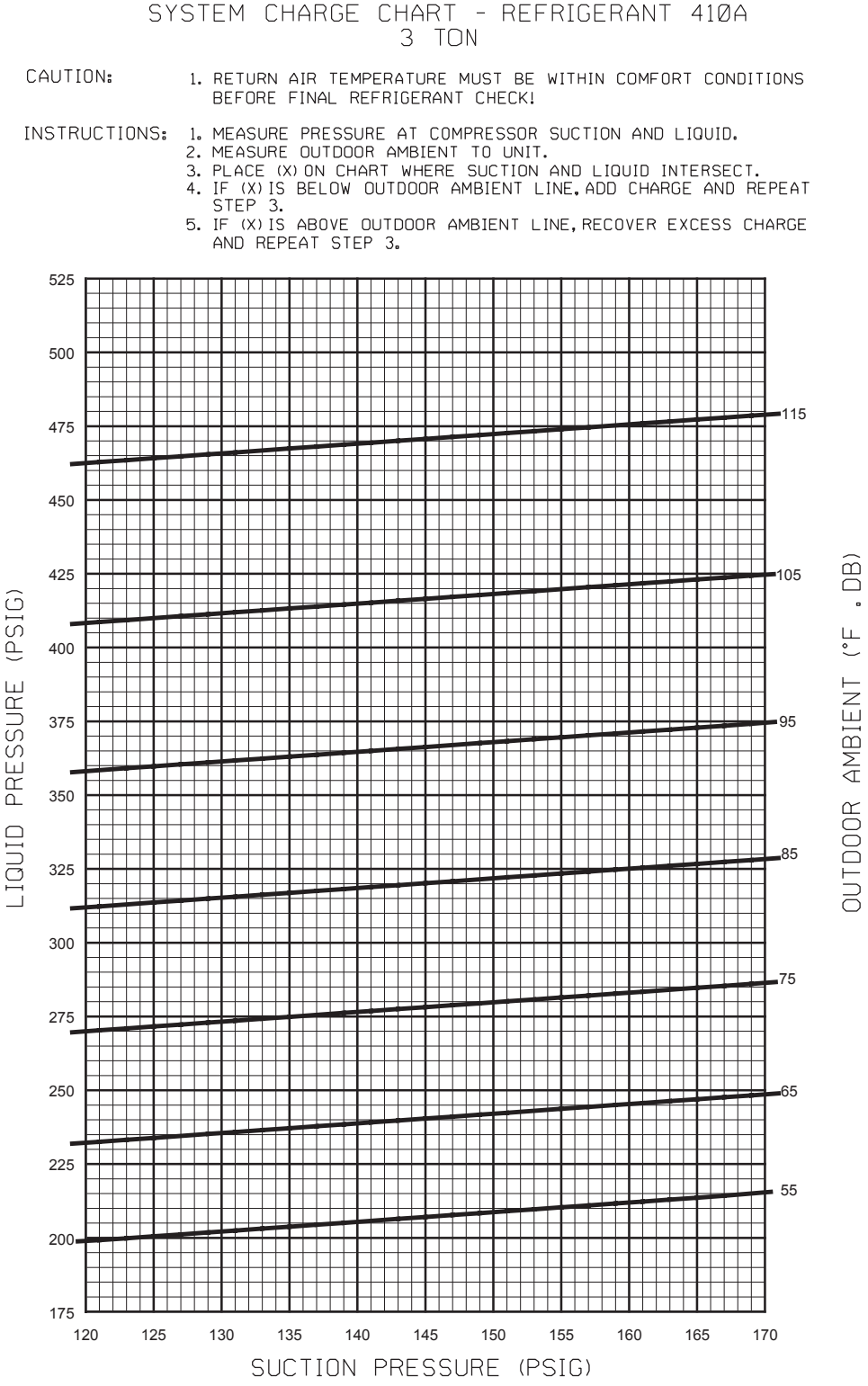


Figure 42: System Charge Chart: MPS A04C Cooling

SYSTEM CHARGE CHART - REFRIGERANT 410A
4 TON, 13 & 14 SEER

CAUTION:
1. RETURN AIR TEMPERATURE MUST BE WITHIN COMFORT CONDITIONS BEFORE FINAL REFRIGERANT CHECK!

INSTRUCTIONS:
1. MEASURE PRESSURE AT COMPRESSOR SUCTION AND LIQUID.
2. MEASURE OUTDOOR AMBIENT TO UNIT.
3. PLACE (X) ON CHART WHERE SUCTION AND LIQUID INTERSECT.
4. IF (X) IS BELOW OUTDOOR AMBIENT LINE, ADD CHARGE AND REPEAT STEP 3.
5. IF (X) IS ABOVE OUTDOOR AMBIENT LINE, RECOVER EXCESS CHARGE AND REPEAT STEP 3.

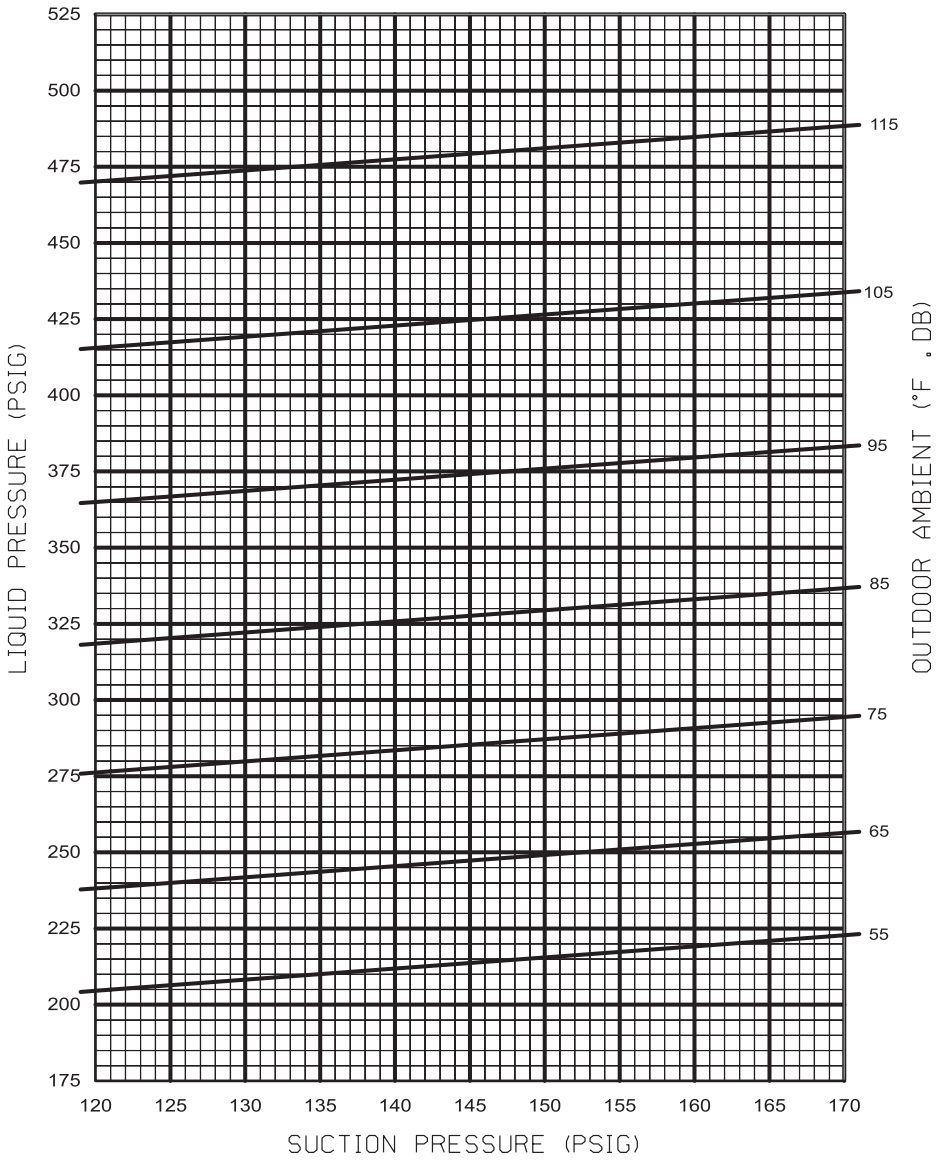
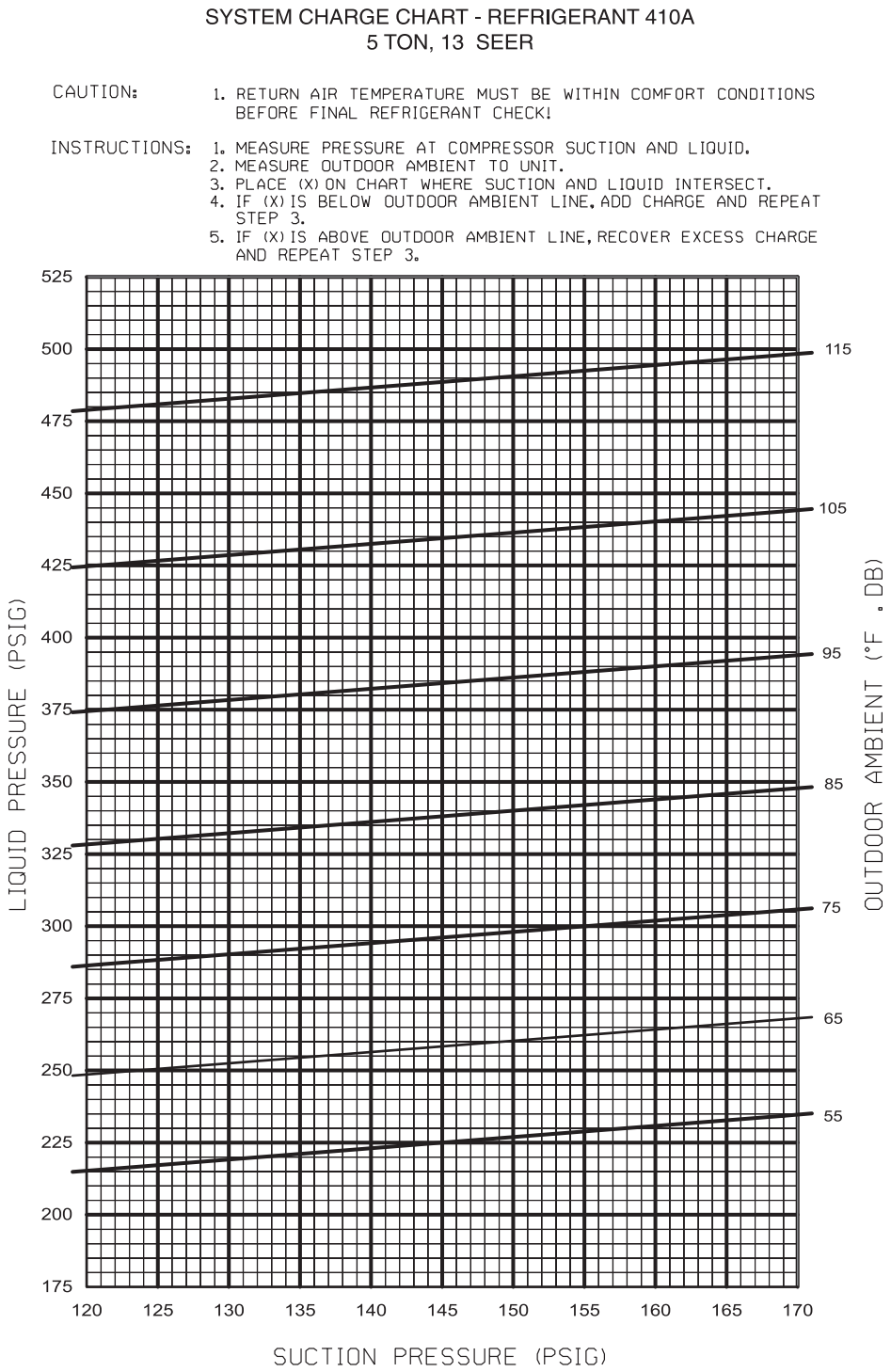


Figure 43: System Charge Chart: MPS A05C Cooling



Blower Motor Speed Taps

After determining necessary CFM and speed tap data from the Airflow Performance Data, follow the steps below to change speeds (see Figure 46 on page 54 for examples).

1. Remove the blower access panel.
2. Reference Figure 44 for location of the speed tap block on the blower.
3. Remove the furnace control access panel.
4. Remove the control box cover. See Figure 45 for location of the integrated furnace control board.
5. Reference Figure 44 and Figure 46 for the proper location of the red and black wires on the speed tap block and on the furnace integrated control board to obtain the speed tap you have chosen.
6. After adjusting the wires accordingly, attach the control box cover, furnace control access panel and the blower access panel to the unit.

Figure 44: Speed Tap Block

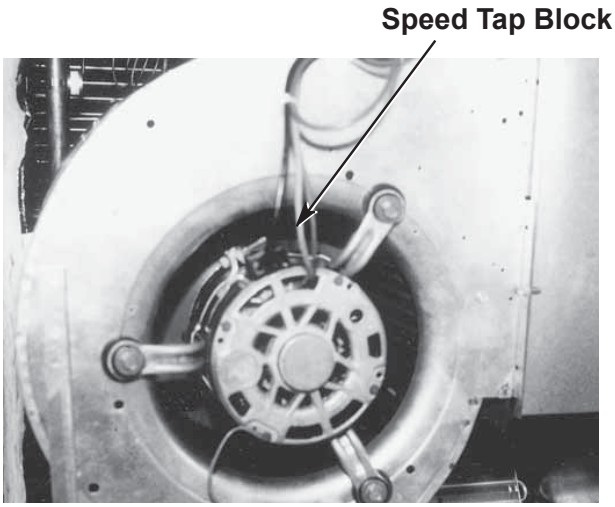


Figure 45: Integrated Furnace Control

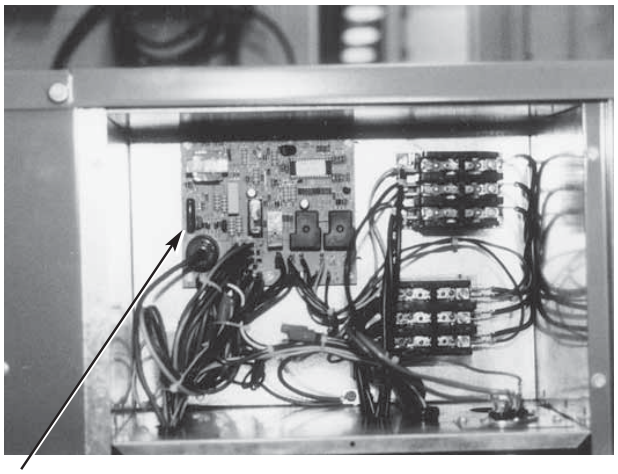
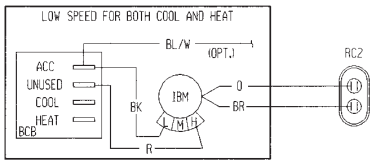
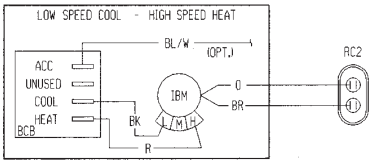


Figure 46: Speed Tap Examples

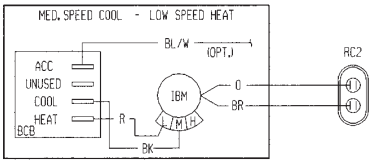
EXAMPLE 1



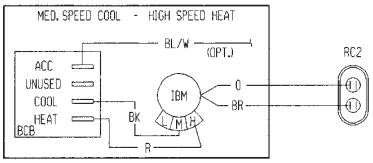
EXAMPLE 2



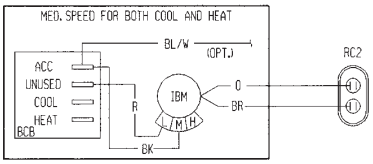
EXAMPLE 3



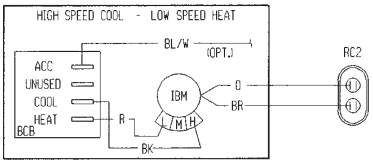
EXAMPLE 4



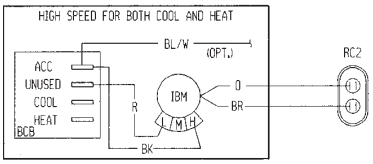
EXAMPLE 5



EXAMPLE 6



EXAMPLE 7



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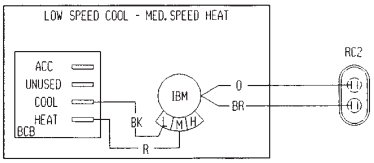

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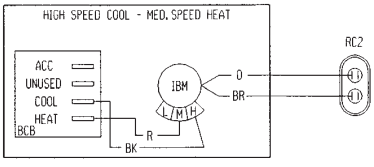

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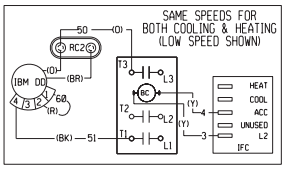

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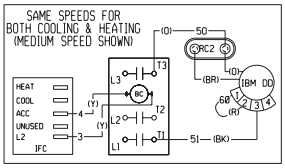

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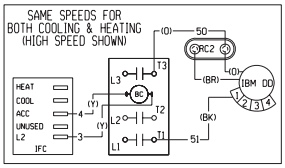

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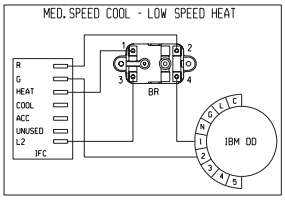

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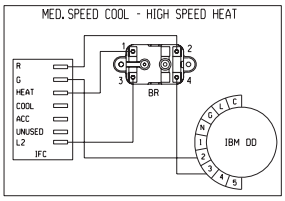


⚠ DANGER

Disconnect all power to unit before servicing. Contactor may break only one side. Failure to shut off power can cause electrical shock resulting in personal injury or death.

Table 28: Cooling Troubleshooting Chart

Symptom	Possible Cause	Remedy
Unit will not run	Power OFF or loose electrical connection	Check for correct voltage at compressor contactor in control box
	Thermostat out of calibration-set too high	Reset
	Failed contactor	Check for 24 volts at contactor coil replace if contacts are open
	Blown fuses/Transformer defective	Replace fuses.
	High pressure control open (if provided)	Check wiring-replace transformer – Reset-also see high head pressure remedy-The high pressure control opens at 450 PSIG
	Interconnecting low voltage wiring damaged	Replace thermostat wiring
Condenser fan runs, compressor doesn't	Loose connection	Check for correct voltage at compressor check & tighten all connections
	Compressor stuck, grounded or open motor winding, open internal overload.	Wait at least 2 hours for overload to reset. If still open, replace the compressor.
	Low voltage condition	At compressor terminals, voltage must be within 10% of rating plate volts when unit is operating
	Low voltage condition	Add start kit components
Insufficient cooling	Improperly sized unit	Recalculate load
	Improper airflow	Check should be approximately 400 CFM per ton.
	Incorrect refrigerant charge	Charge per procedure attached to unit service panel
	Air, non-condensable or moisture in system	Recover refrigerant, evacuate & recharge, add filter drier
	Incorrect voltage	At compressor terminals, voltage must be within 10% of rating plate volts when unit is operating.
Compressor short cycles	Incorrect voltage	At compressor terminals, voltage must be ±10% of nameplate marking when unit is operating.
	Defective overload protector	Replace check for correct voltage
	Refrigerant undercharge	Add refrigerant
Registers sweat	Low evaporator airflow	Increase speed of blower or reduce restriction replace air filter
High head-low vapor pressures	Restriction in liquid line, expansion device or filter drier	Remove or replace defective component
	Flow check piston size too small	Change to correct size piston
	Incorrect capillary tubes	Change coil assembly
High head-high or normal vapor pressure Cooling mode	Dirty condenser coil	Clean coil
	Refrigerant overcharge	Correct system charge
	Condenser fan not running	Repair or replace
	Air or non-condensable in system	Recover refrigerant, evacuate & recharge
Low vapor - cool compressor iced evaporator coil	Defective compressor valves	Replace compressor
	Incorrect capillary tubes	Replace coil assembly
Low vapor cool evaporator coil	Low evaporator airflow	Increase speed of blower or reduce restriction replace air filter
	Operating below 65°F outdoors	Add low ambient kit
	Moisture in system	Recover refrigerant evacuate & recharge add filter drier
High vapor pressure	Excessive load	Recheck load calculation
	Defective compressor Replace	
Fluctuating head & vapor	Air or non-condensate in system	Recover refrigerant, evacuate & recharge
Gurgle or pulsing noise at expansion device or liquid line	Air or non-condensable in system	Recover refrigerant, evacuate & recharge

Furnace Troubleshooting Guide

Figure 47: Furnace Troubleshooting Guide (Combination Heating and Cooling Units with Direct Spark Ignition)

⚠ WARNING

HAZARDOUS VOLTAGE
LINE VOLTAGE
CONNECTIONS

DISCONNECT POWER BEFORE SERVICING.
SERVICE MUST BE BY A TRAINED, QUALIFIED SERVICE TECHNICIAN.

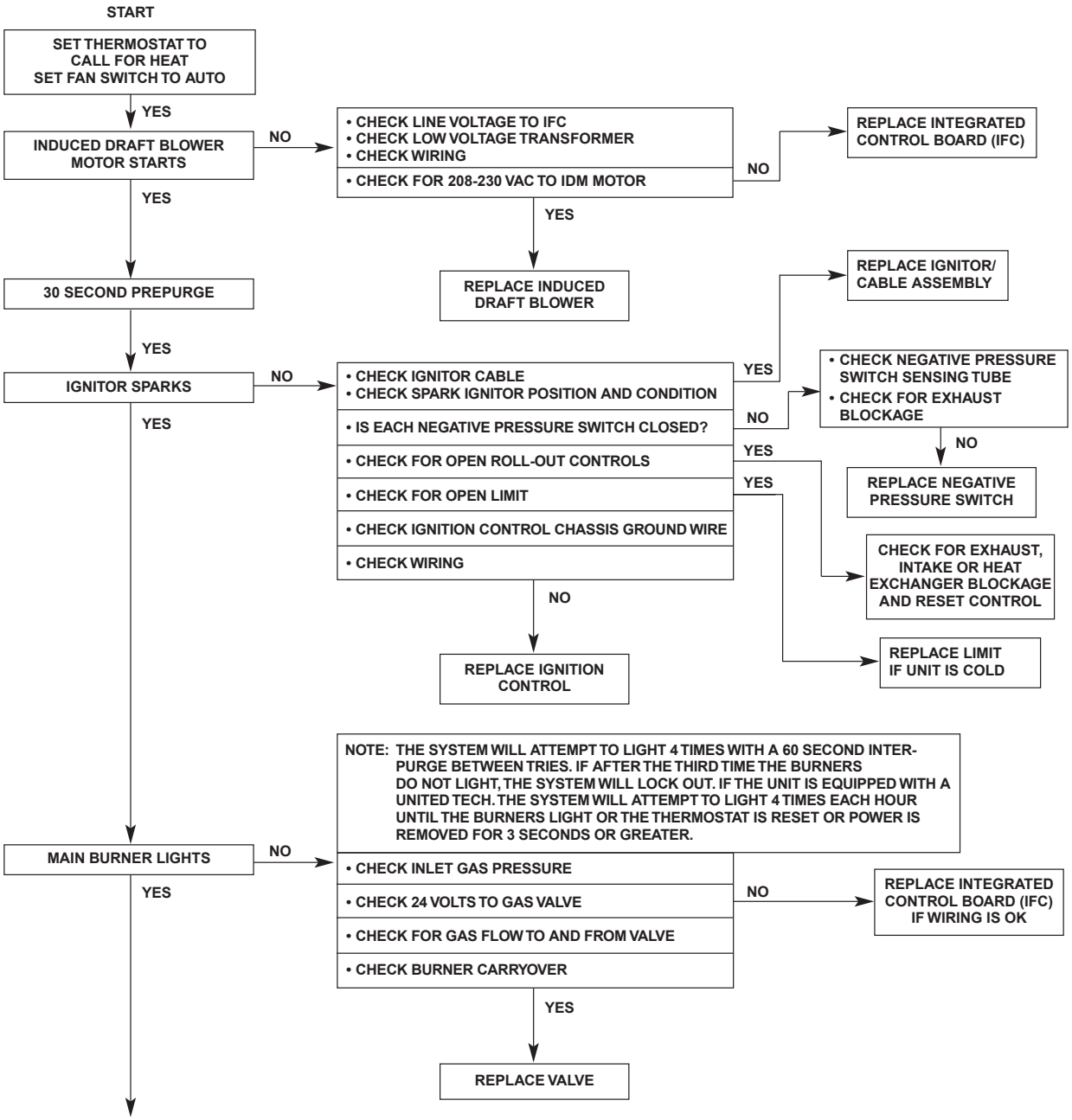
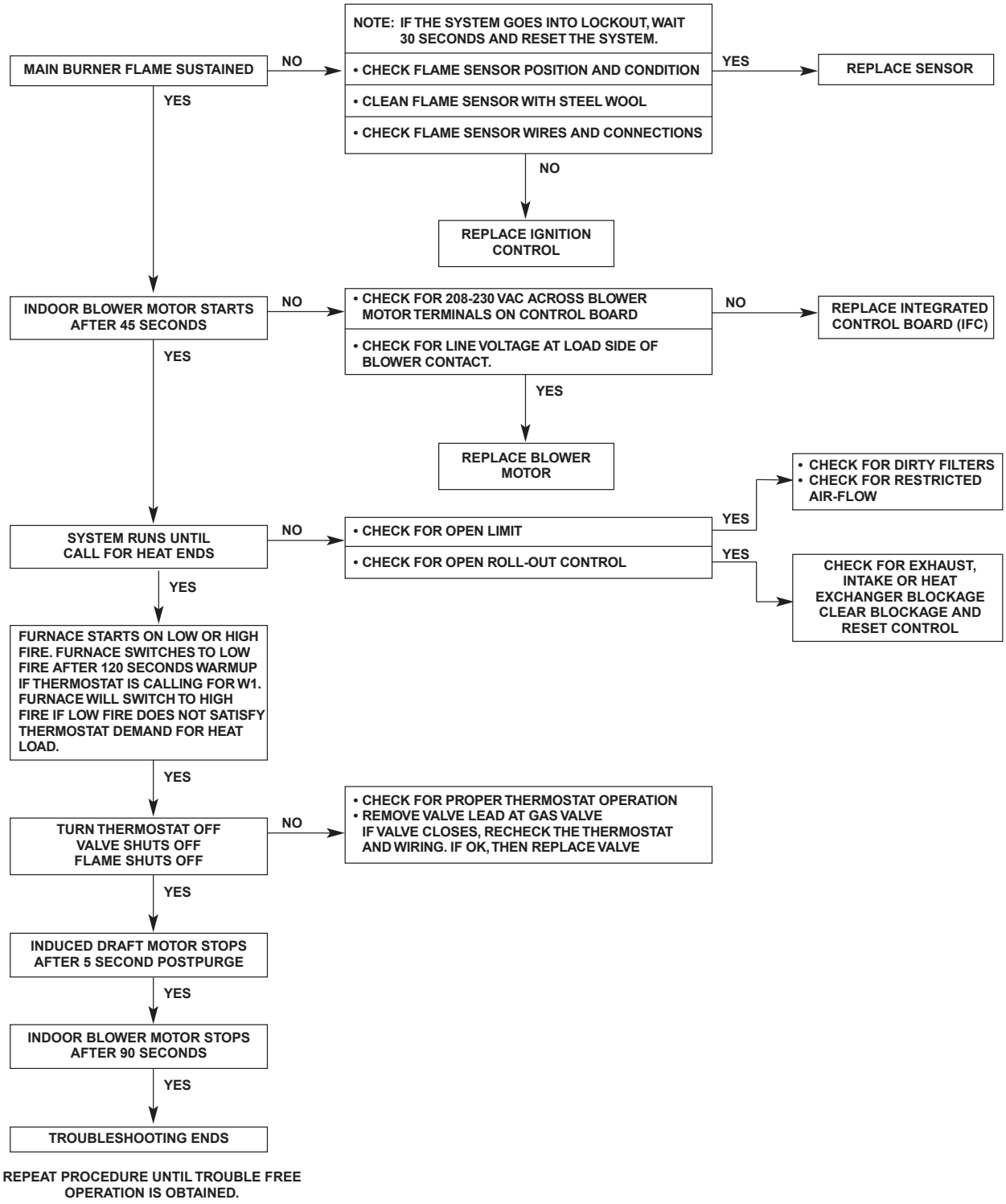


Figure 47 continued: Furnace Troubleshooting Guide



Replacement Parts

To find your local Daikin Applied Certified Parts Distributor, go to www.DaikinApplied.com and select Parts Locator.

Daikin Applied Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority. For training information on all Daikin HVAC products, please visit us at www.DaikinApplied.com and click on Training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied representative for warranty details. To find your local Daikin Applied representative, go to www.DaikinApplied.com.

Aftermarket Services

To find your local parts office, visit www.DaikinApplied.com or call 800-37PARTS (800-377-2787). To find your local service office, visit www.DaikinApplied.com or call 800-432-1342.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.

Products manufactured in an ISO Certified Facility.

INSTALLATION AND SERVICE MANUAL

RISM-15
J30-05380

OUTDOOR ROOFTOP GAS-FIRED DUCT FURNACE

(NATURAL OR POWER VENTED)

ATTENTION: READ THIS MANUAL AND ALL LABELS ATTACHED TO THE UNIT CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THESE UNITS! CHECK UNIT DATA PLATE FOR TYPE OF GAS AND ELECTRICAL SPECIFICATIONS AND MAKE CERTAIN THAT THESE AGREE WITH THOSE AT POINT OF INSTALLATION. RECORD THE UNIT MODEL AND SERIAL No.(s) IN THE SPACE PROVIDED. RETAIN FOR FUTURE REFERENCE.

Unit No. _____ Serial No. _____

SAVE THIS MANUAL

FOR YOUR SAFETY

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.

C ETL US LISTED
Intertek

FOR YOUR SAFETY

If you smell gas:
1. Don't touch electrical switches.
2. Extinguish any open flame.
3. Immediately call your gas supplier.

⚠WARNING Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

⚠WARNING Install, operate and maintain unit in accordance with manufacturer's instructions to avoid exposure to fuel substances or substances from incomplete combustion which can cause death or serious illness. The state of California has determined that these substances may cause cancer, birth defects, or other reproductive harm.

INSTALLER'S RESPONSIBILITY

Installer Please Note: This equipment has been test fired and inspected. It has been shipped free from defects from our factory. However, during shipment and installation, problems such as loose wires, leaks or loose fasteners may occur. **It is the installer's responsibility to inspect and correct any problems that may be found.**

These units are certified by ETL for operation on either natural or propane gas.

Read this manual and all labels attached to the unit carefully before attempting to install, operate or service the following unit models:*

Outdoor Rooftop Duct Furnaces: QV(RT/PV)- (100, 150, 200, 250, 300, 350, 400) (H)(M)
(RT = Natural Vent; PV = Power Vent)

Look in the direction of the unit air flow to determine whether the unit is right or left-hand accessible.

MESTEK, INC.
260 NORTH ELM ST., WESTFIELD, MA 01085
TEL: (413) 564-5540 FAX: (413) 562-5311
www.mestek.com

07/2018 MADE IN THE USA

TABLE OF CONTENTS

The following terms are used throughout this manual to bring attention to the presence of potential hazards or to important information concerning the product:

⚠ DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.

⚠ WARNING Indicates an imminently hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

⚠ CAUTION Indicates an imminently hazardous situation which, if not avoided, may result in minor injury or property damage.

NOTICE: Used to notify of special instructions on installation, operation or maintenance which are important to equipment but not related to personal injury hazards.

SERVICE ACCESS PANEL REMOVAL

To remove an access panel door, use the following procedure: remove the two screws and two washers from the louvered flue discharge area of the service panel (power vent doors only). Each panel is held in place with two "Grip" Latches. Using a slotted head screw driver, turn the latch screwhead counter clockwise. Using the handle provided, pull the panel upwards. Pull the bottom of the panel out and lower the panel to disengage it from the top lip. To replace an access door panel, guide the panel door upwards on the tracks, and push up into the top lip; swing and lower the panel in place until it engages with the bottom panel. Turn the screwhead on each latch clockwise. The screw must turn freely one quarter turn before resistance is felt in order for the lock to engage. If the latch does not hold, turn the screw counter-clockwise several turns and repeat the above procedure. Also refer to Figures 8a, 8b and 8c for more specifications.

RECEIVING INSTRUCTIONS

Inspect shipment immediately when received to determine if any damage has occurred to the carton/crate during shipment.

After the unit has been uncrated, check for any visible damage to the unit. On power vented units, check motor position and turn blower wheel by hand to determine if damage has occurred to these critical parts.

If any damage is found, the consignee should sign the bill of lading indicating such damage and immediately file claim for damage with the transportation company.

PRE-INSTALLATION INSTRUCTIONS

When unit is received and uncrated check data plate on unit for type of gas and electrical specifications and make certain that these agree with those at point of installation.

⚠ WARNING Open all disconnect switches and secure in that position before installing the unit. Failure to do so may result in personal injury or death from electrical shock.

NOTICE: It is the equipment owner's responsibility to provide any scaffolding or other apparatus required to perform emergency service or annual/periodic maintenance to this equipment.

RIGGING

Rig the unit using either belt or cable slings. Use spreader bar to protect the top of the unit when it is lifted.

The furnace units are provided with two holes in the base rail on each side of the unit. Slide pipes beneath the unit through these holes and attach rigging to the pipes for lifting the unit.

LOCATION

Before placing the rooftop unit in its permanent location, make certain that the roof is capable of carrying the additional load of this equipment. Check the shipping weights given in Chart 2.

Refer to Figures 1, 2 and 6 and charts 1 and 2 for adequate unit dimensions and required clearances.

MOUNTING

The units are mounted on skids and are suitable for use on combustible flooring. It is recommended that the skids be mounted either on level solid planking or steel channels, but never on a soft tar roof where the skids could sink and reduce the clearance between the bottom panel and the roof.

GENERAL SAFETY INFORMATION

Roofcurb kits for rooftop gas heating units are shipped knocked down. A curb kit contains (insulated) curb rails, hardware, sealant, self-adhering rubber gasketing, and installation instructions. Roof insulation, cant strips, flashing, roof felts, caulking and nails must be furnished by the installer. See separate curb specifications from manufacturer.

⚠ WARNING Failure to comply with the general safety information may result in extensive property damage, severe personal injury or death!

⚠ WARNING This product must be installed by a licensed plumber or gas fitter when installed within the Commonwealth of Massachusetts.

⚠ WARNING Do not alter the unit heater in any way or damage to the unit and/or severe personal injury or death may occur!

⚠ WARNING Never service any component without first disconnecting all electrical and gas supplies to the unit or severe personal injury or death may occur!

⚠ CAUTION Ensure that all power sources conform to the requirements of the unit heater or damage to the unit will result!

Installation must be made in accordance with local codes, or in absence of local codes, with the latest edition of ANSI Standard Z223.1 (NFPA No. 54) National Fuel Gas Code. All of the ANSI and NFPA Standards referred to in these installation instructions are those that were applicable at the time the design of the appliance was certified. The ANSI Standards are available from the American National Standards Institute, Inc., 11 West 42nd Street, New York, NY, 10036 or www.ansi.org. The NFPA Standards are available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

If installed in Canada, the installation must conform with local building codes, or in absence of local building codes, with current CSA-B149.1 "Installation Codes for Natural Gas Burning Appliance and Equipment" or CSA-B149.2 "Installation Codes for Propane Gas Burning Appliances and Equipment". These outdoor duct furnaces have been designed for and certified to comply with CSA 2.6.

These units have been designed and certified for outdoor use only, and may be located on the roof of the building or at any convenient location external of the building to be heated. The input range is 100,000 BTU/HR. (29.3 kW) to 400,000 BTU/HR. (117.1 kW) in 50,000 BTU/HR. (14.6 kW) increments.

The venting is an integral part of the unit and **must not be altered in the field**. The Natural Vented units are equipped with a vent cap which is designed for gravity venting. Air for combustion enters at the base of the vent through a protective grille, and the design of the vent cap is such that the products of combustion are discharged at the upper section of the cap. This cap is shipped in a separate carton. It should be fastened in position as shown in Figure 7 **and should not be altered in any way**.

The Power Vented unit has a power venting system with the inlet and discharge grille located in the upper section of the side access panel. This balanced flue design also preforms well under all wind conditions.

All internal parts of the standard unit are fabricated from aluminized steel. Standard burners are pressed aluminized steel and have a stainless steel burner port protector and air shutters. All internal and external jacket parts are fabricated from galvanized steel. Stainless steel heat exchangers, burners and flue collectors are optional. An optional 321 or 409 stainless steel heat exchanger is highly recommended for the following applications:

1) When the entering air temperature is below 40°F (4.4°C),
2) When the furnace is installed downstream of a cooling coil section.

A pilot burner plate is provided for access to the pilot burner and ignition systems without removing the burner drawer. Clearances between the external unit and obstruction must be sufficient for proper servicing of pull-out drawer. See Figures 1 and 2 for this clearance.

The outdoor units are certified for operation on either natural or propane gas. If a unit is to be installed at an altitude exceeding 2000 ft. (610 m) above sea level, derate the input by 4% for each 1000 foot rise (305 m rise) above sea level. Check all local codes.

Special orifices are required for installations above 2000 ft. (610 m). Check all local codes.

In Canada, if a unit is to be installed at altitudes of 2000 ft. (610 m) to 4500 ft. (1372 m), the unit must be orificed to 90% of the normal altitude rating.

Unless otherwise specified, the following conversions may be used for calculating SI unit measurements:

1 inch = 25.4 mm	1000 Btu/Cu. Ft. = 37.5 MJ/m^3
1 foot = 0.305 m	1000 Btu per hour = 0.293 kW
1 gallon = 3.785 L	1 inch water column = 0.249 kPa
1 pound = 0.454 kg	liter/second = CFM x 0.472
1 psig = 6.894 kPa	meter/second = FPM ÷ 196.8
1 cubic foot = 0.028 m^3	

SPECIFICATIONS

Figure 1 - Standard Natural Vented Outdoor Duct Furnace

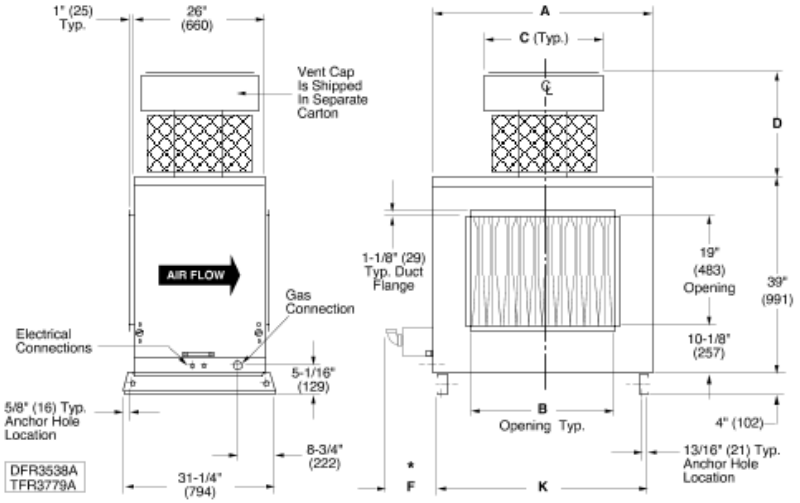


Chart 1 - Dimensional/Data

CAPACITY				US	CANADA			GAS INLET	
(CA)	A	B	C	D	D	*F	K	NAT	LP
10	32-7/8 (835)	15-9/16 (395)	12 (305)	11 (279)	20-11/16 (525)	19-3/8 (492)	30-3/16 (767)	1/2	1/2
15	32-7/8 (835)	18-5/16 (465)	21-1/2 (546)	16 (406)	25-3/16 (640)	23-1/2 (597)	30-3/16 (767)	1/2	1/2
20	43-7/8 (1114)	23-13/16 (605)	23-1/2 (597)	16 (406)	25-3/16 (640)	26-1/4 (667)	41-3/16 (1046)	1/2	1/2
25	43-7/8 (1114)	29-5/16 (745)	23-1/2 (597)	16 (406)	25-3/16 (640)	34-1/2 (876)	41-3/16 (1046)	3/4	3/4
30	54-7/8 (1394)	34-13/16 (884)	26 (660)	17-1/2 (445)	26-11/16 (678)	37-1/4 (946)	52-3/16 (1326)	3/4	3/4
35	54-7/8 (1394)	40-5/16 (1024)	26 (660)	17-1/2 (445)	26-11/16 (678)	45-1/2 (1156)	52-3/16 (1326)	3/4	3/4
40	60-3/8 (1534)	45-13/16 (1164)	26 (660)	17-1/2 (445)	26-11/16 (678)	51 (1295)	57-11/16 (1465)	3/4	3/4

NOTE:
DIMENSIONS ARE IN INCHES, DIMENSIONS IN PARENTHESIS ARE IN MILLIMETERS.
* "F" DIMENSION IS THE RECOMMENDED CLEARANCE TO SERVICE THE BURNER DRAWER(S). REFER TO FIGURE 6 FOR ADDITIONAL CLEARANCE REQUIREMENTS.

Figure 2 - Standard Power Vented Outdoor Duct Furnace

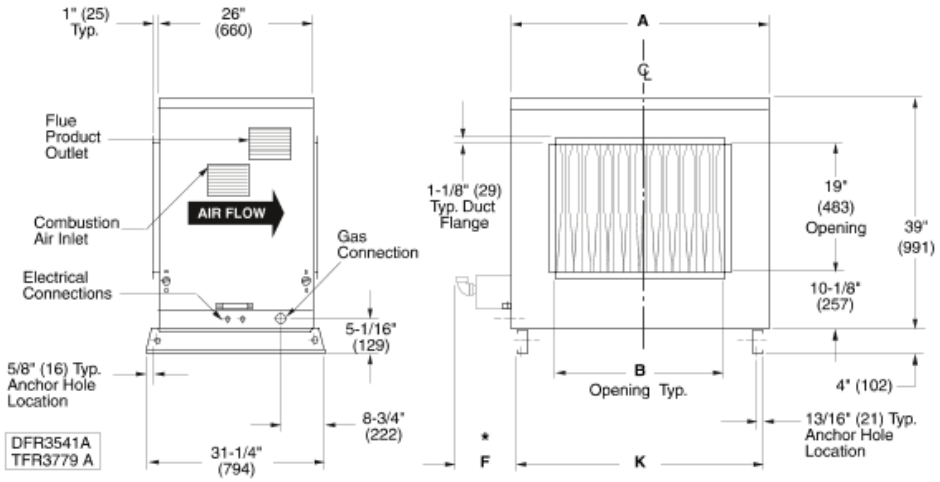


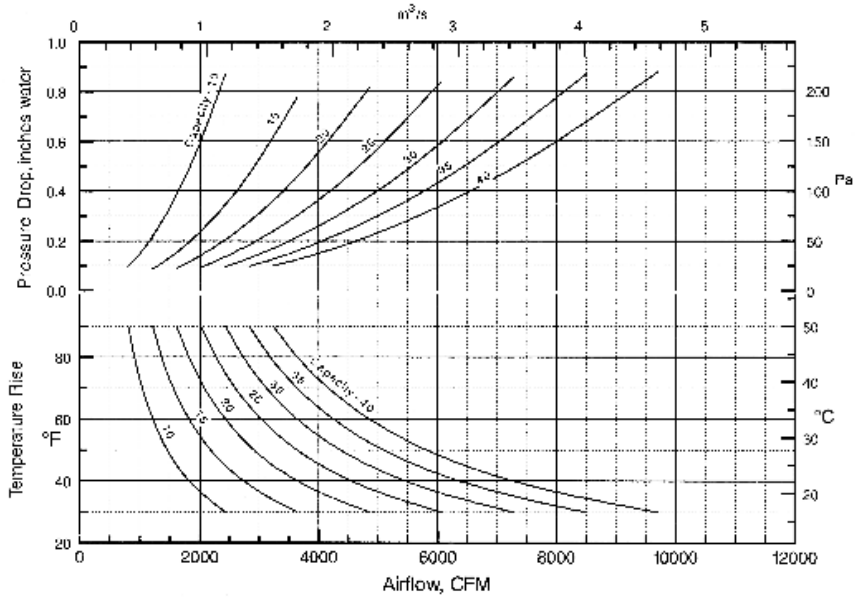
Chart 2 - Performance and Specification Data

	CAPACITY MBH	INPUT RATING BTU/Hr (kW)	OUTPUT RATING BTU/Hr (kW)	EFF. %	MIN. CFM (cu. m/s)	MAX. CFM (cu. m/s)	Temp. Rise °F (°C) Min. - Max.	Static in. of Water (KPa)	F* Min. Clearance in. (mm)	NG Gas Inlet in.	LP Gas Inlet in.	Net Weight lb. (kg)	Shipping Weight lb. (kg)
** NATURAL VENT	100	100,000 (29.3)	80,000 (23.4)	80	823 (0.388)	2,469 (1.165)	30 - 90 (17) - (50)	2 (0.50)	7-1/8 (181)	1/2	1/2	256 (116)	367 (166)
	150	150,000 (43.9)	120,000 (35.1)	80	1,235 (0.583)	3,704 (1.748)	30 - 90 (17) - (50)	2 (0.50)	11-1/4 (286)	1/2	1/2	307 (139)	418 (190)
	200	200,000 (58.6)	160,000 (46.9)	80	1,646 (0.777)	4,938 (2.331)	30 - 90 (17) - (50)	2 (0.50)	14 (356)	1/2	1/2	365 (166)	484 (220)
	250	250,000 (73.2)	200,000 (58.6)	80	2,058 (0.971)	6,173 (2.913)	30 - 90 (17) - (50)	2 (0.50)	22-1/4 (565)	3/4	3/4	405 (184)	524 (238)
	300	300,000 (87.8)	240,000 (70.3)	80	2,469 (1.165)	7,407 (3.496)	30 - 90 (17) - (50)	2 (0.50)	34 (864)	3/4	3/4	469 (213)	596 (270)
	350	350,000 (102.5)	280,000 (82.0)	80	2,881 (1.360)	8,642 (4.079)	30 - 90 (17) - (50)	2 (0.50)	33-1/4 (845)	3/4	3/4	510 (231)	637 (289)
	400	400,000 (117.1)	320,000 (93.7)	80	3,292 (1.554)	9,876 (4.661)	30 - 90 (17) - (50)	2 (0.50)	38 3/4 (984)	3/4	3/4	558 (253)	690 (313)
** POWER VENT	100	100,000 (29.3)	80,000 (23.4)	80	823 (0.388)	2,469 (1.165)	30 - 90 (17) - (50)	2 (0.50)	7-1/8 (181)	1/2	1/2	262 (119)	373 (169)
	150	150,000 (43.9)	120,000 (35.1)	80	1,235 (0.583)	3,704 (1.748)	30 - 90 (17) - (50)	2 (0.50)	11-1/4 (286)	1/2	1/2	298 (135)	409 (186)
	200	200,000 (58.6)	160,000 (46.9)	80	1,646 (0.777)	4,938 (2.331)	30 - 90 (17) - (50)	2 (0.50)	14 (356)	1/2	1/2	356 (161)	475 (215)
	250	250,000 (73.2)	200,000 (58.6)	80	2,058 (0.971)	6,173 (2.913)	30 - 90 (17) - (50)	2 (0.50)	22-1/4 (565)	3/4	3/4	395 (179)	514 (233)
	350	325,000 (95.2)	260,000 (76.2)	80	2,675 (1.263)	8,025 (3.789)	30 - 90 (17) - (50)	2 (0.50)	33-1/4 (845)	3/4	3/4	495 (225)	622 (282)
	400	400,000 (117.1)	320,000 (93.7)	80	3,292 (1.554)	9,876 (4.661)	30 - 90 (17) - (50)	2 (0.50)	38-3/4 (984)	3/4	3/4	543 (246)	675 (306)
*** NATURAL VENT	100	100,000 (29.3)	80,000 (23.4)	80	1,235 (0.583)	3,704 (1.748)	20 - 60 (11) - (33)	2 (0.50)	7 1/8 (181)	1/2	1/2	253 (115)	364 (165)
	150	150,000 (43.9)	120,000 (35.1)	80	1,852 (0.874)	5,556 (2.622)	20 - 60 (11) - (33)	2 (0.50)	11-1/4 (286)	1/2	1/2	304 (138)	415 (188)
	200	200,000 (58.6)	160,000 (46.9)	80	2,469 (1.165)	7,407 (3.496)	20 - 60 (11) - (33)	2 (0.50)	14 (356)	1/2	1/2	362 (164)	481 (218)
	250	250,000 (73.2)	200,000 (58.6)	80	3,086 (1.457)	9,259 (4.370)	20 - 60 (11) - (33)	2 (0.50)	22-1/4 (565)	3/4	3/4	402 (182)	521 (236)
	300	300,000 (87.8)	240,000 (70.3)	80	3,704 (1.748)	11,111 (5.244)	20 - 60 (11) - (33)	2 (0.50)	34 (864)	3/4	3/4	466 (211)	593 (269)
	350	350,000 (102.5)	280,000 (82.0)	80	4,321 (2.040)	12,963 (6.119)	20 - 60 (11) - (33)	2 (0.50)	33-1/4 (845)	3/4	3/4	507 (230)	634 (288)
	400	400,000 (117.1)	320,000 (93.7)	80	4,938 (2.331)	14,815 (6.993)	20 - 60 (11) - (33)	2 (0.50)	38-3/4 (984)	3/4	3/4	555 (252)	687 (312)
*** POWER VENT	100	100,000 (29.3)	80,000 (23.4)	80	1,235 (0.583)	3,704 (1.748)	20 - 60 (11) - (33)	2 (0.50)	7-1/8 (181)	1/2	1/2	259 (117)	370 (168)
	150	150,000 (43.9)	120,000 (35.1)	80	1,852 (0.874)	5,556 (2.622)	20 - 60 (11) - (33)	2 (0.50)	11-1/4 (286)	1/2	1/2	295 (134)	406 (184)
	200	200,000 (58.6)	160,000 (46.9)	80	2,469 (1.165)	7,407 (3.496)	20 - 60 (11) - (33)	2 (0.50)	14 (356)	1/2	1/2	353 (160)	472 (214)
	250	250,000 (73.2)	200,000 (58.6)	80	3,086 (1.457)	9,269 (4.375)	20 - 60 (11) - (33)	2 (0.50)	22-1/4 (565)	3/4	3/4	392 (178)	511 (232)
	300	300,000 (87.8)	240,000 (70.3)	80	3,704 (1.748)	11,111 (5.244)	20 - 60 (11) - (33)	2 (0.50)	34 (864)	3/4	3/4	452 (205)	579 (263)
	350	350,000 (102.5)	280,000 (82.0)	80	4,321 (2.040)	12,963 (6.119)	20 - 60 (11) - (33)	2 (0.50)	33-1/4 (845)	3/4	3/4	492 (223)	619 (281)
	400	400,000 (117.1)	320,000 (93.7)	80	4,938 (2.331)	14,815 (6.993)	20 - 60 (11) - (33)	2 (0.50)	38-3/4 (984)	3/4	3/4	540 (245)	672 (305)

* See figures 1 and 2. ** Indicates high temperature rise furnaces. *** Indicates standard temperature rise furnaces.
The clearances dimensions shown in chart #2 are the absolute minimum clearances for servicing the burner drawer. However, the clearances shown in chart #1 are the ***recommended*** clearances for ease of servicing the unit.

PERFORMANCE DATA CURVES

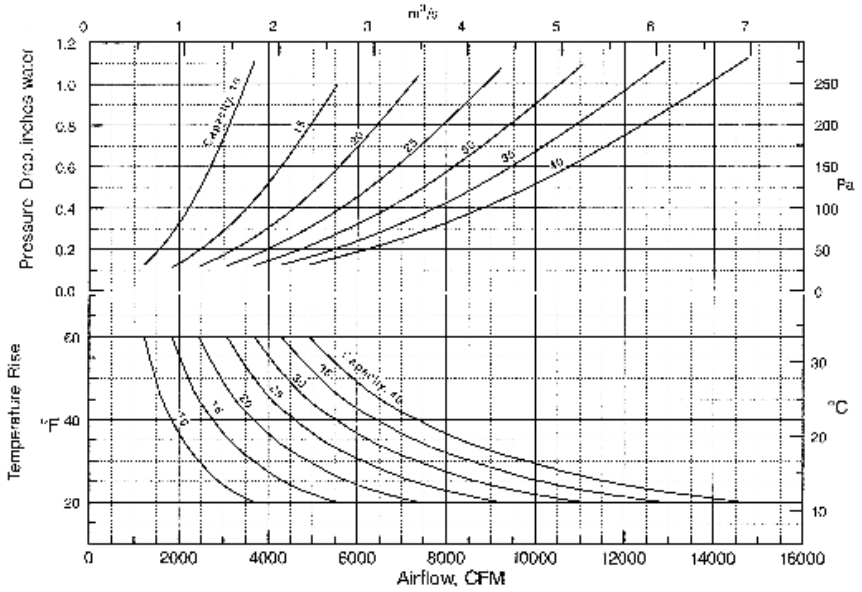
Figure 3 - High Temperature Rise Duct Furnaces — 30-90°F (17-50°C)



Pressure drop through the heat exchanger is based on the CFM throughput. The desired data is obtained in the following manner:

1. Select heater size based on heat loss of the building to be heated.
2. Select temperature rise desired.
3. Based on temperature rise, the horizontal line intersects heater temperature vs. CFM curve.
4. Follow vertical line down to select CFM.
5. For pressure drop selection, follow vertical CFM line until it intersects the selected heater performance curve vs. pressure drop.
6. Follow the horizontal pressure drop line to the left, and read pressure drop of the selected heater.

Figure 4 - Standard Temperature Rise Duct Furnaces — 20-60°F (11-33°C)



BYPASS SIZING INFORMATION

(BUILT ON THE JOB – NOT FURNISHED BY FACTORY)

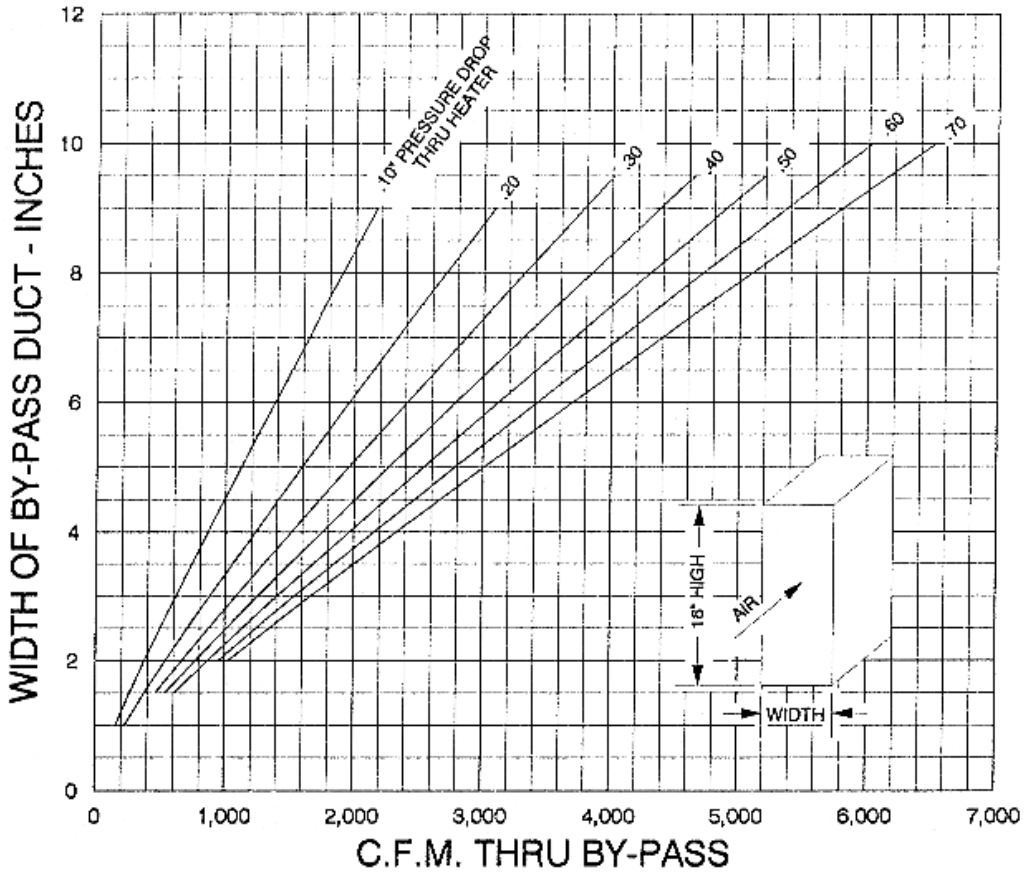
On occassion when a duct furnace is incorporated in an air handling system, it may be desirable to handle a total of more CFM than the duct furnace will pass at a given static pressure drop and temperature rise. Therefore, it is necessary to arrange to bypass the additional CFM required. The size of the bypass duct can be determined by referring to the chart. This permits the static pressure drop through the bypass to balance off the drop through the heat exchanger. The bypass duct is not factory furnished and must be built on the job by the installer and a damper placed therin if required.

USE OF BYPASS CURVES

The width of the by-pass for CFM in excess of that provided through the heater may be found in the following manner:

1. Determine the CFM and pressure drop through the heater based on the heating requirement specifications.
2. Determine the additional CFM desired, over and above the CFM for the heating requirements.
3. Using the pressure drop which was determined from performance curves above, for the heating load, locate this pressure drop on the by-pass curves. Follow this curve until it intersects the vertical CFM line for the excess CFM desired.
4. Follow horizontal line to left to obtain width of by-pass duct.

Figure 5 - By-Pass Curve



INSTALLATION

⚠WARNING Open all disconnect switches and secure in that position before installing unit. Failure to do so may result in personal injury or death from electrical shock.

Installation must conform with local building codes, or in the absence of local codes, with the latest edition of the National Fuel Gas Code ANSI Z223.1 (NFPA 54).

A heat loss study and a complete layout of the system should be made first.

When locating the unit in its permanent location, make certain that the roof is capable of carrying the additional load of the equipment. **Check the net weights from the engineering data.**

Make certain that clearances are provided for service, minimum clearance to combustible material and to venting cap. See below for this information. Service clearance information is given in the engineering data in Figures 1, 2 and 6. Clearances around secondary air must be unobstructed.

If the unit is installed downstream of refrigeration coils, condensate will form and collect in the bottom of the heater. Drain connections are provided to dispose of this condensate from the unit. Connect drain pipes to dispose of this condensate where necessary.

⚠WARNING Ducts which are outdoors must be insulated and sealed to prevent water from entering either furnace or building through duct (see section on duct and drain specifications).

Ducts connected to duct furnaces shall have removable access panels on both upstream and downstream sides of the unit. These openings shall be accessible when the unit is installed in service, and shall be of such size that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heating element. The covers for the openings shall be attached in such a manner as to prevent leaks.

⚠WARNING If a duct furnace is connected to a return air duct or any other inlet air restriction, the appliance shall be installed on the positive pressure side of the air-circulating blower.

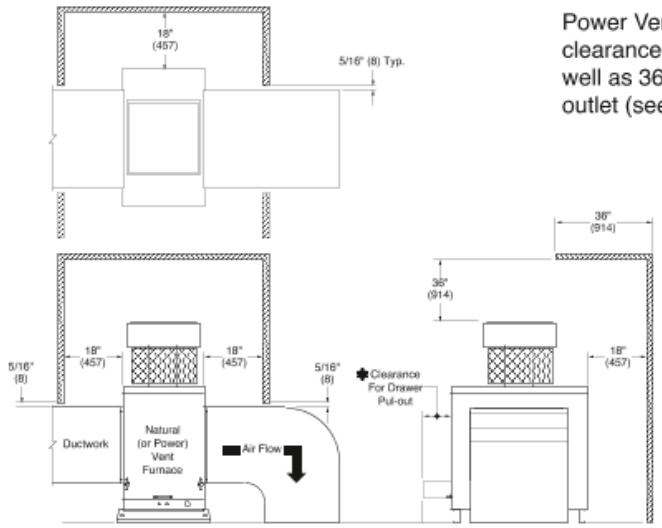
Atmospheres containing solvents or chlorinated hydrocarbons will produce corrosive acids when coming in contact with the flames. This will greatly reduce the life of the gas duct furnace and may void the warranty. Avoid such areas.

CLEARANCES

Minimum clearances are shown in Figures 1, 2 & 6 and charts 1 & 2. It is important that clearances be maintained for servicing the unit (refer to Figures 1 & 2 for clearances necessary to pull out the burner drawer for servicing), and that minimum clearances are provided from combustible material and from the venting cap/top of unit. Clearances around the outside air hood must be unobstructed.

⚠WARNING Provide adequate clearance from combustibles to prevent injury or death from fire.

Figure 6 - Minimum Clearances to Combustible Material or Obstructions



Power Vent Units required 36" clearance above top of unit, as well as 36" from the flue product outlet (see Figure 2 for location).

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*See figures 1 & 2 and charts 1 & 2.

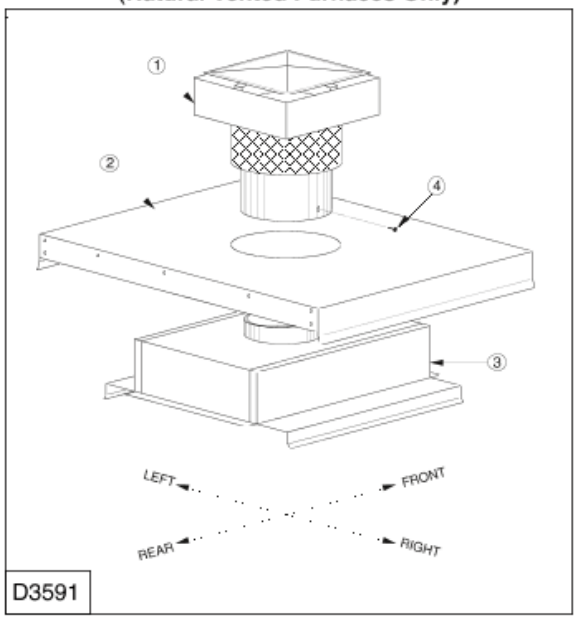
VENTING

All venting installations shall be in accordance with the latest edition of "Part 7, Venting of Equipment of the National Fuel Gas Code, ANSI Z223.1 (NFPA 54), or applicable provisions of local building codes".

Natural venting models are equipped with a vent cap designed for natural venting. Air for combustion enters at the base of the vent through a protective grille, and the design of the vent cap is such that the products of combustion are discharged at the upper section of the cap. The cap is shipped in a separate carton. It should be fastened in position as shown in Figure 7 and should not be altered in any way.

⚠WARNING The venting is an integral part of the unit and must not be altered in the field. If altered, excessive carbon monoxide could be produced.

Figure 7 - Vent Cap Assembly (Natural Vented Furnaces Only)



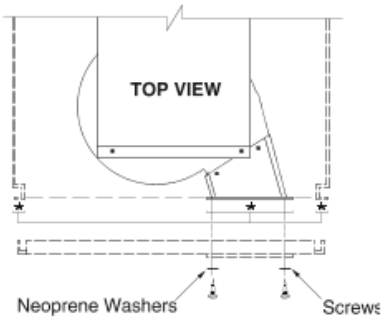
FIELD INSTALLATION INSTRUCTIONS

1. Remove "Side Access Panel".
2. Insert Vent Sleeve of "Vent Cap Assembly" (Item 1) thru "Top Panel Assembly" (Item 2), and over Vent Collar of "Flue Collector Assembly" (Item 3).
3. Align "Vent Cap Assembly" so it is square to "Top Panel Assembly".
4. Fasten with "Drill Screw" or "Sheet Metal Screw" (Item 4) by reaching between "Flue Collector Assembly" (Item 3) & "Top Panel Assembly" (Item 2), and drilling through vent sleeve of "Vent Cap Assembly" into vent collar of "Flue Collector Assembly".
5. Replace "Side Access Panel".

NOTICE: If your unit is to be equipped with the optional extended vent cap assembly, see the special instructions supplied with the vent cap.

Power vented models are designed with combustion air inlet and flue products outlet located in the louvered side access panel. Never locate these units in an area where the flue products outlet may be directed at any fresh air vents.See Figures 8a 8b, and 8c for installation and servicing requirements.

Figure 8a - Power Venter Discharge Location



*These Surfaces (indicated with an asterisk in figures 8a & 8b) **MUST** be flush and sealed at all times to ensure the proper discharge of flue products from the unit.

These discharge flanges are equipped with special gasketing, which must create an air tight seal connection around the louvers of the access panel.

Secure in place the access door to the discharge adaptor using the two screws and neoprene washers, then tighten the grip latches (see service access panel removal section).

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Figure 8b

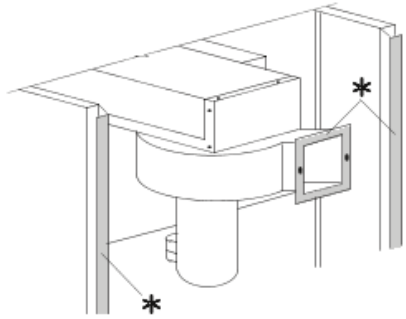
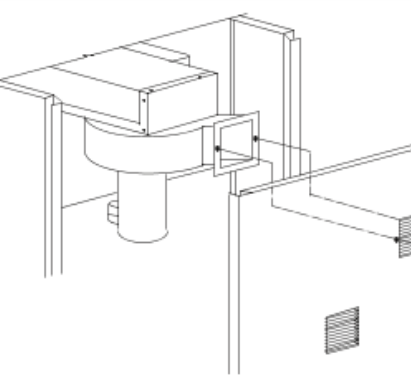


Figure 8c



DUCT SPECIFICATIONS

Ductwork which is outdoors must be insulated and sealed to prevent water from entering either furnace or building through the duct. **Do not alter the flange connection for the duct attachment; air may bypass and cause combustion problems.** Be sure to properly seal to avoid any air leakage (refer to Figures 1 and 2).

Ductwork connected to duct furnaces should have removable access panels on both the upstream and downstream sides of the unit. These openings should be accessible when the unit is installed, and should be sized so that smoke or reflected light can be observed inside the casing to indicate the presence of leaks in the heating equipment. The covers of the openings should be attached in a manner that prevents leaks.

GAS CONNECTIONS

All gas piping should be installed in accordance with local codes. It is required that a ground union be installed adjacent to the manifold for easy servicing. On vertical runs, a drip leg should be provided upstream of the control manifold (see figure 9a). An additional shut-off must be located externally of the jacket enclosure where required by local code. The location of this valve must comply with the local codes. A 1/8 inch NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the unit. Field gas piping recommendations are shown in Figure 9b.

It is recommended that the gas piping not be installed through the bottom of the duct furnace bottom panel. If piping must penetrate the duct furnace bottom panel, it must be sealed to prevent water leakage.

⚠WARNING To avoid equipment damage or possible personal injury, do not connect gas piping to this unit until a supply line pressure/ leak test has been completed. Connecting the unit before completing the pressure/leak test may damage the unit gas valve and result in a fire hazard.

⚠CAUTION Do not rely on a shutoff valve to isolate the unit while conducting gas pressure/leak tests. These valves may not be completely shut off, exposing the unit gas valve to excessive pressure and damage. Do not overtighten the inlet gas piping. This may cause stresses that would crack the valve.

⚠WARNING Never use an open flame to detect gas leaks. Explosive conditions may exist which would result in personal injury or death.

The gas line should be supported so that no strain is placed on the unit. Pipe compounds which are not soluble to liquid petroleum gases should be used on threaded joints.

The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressure in excess of 1/2 psig (3.5 kPa).

The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressure equal to or less than 1/2 psig (3.5 kPa).

For additional piping information, refer to the latest edition of the National Fuel Gas Code ANSI Z233.1 (NFPA 54).

Figure 9a - Drip Leg Installation

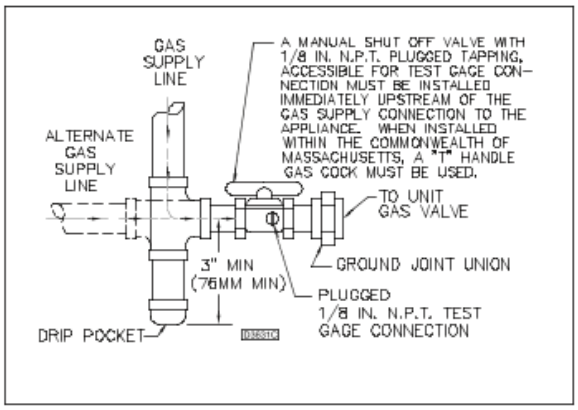
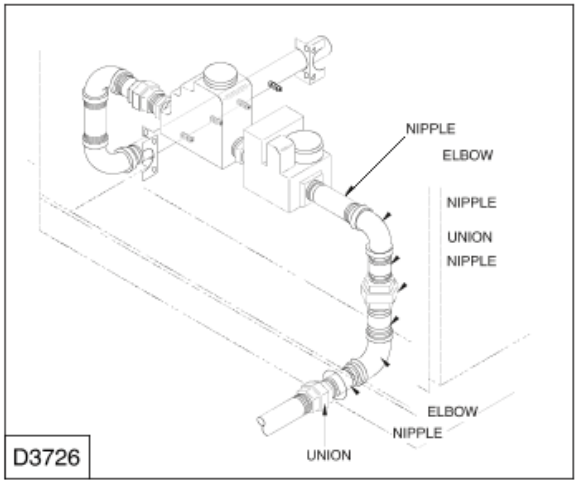


Figure 9b - Field Piping Recommendations



GAS CONNECTIONS (continued)

For the most satisfactory piping installation, the following procedure should be followed. Make piping layout of the whole installation and calculate the cubic feet of gas that each supply pipe will carry. See piping example below.

Calculate the cubic feet of gas that each supply pipe will carry:

$$\frac{\text{Btu/Hr.}}{\text{1000 Btu Natural Gas/Cu. Ft.}} = \text{Cu. Ft. Per Hour of Gas to Unit (cfh)}$$

$$\frac{\text{Unit Kilowatt}}{\text{37.3 Megajoules Natural Gas/Cu Meter}} = \text{Liters per second on Gas to Unit (l/s)}$$

NOTICE: Contact your natural gas supplier for the Btu/Cu. Ft. content of natural gas in your area. This may be higher or lower than the nominal 1000 Btu/Cu. Ft. used in this example:
Refering to the piping example in figure 10, the length of pipe from the gas meter (A) to the most remote heater (E) is 60 feet. This distance should be used for all of the heaters when determining the pipe size required. Based on the column marked 60 feet in chart 3, the piping for this example should be sized as follows:

- 450 cfh is supplied from A to B, requiring 1-1/4 inch pipe.
- 200 cfh is supplied from B to C, requiring 1 inch pipe.
- 250 cfh is supplied from B to D, requiring 1 inch pipe.
- 100 cfh is supplied from D to E, requiring 3/4 inch pipe.
- 150 cfh is supplied from D to F, requiring 1 inch pipe.

For SI calulations, refer to metric conversion chart in general safety section of this manual.

NOTICE: If more than one gas duct furnace is to be served by the same piping arrangement, the total cu. ft./hr. input and length of pipe must be considered.

NOTICE: If the gas duct furnace is to be fired with LP gas, consult local LP gas dealer for pipe size information. Heater installation for use with propane (bottled) gas must be made by a qualified LP gas dealer or installer. He will insure proper joint compounds are used for making pipe connections; that air is purged from lines; that a thorough test is made for leaks before operating heater; and that it is properly connected to propane gas supply system.

Before any connection is made to an existing line supplying other gas appliances, contact the local gas company to make certain that the existing line is of adequate size to handle the combined load.

Check all connections with a soap solution before leaving job.

Figure 10 - Example of Piping Layout for Determining Pipe Size

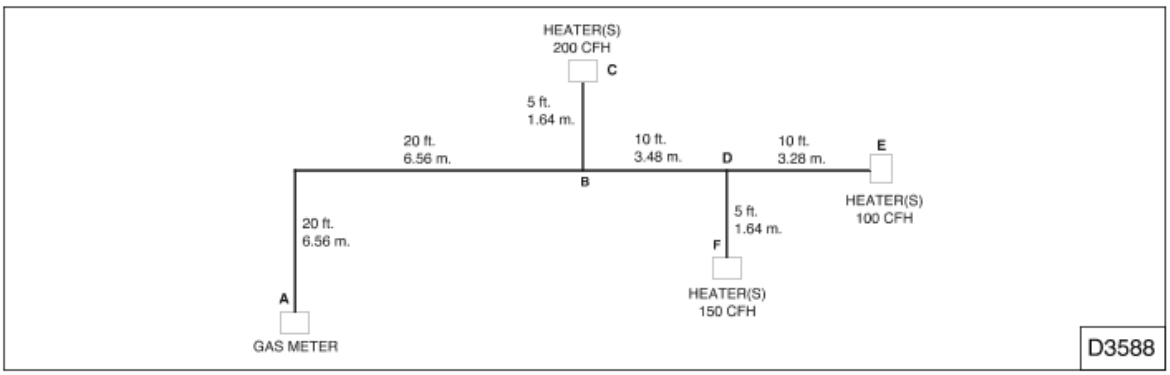


Chart 3 **GAS PIPE SIZE**

Maximum Capacity of Pipe in Cubic Feet of Gas per Hour for Gas Pressures of 0.5 psig (3.5 kPa) or Less, and a Pressure Drop of 0.5 Inch Water Column (124.4 Pa) (Based on a 0.60 Specific Gravity Gas)

Nominal Iron Pipe Size	Internal Dia.	Length of Pipe, ft. (Meters)													
in.	in.	10	20	30	40	50	60	70	80	90	100	125	150	175	200
	(mm)	(3.0)	(6.1)	(9.1)	(12.2)	(15.2)	(18.3)	(21.3)	(24.4)	(27.4)	(30.5)	(38.1)	(45.7)	(53.3)	(61.0)
1/2	0.622	175	120	97	82	73	66	61	57	53	50	44	40	37	35
	(16)	(4.96)	(3.40)	(2.75)	(2.32)	(2.07)	(1.87)	(1.73)	(1.61)	(1.50)	(1.42)	(1.25)	(1.13)	(1.05)	(0.99)
3/4	0.824	360	250	200	170	151	138	125	118	110	103	93	84	77	72
	(21)	(10.2)	(7.08)	(5.66)	(4.81)	(4.28)	(3.91)	(3.54)	(3.34)	(3.11)	(2.92)	(2.63)	(2.38)	(2.18)	(2.04)
1	1.049	680	465	375	320	285	260	240	220	205	195	175	160	145	135
	(27)	(19.3)	(13.2)	(10.6)	(9.06)	(8.07)	(7.36)	(6.80)	(6.23)	(5.80)	(5.52)	(4.96)	(4.53)	(4.11)	(3.82)
1 1/4	1.380	1400	950	770	660	580	530	490	460	430	400	360	325	300	280
	(35)	(39.6)	(26.9)	(21.8)	(18.7)	(16.4)	(15.0)	(13.9)	(13.0)	(12.2)	(11.3)	(10.2)	(9.20)	(8.50)	(7.93)
1 1/2	1.610	2100	1460	1180	990	900	810	750	690	650	620	550	500	460	430
	(41)	(59.5)	(41.3)	(33.4)	(28.0)	(25.5)	(22.9)	(21.2)	(19.5)	(18.4)	(17.6)	(15.6)	(14.2)	(13.0)	(12.2)
2	2.067	3950	2750	2200	1900	1680	1520	1400	1300	1220	1150	1020	950	850	800
	(53)	(112)	(77.9)	(62.3)	(53.8)	(47.6)	(43.0)	(39.6)	(36.8)	(34.5)	(32.6)	(28.9)	(26.9)	(24.1)	(22.7)
2 1/2	2.469	6300	4350	3520	3000	2650	2400	2250	2050	1950	1850	1650	1500	1370	1280
	(63)	(178)	(123)	(99.7)	(85.0)	(75.0)	(68.0)	(63.7)	(58.0)	(55.2)	(52.4)	(46.7)	(42.5)	(38.8)	(36.2)
3	3.068	11000	7700	6250	5300	4750	4300	3900	3700	3450	3250	2950	2650	2450	2280
	(78)	(311)	(218)	(177)	(150)	(135)	(122)	(110)	(105)	(97.7)	(92.0)	(83.5)	(75.0)	(69.4)	(64.6)
4	4.026	23000	15800	12800	10900	9700	8800	8100	7500	7200	6700	6000	5500	5000	4600
	(102)	(651)	(447)	(362)	(309)	(275)	(249)	(229)	(212)	(204)	(190)	(170)	(156)	(142)	(130)

1. *See local codes before installing 1/2" pipe.
2. FOR NATURAL GAS: cu. ft./hr. = $\frac{\text{Input Rate of Unit}}{\text{Btu Value of Gas}}$
3. FOR PROPANE GAS: Multiply the Cu. Ft. / Hr. obtained in note 2 by 0.633 before entering chart.

ELECTRICAL CONNECTIONS

⚠ WARNING

HAZARDOUS VOLTAGE!
DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING. Failure to disconnect power before servicing can cause severe personal injury or death.

The rooftop duct furnace is wired at the factory and ready to be connected. Actual wiring will differ according to the options used. Each furnace will be shipped with its own wiring diagram; refer to this wiring diagram for all electrical connections to the unit.

All electrical connections must conform to the latest edition of ANSI/NFPA No. 70 National Electrical Code and applicable local codes; In Canada, to the Canadian Electrical Code, Part I CSA Standard C22.1.

⚠ CAUTION **Do not use any tools (i.e. screwdriver, pliers, etc.) across the terminals to check for power. Use a voltmeter.**

The outdoor conduits leading into the unit should be installed to prevent rain from wetting any high voltage wire. Locate the thermostat in accordance with the instructions packed with each thermostat.

NOTICE: Should any original wire supplied with the heater have to be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C (221°F).

OPERATION

GENERAL

All units are equipped with intermittent pilot ignition systems. This system is 100% pilot burner shut off. See Figure 11 for burner/gas controls. The pilot is lit and extinguished during every cycle of operation. There is no burning standing pilot.

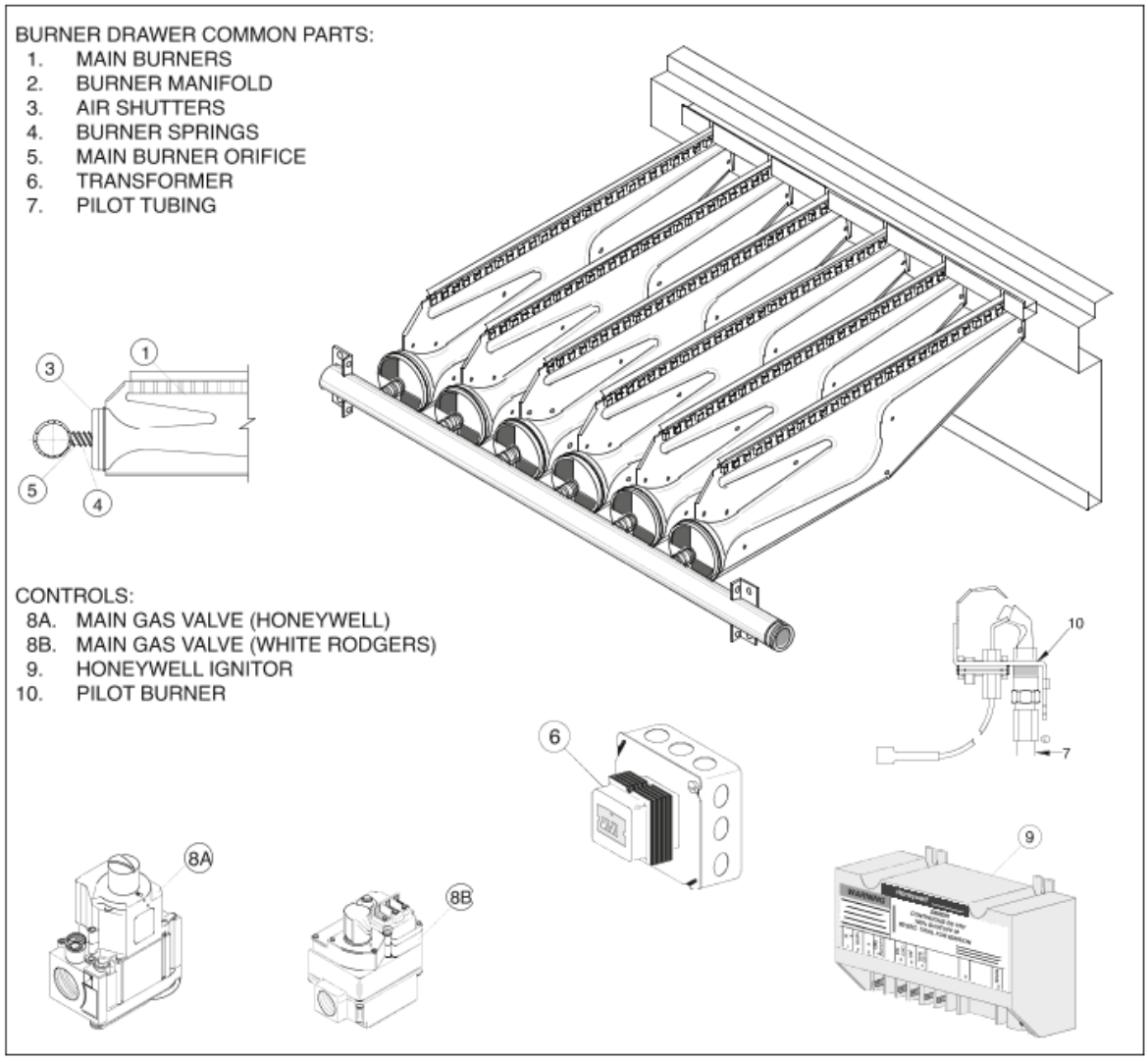
On natural gas units, the ignitor will spark and pilot gas will continue to flow until the pilot flame is proven.

LP (propane) gas units are equipped with 100% lockout. The lockout function shuts off the main and pilot gas valves if the pilot gas fails to ignite within 30 seconds. In order to initiate a reignition trial, the power supply must be interrupted for a minimum of 5 minutes to allow dispertion of unburned gas.

NOTICE: Check gas supply pressure (see chart 4). Gas valves are suitable to a maximum pressure of 0.5 psi (14 inches water column). If the main gas supply pressure for natural gas is greater than 14 inches WC (3.5 kPa), a stepdown pressure regulator must be installed ahead of the gas valve. For LP (propane) gas, the gas pressure supplied should not exceed 14 inches WC (3.5 kPa).

The controls are located inside the compartment on the access side of the unit. The input for single-stage firing is based on full fire. On two-stage fire, the unit will fire 50% of full fire on the first stage and full fire on the second stage. When electronic modulating is used, the unit will first fire at 100% of full fire and modulate down to 40% of full fire.

Figure 11 - Burner Components — Intermittent Pilot Ignition (Natural or Power Vented Duct Furnaces)



OPERATION continued

Chart 4 - Gas Supply Pressure

	Natural Gas	Propane Gas
Heating Value	1075 Btu/Ft^3 (40.1 MJ/m^3)	2500 Btu/Ft^3 (93.1 MJ/m^3)
Manifold Pressure		
Single Stage Application	3.5 inch WC (0.87 kPa)	10.0 inch WC (2.49 kPa)
Two Stage Application - High Fire	3.5 inch WC (0.87 kPa)	10.0 inch WC (2.49 kPa)
Two Stage Application - Low Fire	1.1 inch WC (0.27 kPa)	3.8 inch WC (0.95 kPa)
Modulating Application - High Fire	3.5 inch WC (0.87 kPa)	10.0 inch WC (2.49 kPa)
Modulating Application - Low Fire	0.9 inch WC (0.22 kPa)	3.5 inch WC (0.87 kPa)
Minimum Supply Pressure		
Single Stage Application	5.0 inch WC (1.24 kPa)	11.0 inch WC (2.74 kPa)
Two Stage Application	6.5 inch WC (1.62 kPa)	11.5 inch WC (2.86 kPa)
Modulating Application	6.5 inch WC (1.62 kPa)	11.5 inch WC (2.86 kPa)
Maximum Supply Pressure	14.0 inch WC (3.49 kPa)	14.0 inch WC (3.49 kPa)

CONTROLS

Electronic modulating gas firing is available from the factory on natural and propane gas units.

Do not use a thermostatic fan control switch when either two-stage firing or modulated gas controls are used. A fan time delay switch can be used, however, and is available as an option on outdoor duct furnaces.

All controls are located on the access side of the unit.

Chart 5 lists orifice sizes for outdoor duct furnaces.

OPERATING HIGH LIMIT CONTROL

The operating limit control is a factory installed component surface mounted in the inlet air stream end of the heat exchanger. This surface mounted safety device must have adequate contact to the rear header plate of the heat exchanger to insure its function.

When the temperature reaches the limit set point, all heat is shutoff. The limit control has a built in auto-reset that comes on when the equipment is sufficiently cooled down. Reference the unit's wiring diagram.

PILOT CONTROL

Intermittent pilot ignition is standard on all outdoor unit sizes. Intermittent pilot ignition contains a solid state ignition control system that ignites the pilot by spark for each cycle of operation. When the pilot flame is proven, the main burner valve opens to allow gas flow to the burners. Both the pilot and burners are extinguished during the off cycle.

HIGH GAS LINE PRESSURE REGULATOR (Natural Gas only)

The pressure regulator is a field installed component located external of the unit and as close as possible to where the gas line inlet enters the unit.

The pressure regulator reduces the main gas line pressure to a minimum of seven inches WC (1.74 kPa).

GAS CONTROLS

SINGLE STAGE CONTROL

Gas heating units are factory provided with an automatic single-stage gas valve. This valve is an on/off type control, typically activated by a low voltage single-stage thermostat.

1. The thermostat calls for heat.
2. The pilot valve opens.
3. The ignitor sparks continuously to ignite the pilot.
4. The sensor proves pilot ignition and shuts off the ignitor.
5. With the pilot lit, the main gas valve opens.
6. Main burners are lit at 100 percent of unit's rated input.
7. The fan time delay relay (optional) allows the heat exchanger to come up to operating temperature. At this time, the fan time delay relay closes and activates the fan controls.
8. The unit continues to fire until the thermostat is satisfied and no longer calls for heat.
9. The main and pilot valves close.

TWO-STAGE CONTROL

Optional two-stage control is provided with a two-stage gas valve capable of firing at 100% and 50% of rated input. Ignition at a low fire (50% of the unit's rated input) and the unit is typically controlled by a voltage two-stage thermostat.

With power applied to the unit, this system operates in the following manner:

1. The first stage of the thermostat call for heat.
2. The pilot valve opens.
3. The ignitor sparks continuously to ignite the pilot.
4. The sensor proves pilot ignition and shuts off the ignitor.
5. With the pilot lit, the main gas valve open to low fire.
6. Main burners are lit at 50 percent of unit's rated input.
7. The fan time delay relay (optional) allows the heat exchanger to come up to operating temperature. At this time, the fan time delay closes and activates the fan motor.
8. If additional heat is required, the second stage of the thermostat calls for heat.
9. The main gas valve opens to full fire. The main burners are now at full fire. The unit continues a full fire until the second stage of the thermostat is satisfied and no longer call for heat.
10. The main valve closes to low fire. The main burners are now at low fire. The unit continues at low fire until the first stage of the thermostat is satisfied and no longer calls for heat.
11. The main and pilot valves closes.
12. The fan time delay remains closed, keeping the fan operating to dissipate residual heat from the heat exchanger. At this time, the fan time delay relay opens and deactivates the fan motor.

ELECTRONIC MODULATING CONTROL

Units with electronic modulating control are provided with an electronic modulating valve capable of firing from 100 percent to 40 percent of rated input. Ignition is at full fire (100 percent of unit's rated input). The electronic modulating valve is controlled by a room thermostat or duct thermostat with remote setpoint adjustment which modulates the gas input from 100 percent to 40 percent of rated input.

An optional override room thermostat is available for use with the duct thermostat. The override room thermostat allows full fire and overrides the duct thermostat when the room temperature falls below the override room thermostat's setpoint.

With power applied to the unit, this system operates in the following manner:

1. The thermostat calls for heat.
2. The pilot valve opens.
3. The ignitor sparks continuously to ignite the pilot.
4. The sensor proves pilot ignition and shuts off the ignitor.
5. With the pilot lit, the main gas valve opens.
6. Main burners are lit at 100 percent of unit's rated input.
7. The fan time delay relay (optional on duct furnaces) allows the heat exchanger to come up to operating temperature. At this time the fan time delay relay closes and activates the fan motor.
8. The unit is controlled by the electronic thermostat which modulates the unit from 100 to 40 percent of unit's rated input. The electronic thermostat can be a duct sensing device or a room sensing device. An amplifier receives an electrical signal from the thermostat and converts this into a working voltage. This working voltage determines the position of the modulating valve. With no voltage applied to the valve, the valve will be full open and full fire will occur. As increasing voltage is applied to the valve, the valve will modulate closed. At approximately 12 volts dc, the valve will be at it's minimum fire position. As temperature drops, the voltage also drops causing the relay to reopen the valve. The unit will continue to cycle in this manner until either an increase in the unit's firing rate is required or the sensing device is satisfied and no longer calls for heat. If the voltage continues to increase, indicating a further reduction in the unit's firing is required, the increased voltage closes a relay which closes the automatic gas valve.
9. When the sensing device is satisfied, the main and pilot valves close.
10. The fan time delay relay remains closed keeping the fan motor operating to dissipate residual heat from the heat exchanger. At this time, the fan time delay relay opens and deactivates the fan motor.

AIR DISTRIBUTION

Two basic air control systems are used to deliver conditioned air to the occupied space: “constant” fan operation and “intermittent” fan operation.

INTERMITTENT FAN OPERATION

This air control system is available on duct furnaces when the fan time delay relay is ordered (optional). The thermostat turns the gas on whenever the temperature drops below the thermostat setting. The fan time delay relay allows the unit to fire for a period of 60 seconds before fan operation. It also allows the fan to operate for 120 seconds after burner shutdown.

CONSTANT FAN OPERATION

Duct Furnaces: This air control system is standard on duct furnaces without a fan time delay relay. The blower operates constantly, circulating air through the unit, through the discharge, continuously into the occupied zone, and back to the return. The thermostat turns the gas valve on or off, raising the temperature of the air to maintain comfort conditions in the occupied area.

AIR THROUGHPUT

Static Pressure through the duct furnace should not exceed 2.0 inches (0.50 kPa) water column. The standard outdoor duct furnaces are operated at a temperature rise range of 20° to 60°F (11° to 33°C) rise. The furnaces are also available at a higher temperature rise range of 30° - 90°F (17° - 50°C).

NOTICE: It is important that the final temperature leaving the furnace does not exceed 150°F (66°C). When final air throughput adjustments are being made, a quick check of the final temperature can be made by locating a thermometer approximately 6 to 12 inches (152 to 305 mm) downstream from the air discharge and approximately 3 to 4 inches (76 to 102 mm) from the bottom of the duct. The unit should be operated at least 15 to 20 minutes before temperature readings are made.

⚠ CAUTION A unit should never be allowed to cycle over a prolonged period on the high limit. The high limit is not an operating control. It is a safety control to prevent a fire. If cycling on the high limit is noted, corrective measures should be taken immediately. Failure to do so could cause unit damage and possible fire.

AIR FILTERS (ON MATED AIR MOVING DEVICE)

It is recommended that air filters be changed or cleaned at least twice a year. More frequent attention will be required if the air being handled is unusually dirty. Air flow reduction, caused by clogging air filters, will increase the discharge air temperature and may cause nuisance tripouts.

Filters (by others) should be serviced regularly and changed or washed when necessary to maintain the required throughput. In a dusty environment, filters may clog up in less than one month. A clogged filter switch is recommended to assist with filter maintenance.

LIGHTING

Purge the gas line of air before attempting to light the pilot in the unit. Wait 5 minutes for unburned gas to vent. Check for gas leaks.

⚠WARNING Never use an open flame to detect gas leaks. Explosive conditions may exist which could result in personal injury or death.

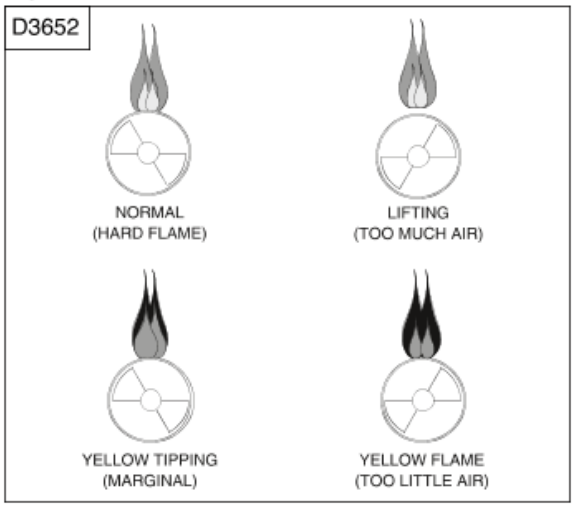
The unit is furnished with an intermittent pilot ignition system. A lighting instruction plate is permanently attached to the unit for the pilot system supplied with the unit. **To set the intermittent pilot ignition system in operation, proceed as follows:**

1. Turn on the main manual valve and pilot valve.
2. Turn on electrical power. The unit should now be under the control of the thermostat.
3. Turn the thermostat to the high heat reading to see if the pilot and main burner ignite.
4. Turn the thermostat to the lowest setting to interrupt power to the ignition system to determine that both the pilot burner and main burner are extinguished.
5. Set the thermostat at the desired setting for normal operation.

   For complete shutdown:

   1. Turn the main and pilot valves to the OFF position.
   2. Shut off electric power.
   3. Adjust the thermostat to the lowest setting.

Figure 12 - Main Burner Flames



NOTICE: There may be momentary and spasmodic orange flashes in the flame. This is caused by the burning of airborne dust particles, and not to be confused with the yellow tipping, which is a stable or permanent situation when there is insufficient primary air.

Chart 5 - Main Burner Orifice Schedule*

* INPUT IN 1000 BTU	TYPE OF GAS	STD. TEMP. RISE FURNACE (20°-60°F) NATURAL	STD. TEMP. RISE FURNACE (20°-60°F) PROPANE	NUMBER OF BURNER ORIFICES	HIGH TEMP. RISE FURNACE (30°-90°F) NATURAL	HIGH TEMP. RISE FURNACE (30°-90°F) PROPANE
	HEATING VALUE	1075 BTU/Ft³ (40.1 MJ/m³)	2500 BTU/Ft³ (93.1 MJ/m³)		1075 BTU/Ft³ (40.1 MJ/m³)	2500 BTU/Ft³ (93.1 MJ/m³)
	MANIFOLD PRESSURE	3.5 inch WC (0.87kPA)	10 inch WC (2.49 kPA)		3.5 inch WC (0.87kPA)	10 inch WC (2.49 kPA)
PV/RT 100	FT ³/HR	93	40	4	93	40
	ORIFICE DRILL	42	54		42	54
PV/RT 125	FT ³/HR	116	50	5	116	50
	ORIFICE DRILL	42	54		42	54
PV/RT 150	FT ³/HR	140	60	6	140	60
	ORIFICE DRILL	42	54		42	54
PV/RT 175	FT ³/HR	163	70	7	163	70
	ORIFICE DRILL	42	54		42	54
PV/RT 200	FT ³/HR	186	80	8	186	80
	ORIFICE DRILL	42	54		42	54
PV/RT 225	FT ³/HR	210	90	9	210	90
	ORIFICE DRILL	42	54		42	54
PV/RT 250	FT ³/HR	233	100	10	233	100
	ORIFICE DRILL	42	54		42	54
PV 300	FT ³/HR	280	120	12	NOT AVAILABLE	
	ORIFICE DRILL	42	54			
RT 300	FT ³/HR	280	120	12	280	120
	ORIFICE DRILL	42	54		42	54
PV 350	FT ³/HR	326	140	14	302	130
	ORIFICE DRILL	42	54		43	55
RT 350	FT ³/HR	326	140	14	326	140
	ORIFICE DRILL	42	54		42	54
PV/RT 400	FT ³/HR	372	160	16	372	160
	ORIFICE DRILL	42	54		42	54

* This schedule is for units operating within the U.S.A. at normal altitudes of 2000 ft. (610m) or less. For altitudes above 2,000 ft., refer to local codes, or in absence of local codes, refer to the latest edition of the National Fuel Gas Code ANSI Standard Z223.1 (NFPA no. 54).

When installed in Canada, any references to deration at altitudes in excess of 2000 feet (610m) are to be ignored. At altitudes of 2000 to 4500 feet (610 to 1372m), the unit heaters must be orificed to 90% of the normal altitude rating, and be so marked in accordance with the ETL certification.

PRIMARY AIR SHUTTER ADJUSTMENT

After the unit has been operated for at least 15 minutes, adjust the primary air flow to the burners. Turn the friction-locked, manually-rotated air shutters clockwise to close, or counterclockwise to open.

For correct air adjustment, close the air shutter until yellow tips in the flame appear. Then open the air shutter to the point just beyond the position where yellow tipping disappears.

PILOT ADJUSTMENT

1. With unit firing, remove the pilot adjustment cap.
2. Adjust the pilot screw to provide properly sized flame.
3. A proper pilot flame is a soft steady flame that envelopes 3/8 to 1/2 inch (9.5 to 12.7 mm) of the flame sensor.
4. Replace the pilot adjustment cap.

GAS INPUT ADJUSTMENT

When shipped from the factory, all gas fired units are equipped for the average BTU of the gas stamped on the rating plate.

⚠ CAUTION Since the BTU content of gases varies in many localities, the input must be checked after installation of the unit. If the unit is overfired, the overheating will substantially shorten the life of the heat exchanger. Never exceed the input on the rating plate.

The input may be checked by either the meter method or the pressure of the gas in the manifold. A 1/8 inch pipe tap is available on the body of the gas valve.

⚠ CAUTION Never overfire the unit heater, as this may cause unsatisfactory operation or shorten the life of the heater.

METER METHOD OF CHECKING INPUT:

1. Obtain the heating value of the gas from the local utility. This should be in BTU per cubic foot (MJ/m^3).
2. Determine the cubic feet per minute of the gas as shown in the following example. The rating plate input should be taken from the unit as stamped on the plate.
   EXAMPLE: Assume this is a unit having an input of 250,000 BTU/hr. and the heating value of the gas to be used in the furnace is 1000 BTU/hr.

$$\text{INPUT} = \frac{250{,}000 \text{ BTU/hr.}}{1000 \text{ BTU/cu. ft.} \times 60 \text{ min/hr}}$$

$$= 41.7 \text{ cu feet per min.}$$

   Before checking the unit input, all other gas appliances connected to the same meter must be turned off.
3. Fire the unit according to instructions.
4. Observe on the meter dial the cubic feet of gas for a period of five minutes. This should be 41.7 cu ft. per min. x 5 minutes, or 20.8 cu. feet. Minor input adjustments can be made by moving the regulator screw clockwise for increased input and counter-clockwise for decreased input. Any appreciable adjustment in input should be made by re-orificing.

MANIFOLD PRESSURE METHOD OF CHECKING INPUT

1. Close the manual gas valve on the unit.
2. Install a 1/8 inch pipe connection in the tapped hold provided on the valve body and a “U” tube or manometer by means or a rubber hose.
3. Fire the unit and observe the pressure.
4. Small variations in gas pressure adjustment can be made by means of the pressure regulator. Remove the cap from the regulator. Turning the screw clockwise will increase the input, and turning it counterclockwise will decrease the input. The adjusted manifold pressure should not vary more than 10% from the pressures specified in chart 5.

START-UP

Before starting the rooftop gas heating unit, use the "Installation Check Sheet" (found at the end of this manual) in conjunction with the procedures outlined below to ensure that the unit is completely and properly installed and ready for start-up.

1. Inspect all wiring connections; connections should be clean and tight.
2. Trace circuits to ensure that actual wiring agrees with the "as wired" diagrams provided with the unit. Information in the title block of the wiring diagram(s) should match the data appearing on the unit nameplate.
3. Verify that the system switch is in the OFF position.
4. Check unit supply voltage to ensure that it is within the utilization range.
5. Inspect the interior of the unit; remove any debris or tools which may be present.

STARTING UNIT IN HEATING MODE

1. Close the unit disconnect switch(s) that provide current to the unit control panel.

⚠WARNING High voltage is present in some areas of the control panel(s) with the unit disconnect switch closed. Failure to exercise caution when working around energized electrical components may result in injury or death from electrical shock.

2. Set the room thermostat/switching subbase as indicated below:
   a. position the heating system switch at either HEAT or AUTO;
   b. set the fan switch at AUTO; and,
   c. adjust the temperature control setting to some point above room temperature.
3. Place the system switch in the ON position.

With the thermostat calling for heating, unit operation is automatic.

FINAL CHECKOUT

Run the unit sequentially through its stages of heating. One proper unit operation is verified, perform these final steps:

1. Inspect the unit for debris and/or misplaced tools and hardware.
2. Be sure all gas valves and controls are in the operating position if the unit will be operating immediately
3. Secure all exterior panels in place.

MAINTENANCE

⚠WARNING Open all disconnect switches and secure in that position before servicing unit. Failure to do so may result in personal injury or death from electrical shock.

⚠WARNING Gas tightness of the safety shut-off valves must be checked on at least an annual basis.

To check gas tightness of the safety shut-off valves, turn off the manual valve upstream of the appliance combination control. Remove the 1/8 inch pipe plug on the inlet side of the combination control and connect a manometer to that tapping. Turn the manual valve on to apply pressure to the combination control. Note the pressure reading on the manometer, then turn the valve off. A loss of pressure indicates a leak. If a leak is detected, use a soap solution to check all threaded connections. If no leak is found, combination control is faulty and must be replaced before putting appliance back in service.

Rooftop duct furnaces have been developed for outdoor installation. Should maintenance be required, perform the following inspection and service routine: Inspect area near the unit to be sure that there is no combustible material located within minimum clearance requirements (refer to Figures 1, 2 and 6). Service panels provide easy access to the burner controls. To remove the service door, refer to "Access Panel Removal" section (at the beginning of this manual).

The pilot burner can be serviced by removing the pilot plate from the main burner assembly.

To remove the main burner drawer assembly for servicing the burners, proceed as follows:

1. Shut off the main gas valve and electrical power to the gas duct furnace.
2. To slide out the burner drawer, the following two procedures (a or b) may be chosen depending on the complexity of the unit's controls:
   a.) Disconnect the pilot burner gas tube. Break the union between the automatic gas valve and the burner manifold. Also break the union on the discharge air end of the furnace (inside the unit). Loosen the union located directly outside of the furnace's bottom panel (refer to figure 9b). Swing down this end of the piping to clear the bottom of the burner drawer. The control and piping assembly may be tied out of the way of the pull-out drawer.
   b.) Disconnect all wiring to the unit's controls. Break the union located in the discharge end of the furnace; loosen the external union, and swing piping clear of the bottom of the drawer (same procedure as a).
3. Remove the locking screws holding the burner drawer in position.
4. Slide the drawer out of the furnace.
5. Burners can be removed from the drawer by raising the front of the burner and pushing it against the hold-in spring until the front of the burner comes out of the slot.
6. To clean or replace the main burners, slide out the pullout drawer, and compress the spring by moving the burner toward the manifold. Slide the opposite end of the burner downward from the locating slot while retaining spring is still compressed. Pull the burners upward and out.
7. Remove any dirt, dust or other foreign matter from the burners using a wire brush and/or compressed air. Ensure that all parts are unobstructed. Inspect and clean pilot burner if necessary.
8. Reassemble the gas duct furnace by replacing all parts in order.
9. Complete the appropriate unit start-up procedure as given in the "Start-Up" section of this manual.
10. Check the burner adjustment. See the "Primary Air Shutter Adjustment" section of this manual.
11. Check all gas control valves and pipe connections for leaks.

⚠WARNING Under no circumstances should combustible material be located within the clearances specified in Figure 6. Failure to provide proper clearance could result in personal injury or equipment damage from fire.

12. Check the operation of the automatic gas valve by lowering the setting of the thermostat, stopping the operation of the gas duct furnace. The gas valve should close tightly, completely extinguishing the flame on the main burners.
13. Check the operation of all safety devices.
14. Inspect and service the blower section of the system.

The outdoor unit should be thoroughly checked before the start of the heating season. Check the air throughput as an added precaution to stay within the specified temperature limits.

If the unit is used with cooling equipment, periodic maintenance should be scheduled throughout the year.

Figure 13 - Natural Vent Duct Furance

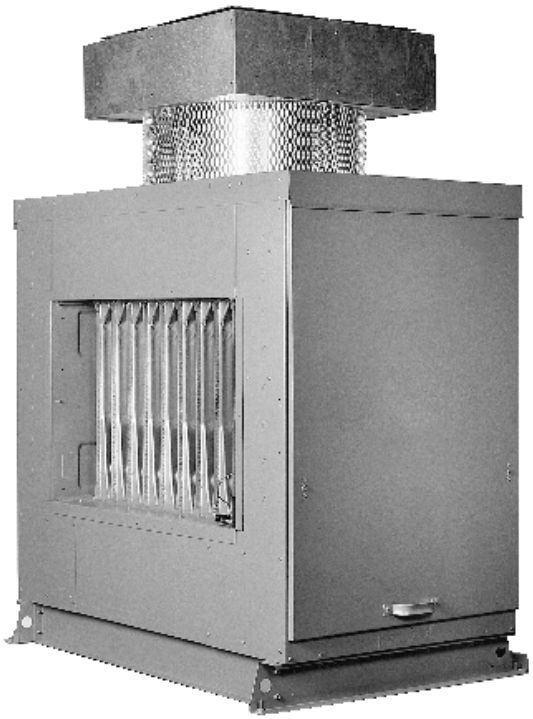


Figure 14 - Power Vent Duct Furnace

Chart 6 - Troubleshooting

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTIONS
A. **Gas odor.**	1. **Shut off gas supply immediately.** 2. Blocked heat exchanger. 3. Drafts around heater. 4. Negative pressure in the building. 5. Blocked draft hood/flue collector.	1. **Inspect all gas piping and repair.** 2. Clean heat exchanger. 3. Eliminate Drafts. Refer to installation. 4. See installation. 5. Clean draft hood/flue collector.
B. Delayed ignition.	1. Excessive primary air. 2. Main burner ports clogged near pilot. 3. Pressure regulator set too low. 4. Pilot decreases in size when main burners come on. 5. Pilot flame too small.	1. Close air shutter. Refer to operation. 2. Clean main burner ports. 3. Reset manifold pressure. Refer to operation. 4. Supply piping is inadequately sized. Refer to installation. 5. Clean pilot orifice. Refer to operation.
C. Pilot will not light, or will not stay lit.	1. Main gas off. 2. Pilot adjustment screw turned too low on combination main gas valve. 3. Air in gas line. 4. Dirt in pilot orifice. 5. Extremely high or low gas pressure. 6. Pilot valve not opening. a. Faulty wiring. b. Defective ignition control. c. Defective valve. 7. No spark. a. Faulty wiring. b. Defective pilot. c. Defective ignition control. d. Sensor grounded.	1. Open all manual gas valves. 2. Increase size of pilot flame. 3. Purge air from gas supply. 4. Remove pilot orifice. Clean with compressed air or solvent. (Do not ream). 5. Refer to operation. 6. a. Inspect & correct all wiring. b. Replace c. Replace. 7. a. Inspect & correct all wiring. b. Replace. c. Replace. d. Inspect & correct ignition system.
D. Main burners will not light.	1. Main gas off. 2. Lack of power at unit. 3. Thermostat not calling for heat. 4. Defective limit switch. 5. Improper thermostat or transformer wiring at gas valve. 6. Defective gas valve. 7. Defective thermostat.	1. Open all manual gas valves. 2. Replace fuse or turn on power supply. 3. Turn up thermostat. 4. Check limit switch with continuity tester. If open, replace limit switch. 5. Check wiring per diagrams. 6. Replace gas valve. 7. Check thermostat and replace if defective.

Chart 6 - Troubleshooting continued

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTION
D. Main burners will not light. *continued*	8. Defective transformer. 9. Loose wiring. 10. Defective ignition control.	8. Be sure 115 volts is supplied to the transformer primary then check for 24 volts at secondary terminal before replacing. 9. Check and tighten all wiring connections. 10. Replace.
E. Flame lifting from burner ports.	1. Pressure regulator set too high. 2. Defective regulator. 3. Burner orifice too large.	1. Reset manifold pressure. Refer to operation. 2. Replace regulator section of combination gas valve or complete valve. 3. Check with local gas supplier for proper orifice size and replace. Refer to operation.
F. Flame pops back.	1. Excessive primary air.	1. Close air shutter. Refer to Operation. 2. Check with local gas supplier for proper orifice size and replace.
G. Noisy flame.	1. Too much primary air. 2. Noisy pilot. 3. Irregular orifice causing whistle or resonance. 4. Excessive gas input. a. Pressure regulator set too high. b. Defective regulator. c. Burner orifice too large.	1. Close air shutter. Open all manual gas valves. 2. Reduce pilot gas. Refer to operation. 3. Replace orifice. 4. a. Reset manifold pressure Refer to operation. b. Replace regulator section of combination gas valve or complete valve. c. Check with local gas supplier for proper orifice size and replace. Refer to operation.
H. Yellow tip flame (some yellow tipping on propane gas is permissible.	1. Insufficient primary air. 2. Clogged main burner ports. 3. Misaligned orifices. 4. Air shutter linted. 5. Insufficient combustion air. 6. Clogged draft hood/flue collector.	1. Open air shutters. Refer to operation. 2. Clean main burner ports. 3. Replace manifold assembly. 4. Check for dust or lint at air mixer opening and around the air shutter. 5. Clean combustion air inlet openings in bottom panel. Refer to installation. 6. Clean draft hood/flue collecter.

Chart 6 - Troubleshooting continued

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTION
J. Floating flame.	1. Blocked heat exchanger. 2. Insufficient combustion air. 3. Blocked venting. 4. Air leak into combined chamber, draft hood, or flue collector.	1. Clean heat exchanger. 2. Clean combustion air inlet openings in bottom panel. Refer to installation. 3. Clean flue. Refer to installation. 4. Determine cause and repair accordingly. Refer to installation.
K. Burner won't turn off.	1. Poor thermostat location. 2. Defective thermostat. 3. Improper thermostat or transformer. 4. Short circuit. 5. Defective or sticking gas valve. 6. Excessive gas supply pressure.	1. Relocate thermostat away from drafts. 2. Replace thermostat. 3. Check wiring diagrams. 4. Check operation at valve. Look for short and correct (such as staples piercing thermostat wiring). 5. Replace gas valve. 6. Refer to operation.
L. Rapid burner cycling.	1. Loose electrical connections at gas valve or thermostat. 2. Excessive thermostat heat anticipation. 3. Unit cycling on high limit. 4. Poor thermostat location.	1. Tighten all electrical connections. 2. Adjust thermostat heat anticipation for longer cycles. Refer to operation. 3. Check for proper air supply across heat exchanger. 4. Relocate thermostat. (Do not mount thermostat on unit).
M. Not enough heat.	1. Incorrect gas input. 2. Heater undersized. 3. Thermostat malfuction. 4. Heater cycling on limit control. 5. Check outside dampers if used.	1. Refer to operation. 2. This is especially true when the heated space is enlarged. Have the heat loss calculated and compare to the heater output (80% of input). Your gas supplier or installer can furnish this information. If heater is undersized, add additional heaters. 3. Replace thermostat. 4. Check air movement through heat exchanger. Check voltage to power venter motor, clean power venter wheel and heat exchanger, and oil power venter motor. Check filters, replace if necessary. 5. Adjust dampers accordingly.

Chart 6 - Troubleshooting continued

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTION
N. Too much heat.	1. Thermostat malfunction. 2. Heater runs continuously. a. Improper thermostat or transformer wiring at gas valve. b. Short circuit. c. Defective or sticking gas valve. d. Excessive gas supply pressure.	1. Replace thermostat. 2. a. Check wiring per diagrams. b. Check operation at valve. Look for short and correct (such as staples piercing thermostat wiring). c. Replace gas valve. d. Refer to operation.
*P. Power venter motor will not start.	1. Lack of power at unit. 2. Defective power venter relay. 3. Defective motor. 4. Thermostat not calling for heat. 5. Defective limit switch.	1. Replace fuse or turn on power. 2. Replace. 3. Replace. 4. Turn up thermostat. 5. Replace limit switch.
*Q. Noisy power venter.	1. Power venter wheel loose. 2. Bearings dry. 3. Power venter wheel blade dirty. 4. Power venter wheel rubbing housing.	1. Tighten or replace. 2. Oil bearings on power venter motor. 3. Clean power venter wheel blade. 4. Realign power venter wheel.
*R. Power venter will not run.	1. Loose wiring. 2. Defective motor overload protector or defective motor. 3. Defective power venter relay.	1. Check and tighten all wiring connections per diagrams. 2. Replace motor. 3. Check for 24V across 1 & 3 terminals on fan relay. If 24V is present, jumper terminals numbered 2 and 4. If motor runs, relay is defective and must be replaced. If 24V is not present check wiring diagrams.
*S. Power venter motor will not stop.	1. Improperly wired fan relay. 2. Defective fan relay.	1. Check all wiring. 2. Replace fan relay.

***Indicates Power Vent Units Only**

How to order Replacement Parts

Please provide the following information to your local representative:

- Unit Number
- Serial Number (if any)
- Part Description and Number as shown in Replacement Parts Literature

If further assistance is needed, please contact the manufacturer's customer service department.

SERVICE NOTE

Due to the many configurations, options and voltage characteristics available on Outdoor Duct Furnaces, the information provided in their manual is somewhat general in its context. Should user or service organization incur a problem, the nature of which is not herein, we urge you to contact the manufacturer. It would be of great assistance to the manufacturer if you can provide the model and serial number and wiring diagram number, as well as access type.

LIMITED WARRANTY

Gas–Fired Engineered Products
Natural or Power Vented Outdoor Duct Furnaces

The "Manufacturer" warrants to the original owner at the original installation site that the Gas–Fired Engineered Products (the "Product") will be free from defects in material or workmanship for a period not to exceed one (1) year from the date start up or eighteen (18) months from the date of shipment from the factory, whichever occurs first. If upon examination by the Manufacturer the Product is shown to have a defect in material or workmanship during the warranty period, the Manufacturer will repair or replace, at its option, that part of the Product which is shown to be defective.

This limited warranty does not apply:

(a) if the Product has been subjected to misuse or neglect, has been accidentally or intentionally damaged, has not been installed, maintained or operated in accordance with the furnished written instructions, or has been altered or modified in any way.
(b) to any expenses, including labor or material, incurred during removal or reinstallation of the defective Product or parts thereof.
(c) to any damage due to corrosion by chemicals (including halogenated hydrocarbons) precipitated in the air.
(d) to any workmanship of the installer of the Product.

This limited warranty is conditional upon:

(a) shipment, to the Manufacturer, of that part of the Product thought to be defective. Goods can only be returned with prior written approval from the Manufacturer. All returns must be freight prepaid.
(b) determination, in the reasonable opinion, of the Manufacturer that there exists a defect in material or workmanship.

Repair or replacement of any part under this Limited Warranty shall not extend the duration of the warranty with respect to such repaired or replaced part beyond the stated warranty period.

THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, AND ALL SUCH OTHER WARRANTIES, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS LIMITED WARRANTY. IN NO EVENT SHALL THE MANUFACTURER BE LIABLE IN ANY WAY FOR ANY CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OF ANY NATURE WHATSOEVER, OR FOR ANY AMOUNTS IN EXCESS OF THE SELLING PRICE OF THE PRODUCT OR ANY PARTS THEREOF FOUND TO BE DEFECTIVE. THIS LIMITED WARRANTY GIVES THE ORIGINAL OWNER OF THE PRODUCT SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY BY EACH JURISDICTION.

In the interest of product improvement, we reserve the right to make changes without notice.

NOTES:

GAS EQUIPMENT START-UP

Customer _____ **Job Name & Number** _____

PRE-INSPECTION INFORMATION
With power and gas off.

Type of Equip: Duct Furnace Rooftop

Serial Number _____ Model Number _____

Name Plate Voltage: _____ Name Plate Amperage: _____

Type of Gas: Natural LP Tank Capacity _____ lbs. Rating: _____ BTU @ ____ °F
_____ kg _____ kw @ ____ °C

- ❒ Are all panels, doors, vent caps in place?
- ❒ Has the unit suffered any external damage? Damage _____
- ❒ Does the gas piping and electric wiring appear to be installed in a professional manner?
- ❒ Has the gas and electric been inspected by the local authority having jurisdiction?
- ❒ Is the gas supply properly sized for the equipment?
- ❒ Were the installation instructions followed when the equipment was installed?
- ❒ Have all field installed controls been installed?
- ❒ Do you understand all the controls on this equipment? ***If not, contact your wholesaler or rep.***
(DO NOT START this equipment unless you fully understand the controls.)

GENERAL
With power and gas off.

- ❒ Make certain all packing has been removed.
- ❒ Tighten all electrical terminals and connections.
- ❒ Check damper linkages for tightness.
- ❒ Check all fans & blowers for free movement.
- ❒ Check all controls for proper settings.
- ❒ Check all set screws on blowers and bearings.
- ❒ Check belt tightness.

GAS HEATING
With power and gas on.

- ❒ Inlet gas pressure. ____ in. WC or ____ kPa
- ❒ Pilot & main burner ignition.
- ❒ Manifold gas pressure. ____ in. WC or ____ kPa
- ❒ Cycle firestat and/or freezestat.
- ❒ Check electronic modulation. Set at: _____
- ❒ Cycle and check all other controls not listed.
- ❒ Check operation of remote panel.
- ❒ Entering air temp. ____ °F or ____ °C
- ❒ Discharge air temp. (high fire) ____ °F ____ °C
- ❒ External static pressure ____ in. WC or ____ kPa
- ❒ Cycle by thermostat or operating control.
- ❒ Combustion Reading
  Carbon Monoxide ____ PPM
  Carbon Dioxide ____ %

Remarks: _____

_____

_____

AC/VCR

Centrifugal Roof and Wall Exhausters

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

This publication contains the installation, operation and maintenance instructions for standard units of the *AC & VCR: Centrifugal Roof and Wall Exhausters.*

Carefully read this publication and any supplemental documents prior to any installation or maintenance procedure.

Loren Cook catalogs, *AC* and *VCR,* provide additional information describing the equipment, fan performance, available accessories and specification data.

For additional safety information, refer to AMCA Publication 410-96, *Safety Practices for Users and Installers of Industrial and Commercial Fans*.

All of the publications listed above can be obtained from:

- lorencook.com
- *info@lorencook.com*
- 417-869-6474 ext. 166

For information and instructions on special equipment, contact Loren Cook Company at 417-869-6474.

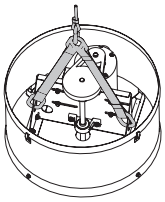
Receiving and Inspection

Carefully inspect the fan and accessories for any damage and shortage immediately upon receipt of fan.

- Turn the wheel by hand to ensure it turns freely and does not bind
- Inspect dampers (if included) for free operation of all moving parts
- Record on the Delivery Receipt any visible sign of damage

Handling

Lift the fan by the lifting lugs provided under top cap. ***NOTICE! Never lift by the shaft, motor or housing.***



Lifting Lugs

Storage

If the fan is stored for any length of time prior to installation, store it in its original shipping crate and protect it from dust, debris and the weather.

Installation

If the fan was delivered with the motor unmounted, see the maintenance sections for belt and pulley installation.

ACE

ACRU ACSC VCR

ACW

⚠WARNING

Rotating Parts & Electrical Shock Hazard:

Fans should be installed and serviced by qualified personnel only.

Disconnect electric power before working on unit (prior to removal of guards or entry into access doors).

Follow proper lockout/tagout procedures to ensure the unit cannot be energized while being installed or serviced.

A disconnect switch should be placed near the fan in order that the power can be swiftly cut off, in case of an emergency and in order that maintenance personnel are provided complete control of the power source.

Grounding is required. All field-installed wiring must be completed by qualified personnel. All field installed wiring must comply with National Electric Code (NFPA 70) and all applicable local codes.

Fans and blowers create pressure at the discharge and vacuum at the inlet. This may cause objects to get pulled into the unit and objects to be propelled rapidly from the discharge. The discharge should always be directed in a safe direction and inlets should not be left unguarded. Any object pulled into the inlet will become a projectile capable of causing serious injury or death.

When air is allowed to move through a non-powered fan, the impeller can rotate, which is referred to as windmilling. Windmilling will cause hazardous conditions due to unexpected rotation of components. Impellers should be blocked in position or air passages blocked to prevent draft when working on fans.

Friction and power loss inside rotating components will cause them to be a potential burn hazard. All components should be approached with caution and/or allowed to cool before contacting them for maintenance.

Under certain lighting conditions, rotating components may appear stationary. Components should be verified to be stationary in a safe manner, before they come into contact with personnel, tools or clothing.

Failure to follow these instructions could result in death or serious injury.

The attachment of roof mounted fans to the roof curb as well as the attachment of roof curbs to the building structure must exceed the structural requirements based on the environmental loading derived from the applicable building code for the site. The local code official may require variations from the recognized code based on local data. The licensed engineer of record will be responsible for prescribing the correct attachment based on construction materials, code requirements and environmental effects specific to the installation.

Wall Exhausters

If the fan is a wall mount unit and a grease terminator or grease trough was not purchased, a 1-1/16 inch diameter drain hole should be inserted on the bottom side of the unit for drainage.

If your fan is a wall exhauster with a round base, a mounting template is shipped with the fan. Use the template to locate the necessary lag screws or anchor bolts on the wall. The fan can then be lifted and attached easily. Secure with lag screws, anchor bolts, or other suitable fasteners.

VCR Installation

1. Ensure the fan discharge is a minimum 40 inches above the roof the roof surface and a minimum of 10 foot from any building air intake in order to comply with NFPA 96.
2. Minimum exhaust velocity in the duct should be 1500 FPM in accordance with NFPA 96.
3. If the fan is installed on a surface that is not level, install the fan in a position that places the drain tube at the lowest position.
4. Secure the fan to the roof curb at all four corners using a minimum of four anchor bolts, lag screws or other suitable fastener.

Damper Installation

If your fan is supplied with dampers, follow the directions below.

1. Place the damper inside the curb or inside the duct work. Ensure the damper will open freely for the correct direction of the airflow.
2. Secure to curb at the damper shelf.
3. Drill hole in the curb shelf for conduit needed for motor wiring.
4. Operate the dampers manually to ensure the blades move freely.
5. Install fan over curb while aligning the conduit location with the conduit hole in the curb.

⚠WARNING

Smoke Control:

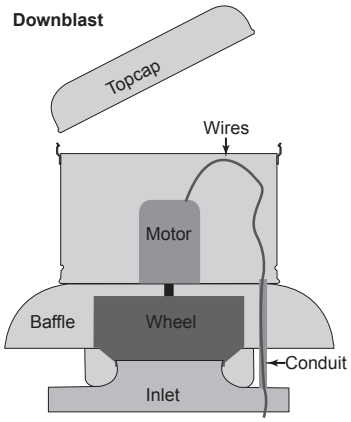
Use of any backdraft dampers is not permitted. Fire dampers and/or smoke dampers may be required in a smoke control system. These dampers must meet the requirements determined by the local code authority.

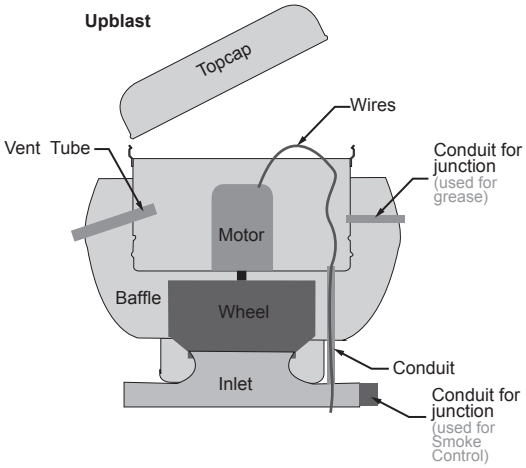
Wiring

ACRU Upblast units have two wiring conduits. The horizontal conduit is directly above the vertical conduit. ACE downblast units have a single vertical conduit.

The motor's wiring box is the approved field wiring compartment of the unit for ACE, ACRU and ACW units. The motor's wiring box may be on the side of the motor, the shaft end of the motor or the opposite shaft end of the motor. If an additional field wiring compartment is added, then an approved metal box with cover must be secured to the unit with two screws in order that the box does not rotate. All wiring must be protected from abrasion where they enter and exit. The ground wire must be secured under the green ground screw within the field wiring compartment. See motor wiring diagram, NEC and local code for additional details.

For VCR and ACSC units a separate NEMA 3 field wiring compartment is provided on the exterior of the unit.





⚠ ***For further information refer to the National Electrical Code and the wiring diagram provided on the motor.***

Leave enough slack in the wiring to allow for motor movement when adjusting belt tension. Some fractional motors have to be removed in order to make the connection with the terminal box at the end of the motor.

NOTICE! Follow the wiring diagram in the disconnect switch and the wiring diagram provided with the motor. Correctly label the circuit on the main power box and always identify a closed switch to promote safety (i.e., red tape over a closed switch).

1. Remove the top cap which covers the motor assembly by unlatching the snap clips.
2. For internal wiring, run the electrical wire and conduit through the opening drilled in the damper shelf (refer to Damper Installation), then through the wiring conduit in the ventilator base to the motor compartment. For external wiring, run the wires through the horizontal conduit on upblast units, or under top cap in downblast units.
3. Pull the wires through and complete the wiring.

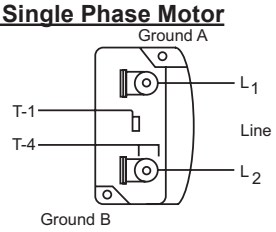
Use the following diagrams to wire the motor except for EC and EC/PM wiring diagrams; see additional supplement.

Wiring Diagrams

Vari-Flow

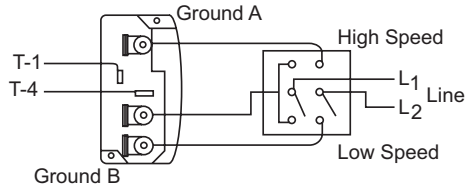
For EC or VF see EC Motor Wiring supplement. For VF2 see PM wiring supplement.

Single Speed, Single Phase Motor



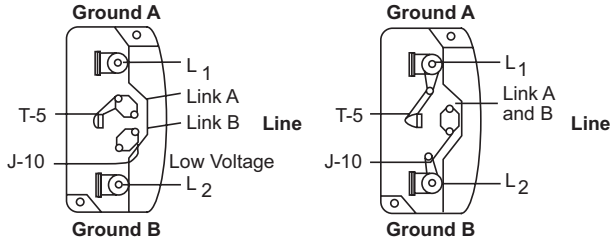
When ground is required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-1 and T-4.

2 Speed, 2 Winding, Single Phase Motor



When ground is required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-1 and T-4 leads.

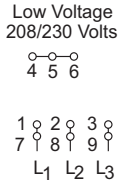
Single Speed, Single Phase, Dual Voltage

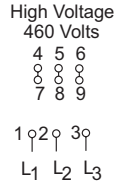


When ground is required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-5 and J-10 leads.

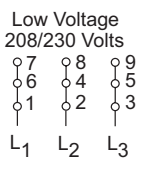
3-Phase, 9 Lead Motor

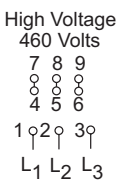
Y-Connection





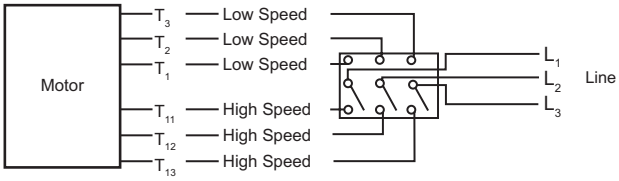
Delta-Connection





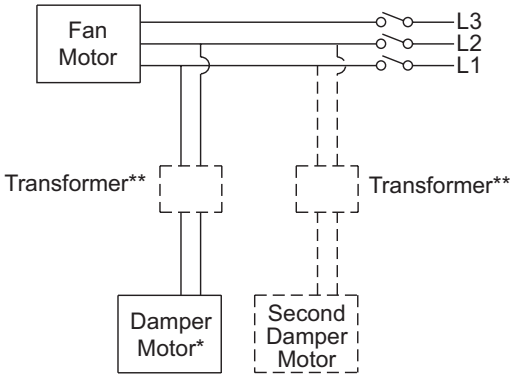
To reverse, interchange any two line leads.

2 Speed, 2 Winding, 3-Phase



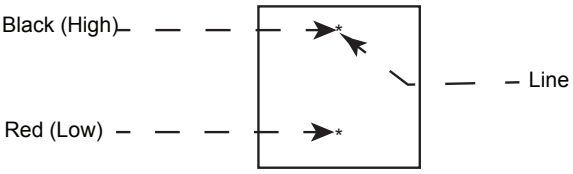
To reverse: High Speed: interchange leads T_{11} and T_{12}; Low Speed: interchange leads T_1 and T_2; Both Speeds: interchange any two line leads.

Typical Damper Motor Schematic



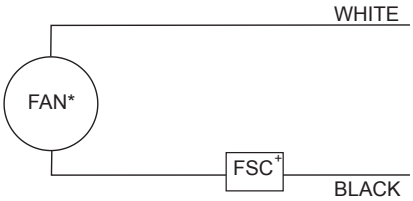
For 3-Phase, damper motor voltage should be the same between L_1 and L_2. For single phase application, disregard L_3.
*Damper motors may be available in 115, 230 and 460 volt models. The damper motor nameplate voltage should be verified prior to connection.
**A transformer may be provided in some installations to correct the damper motor voltage to the specified voltage.

2-Speed PSC Motors

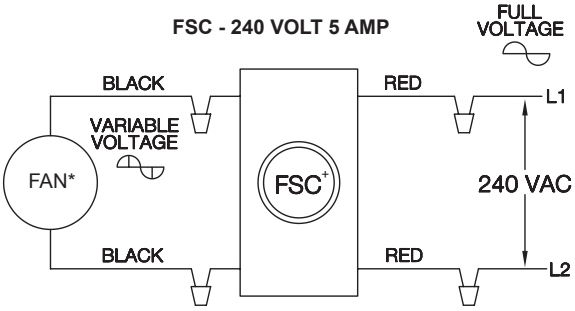


*Cap or insulate unused lead

FSC - 115 VOLT 10 AMP

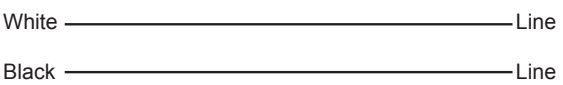


FSC - 240 VOLT 5 AMP



* See wiring diagram for motor wiring.
+ Locate away from heat.

Shade Pole or PSC Motors



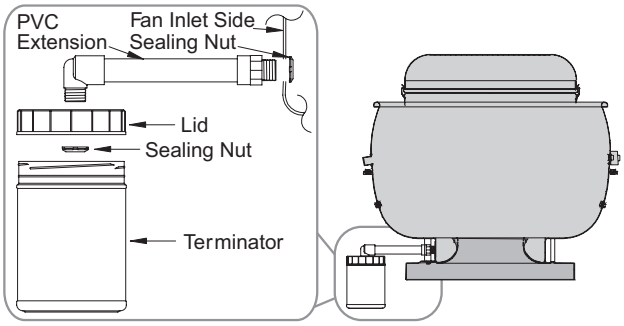
⚠WARNING

Electrical Shock & Fire Hazard:

Insulate Unused Leads Separately.

Failure to follow these instructions could result in death or serious injury.

Grease Terminator



Final Installation Steps

1. Ensure fasteners and set screws, particularly fan mounting and bearing fasteners are tightened according to the recommended torque table, shown below.

Recommended Torque for Setscrews/Bolts (IN-LB)

Setscrews				Hold Down Bolts	
Size	Key Hex Across Flats	Recommended Torque		Size	Recommended Torque
		Min.	Max.		
#8	5/64”	15	21	3/8”-16	324
#10	3/32”	27	33	1/2”-13	780
1/4	1/8”	70	80	5/8”-11	1440
5/16	5/32”	140	160	3/4”-10	2400
3/8	3/16”	250	290	7/8”-9	1920
7/16	7/32”	355	405	1”-8	2700
1/2	1/4”	560	640	1-1/8”-7	4200
5/8	5/16”	1120	1280	1-1/4”-7	6000
3/4	3/8”	1680	1920	-	-
7/8	1/2”	4200	4800	-	-
1	9/16”	5600	6400	-	-

2. Inspect for correct amperage with an ammeter and correct voltage with a voltmeter.
3. Ensure that all accessories are installed.
4. Test the fan to be sure the rotation is the same as indicated by the arrow marked ‘Rotation’.

NOTICE! Do not allow the fan to run in the wrong direction. This will overheat the motor and cause serious damage. For 3-phase motors, if the fan is running in the wrong direction, check the control switch. It is possible to interchange two leads at this location so that the fan is operating in the correct direction.

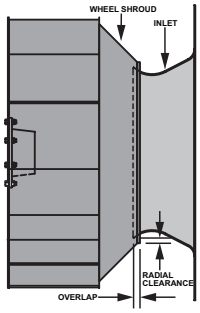
5. Inspect wheel-to-inlet clearance. Wheels may shift in shipment. To realign wheel-to-inlet, shift upper bearing so there is an equal radial clearance between the wheel and inlet.

Wheel-to-Inlet Clearance

The correct wheel-to-inlet clearance is critical to proper fan performance. This clearance should be verified before initial start-up since rough handling during shipment could cause a shift in fan components. Refer to wheel/inlet drawing for correct overlap.

Adjust the overlap by loosening the wheel hub and moving the wheel along the shaft to obtain the correct value.

A uniform radial gap (space between the edge of the cone and the edge of the inlet) is obtained by loosening the upper or lower bearing.



Size	Overlap
60 - 165	3/16”
180 - 245	1/4”
270 - 300	5/16”
330 - 365	3/8”
402	7/16”
445 - 490	1/2”
540	13/16”

Operation

Pre-Start Checks

1. Lock out all the primary and secondary power sources.
2. Inspect and tighten fasteners and setscrews, particularly fan mounting and bearing fasteners Refer to *Torque* chart.
3. Inspect belt tension and pulley alignment. Refer to *Belt and Pulley Installation*.
4. Inspect motor wiring. Refer to *Wiring Installation*.
5. Ensure belt touches only the pulleys.
6. Rotate the wheel to ensure it rotates freely.
7. Ensure fan and ductwork are clean and free of debris.
8. Close and secure all access doors.
9. Restore power to fan.

Start Up

Turn on the fan. (In variable speed units, set the fan to its lowest speed.) Inspect for the following:

- Direction of rotation
- Excessive vibration
- Unusual noise
- Bearing noise
- Improper belt alignment or tension (listen for squealing)
- Improper motor amperage or voltage

If a problem is discovered, immediately shut the fan off. Lock out all electrical power and check for the cause of the trouble. Refer to the Trouble-shooting section.

Use of Variable Frequency Drives

Motors

Motors that are to be operated using a Variable Frequency Drive (VFD) must be VFD compatible. Motors that are not supplied by Loren Cook Company should have the recommendation of the motor manufacturer for use with a VFD.

Grounding

The fan frame, motor and VFD must be connected to a common earth ground to prevent transient voltages from damaging rotating elements.

Wiring

Line reactors may be required to reduce over-voltage spikes in the motors. The motor manufacturer should be consulted for recommended line impedance and usage of line reactors or filters if the lead length between the VFD and the motor exceeds 10 ft (3m).

Fan

It is the responsibility of the installing body to perform coast-down tests and identify any resonant frequencies after the equipment is fully installed. These resonant frequencies are to be removed from the operating range of the fan by using the “skip frequency” function in the VFD programming. Failure to remove resonant frequencies from the operating range will decrease the operating life of the fan and void the warranty.

Inspection

Inspection of the fan should be conducted at the first 30 minute, 8 hour and 24 hour intervals of satisfactory operation. During the inspections, stop the fan and inspect as instructed.

30 Minute Interval

Inspect bolts, setscrews, and motor mounting bolts. Adjust and tighten as necessary.

8 Hour Interval

Inspect belt alignment and tension. Adjust and tighten as necessary.

24 Hour Interval

Inspect belt tension. Adjust and tighten as necessary

Year-round Inspection

Establish a schedule for inspecting all parts of the fan. The frequency of inspection depends on the operating conditions and location of the fan. Regular inspections may be required per local codes. Contact the local code authority for inspection requirements.

All Units

It is recommended the following inspections be conducted twice per year

- Inspect bolts and setscrews for tightness. Tighten as necessary. Refer to *Recommended Torque* chart
- Inspect belt wear and alignment. Replace worn belts with new belts and adjust alignment as needed. Refer to *Belt and Pulley Installation*, page 3
- Bearings should be inspected as recommended in the *Conditions Chart*
- Inspect for cleanliness. Clean exterior surfaces only. Removing dust and grease on motor housing assures proper motor cooling

Units exhausting corrosive or contaminated air

Inspect fans exhausting corrosive or contaminated air within the first month of operation. Fans exhausting contaminated air should be inspected every three months.

NOTICE! ACSC fan is intended for general ventilation, and is UL Listed for Smoke Control Systems. The fan should not be used to exhaust corrosive or contaminated air.

VCR & ACRU

Regular inspections of the Grease Terminator 2 are recommended. Depending on the amount of grease discharged through the fan, the Grease Terminator 2 should be changed every 30 to 45 days to ensure proper operation. Any buildup of grease is easily seen during a visual inspection of the clear canister. However, if the Grease Terminator 2 becomes saturated, grease will no longer be absorbed.

Maintenance

Fan Bearings

NOTICE! The fan bearings are provided prelubricated. Any specialized lubrication instructions on fan labels supersedes information provided herein. Bearing grease is a petroleum lubricant in a lithium base conforming to an NLGI #2 consistency. If user desires to utilize another type of lubricant, they take responsibility for flushing bearings and lines, and maintaining a lubricant that is compatible with the installation.

An NLGI #2 grease is a light viscosity, low-torque, rust-inhibiting lubricant that is water resistant. Its temperature range is from -30°F to 200°F and capable of intermittent highs of 250°F.

Relubrication Intervals

RPM	Temp °F	Greasing Interval
Up to 1000	-30 to 120	6 months
	120 to 200	2 months
1000 to 3000	-30 to 120	3 months
	120 to 200	1 month
Over 3000	-30 to 120	1 month
	120 to 200	2 weeks
Any Speed	< -30	Consult Factory
Any Speed	> 200	1 week

For moist or otherwise contaminated installations; divide the interval by a factor of three. For vertical shaft installations divide the interval by a factor of two.

For best results, lubricate the bearing while the fan is in operation. Pump grease in slowly until a slight bead forms around the bearing seals. Excessive grease can damage seal and reduce life through excess contamination and/or loss of lubricant.

In the event that the bearing cannot be seen, use no more than three injections with a hand operated grease gun.

Motor Bearings

Motors are provided with prelubricated bearings. Any lubrication instructions shown on the motor nameplate supersede instructions below.

Motor bearings without provisions for relubrication should operate up to 10 years under normal conditions with no maintenance. In severe applications, high temperatures or excessive contaminates, it is advisable to have the maintenance department disassemble and lubricate the bearings after three years of operation to prevent interruption of service. For motors with provisions for relubrication, follow intervals of the table.

NOTICE! Motors are provided with a polyurea mineral oil NGLI #2 grease. All additions to the motor bearings are to be with a compatible grease such as Exxon Mobil Polyrex EM and Chevron SRI. To inspect, clean or repair, refer to the diagram below and follow these steps:

Service Conditions	NEMA Frame Size					
	Up to & Including 184T		213T - 365T		404T and Larger	
	1800 RPM and less	Over 1800 RPM	1800 RPM and less	Over 1800 RPM	1800 RPM and less	Over 1800 RPM
Standard	3 yrs	6 months	2 yrs	6 months	1 yr	3 months
Severe	1 yr	3 months	1 yr	3 months	6 months	1 month

The above intervals should be reduced to half for vertical shaft installations.

Motor Services

Should the motor prove defective within a one-year period, contact your local Loren Cook representative or your nearest authorized electric motor service representative.

Changing Shaft Speed

Belt driven ventilators (5HP or less) are equipped with variable pitch pulleys. To change fan speed, perform the following

1. Remove belt (see pulleys/belts for details).
2. Loosen setscrew on driver (motor) pulley and remove key, if equipped.
3. Turn the pulley rim to open or close the groove facing. If the pulley has multiple grooves, all must be adjusted to the same width.
4. After adjustment, reinstall belt and inspect for proper belt tension.

Maximum RPM

Size	ACE		ACRU, ACSC, ACW & VCR				
			Standard		HP		XP
	Standard	Reinforced	Standard	Reinforced	Standard	Reinforced	Standard
60	1981	-	-	-	-	-	-
70	1941	-	-	-	-	-	-
80	1806	-	-	-	-	-	-
100	2013	-	2002	-	-	-	-
120	1669	-	1671	-	-	-	-
135	1574	-	1574	-	-	-	-
150	1519	-	1520	-	1952	-	-
165	1296	-	1295	-	1728	-	2508
180	1513	-	1546	-	1829	-	2396
195	1348	-	1353	-	1570	-	2100
210	1190	-	1205	-	1626	-	2126
225	1043	-	1086	-	1435	-	1879
245	885	-	901	-	1185	1234	1616
270	752	-	766	-	1025	1049	1656
300	837	861	837	877	980	1046	1391
330	716	734	716	748	830	912	1182
365	624	648	624	659	735	872	1132
402	539	550	539	560	-	-	-
445	463	465	463	473	-	-	-
490	360	396	360	403	-	-	-
540	347	401	-	-	-	-	-

Speed Reduction:

Open the pulley in order that the belt rides deeper in the groove (smaller pitch diameter).

Speed Increase:

Close the pulley in order that the belt rides higher in the groove (larger pitch diameter). Ensure that the RPM limits of the fan and the horsepower limits of the motor are maintained.

Replace Pulleys / Belts

1. Clean the motor and fan shafts.
2. Loosen the motor plate mounting bolts to relieve the belt tension. Remove the belt.
3. Loosen the pulley setscrews and remove the pulleys from the shaft. If excessive force is required to remove the pulleys, a three-jaw puller can be used. This tool, however, can easily warp a pulley. If the puller is used, inspect the trueness of the pulley after it is removed from the shaft. The pulley will need replacement if it is more than 0.020 inch out of true.
4. Clean the bores of the pulleys and place a light coat of oil on the bores.
5. Remove any grease, rust or burrs from pulleys.
6. Place the fan pulley on the fan shaft and the motor pulley on the motor shaft. Damage to the pulleys can occur when excessive force is used in placing the pulleys on their respective shafts.
7. After the pulleys have been correctly placed back onto their shafts, tighten the pulley setscrews.

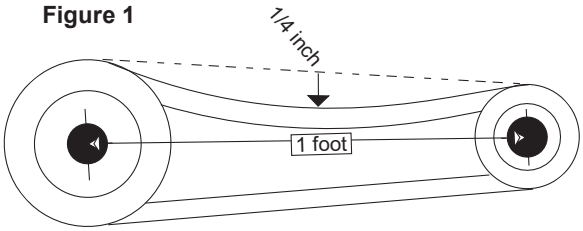
Belt tension

Belt tension is determined by the sound of the belts when the fan is first started. The belts will produce a loud squeal, which dissipates after the fan is operating at full capacity. If belt tension is too tight or too loose, lost efficiency and damage may occur.

Do not change the pulley pitch diameter to change tension. The change will result in a different fan speed.

For units shipped with automatic belt tensioners please refer to the *Automatic Belt Tensioner Supplement I*.

Figure 1



1. Loosen motor plate adjustment bolts and slide motor plate so that belts easily slip into the grooves on the pulleys. Never pry, roll, or force the belts over the rim of the pulley.
2. Slide motor plate until proper tension is reached. For proper tension, a deflection of approximately 1/4" per foot of center distance should be obtained by firmly pressing the belt. Refer to *Figure 1*.
3. Lock the motor plate adjustment bolts in place.

Figure 2

4. Ensure pulleys are properly aligned. Refer to *Figure 2*.

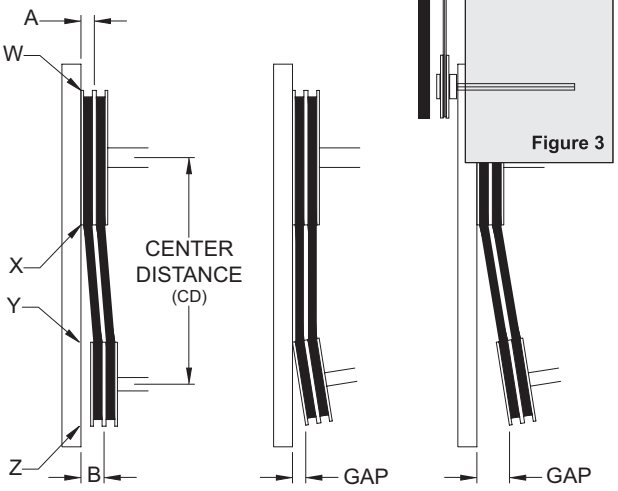


Figure 3

Center Distance	Maximum Gap
Up through 12”	1/16”
12 through 48”	1/8”
Over 48”	1/4”

Belt Alignment

Pulley alignment is adjusted by loosening the motor pulley setscrew and by moving the motor pulley on the motor shaft. *Figure 2* indicates where to measure the allowable gap for the drive alignment tolerance. All contact points (indicated by WXYZ) are to have a gap less than the tolerance shown in the table. When the pulleys are not the same width, the allowable gap must be adjusted by half of the difference in width. *Figure 3* illustrates using a carpenter’s square to adjust the position of the motor pulley until the belt is parallel to the longer leg of the square.

Bearing Replacement

The fan bearings are pillow block type ball bearings.

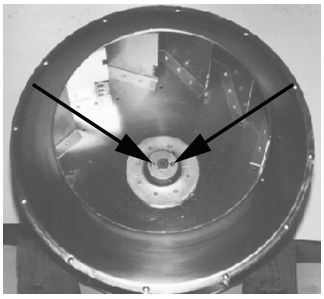
1. Remove the old bearing.
2. Remove any burrs from the shaft by sanding.
3. Slide new bearings onto the shaft to the desired location and loosely mount bearings onto the bearing support. Bearing bolts and setscrews should be loose enough to allow shaft positioning.
4. Correctly position the wheel and tighten the bearing bolts securely to the bearing support.
5. Align setscrews bearing to bearing and secure tightly to the shaft.

NOTICE! Never tighten both pairs of setscrews before securing bearing mounting bolts. This may damage the shaft.

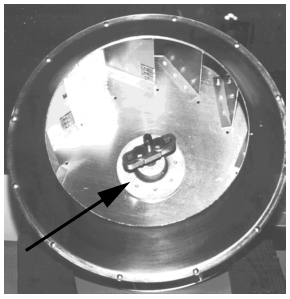
6. Inspect the wheel position again. If necessary, readjust by loosening the bearing bolts and setscrews and repeat from step 3.

Wheel Replacement

1. Drill two holes approximately centered between the shaft and the edge of the hub outer dimension with the following dimensions:
   - 1/4” diameter
   - 3/8” to 1/2” deep
   - 180° apart in face of hub
2. Tap 1/4” holes to 5/16” thread with the 5/16” hole tap. Do not drill or tap any larger than recommended.
3. Screw the puller arms into the tapped holes full depth of threads (3/8” to 1/2” approximately). Align center of puller with center of shaft. Make certain all setscrews in hub (normally a quantity of two) are fully removed. Work puller slowly to back wheel off the shaft.



Drilled Hole Location



Wheel Puller

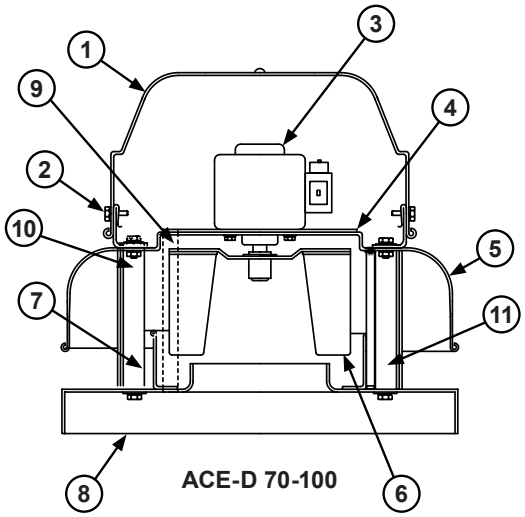
Recommended Puller:

Lisle No. 45000 Steering Wheel Puller. This puller is available at most automotive parts retail outlets.

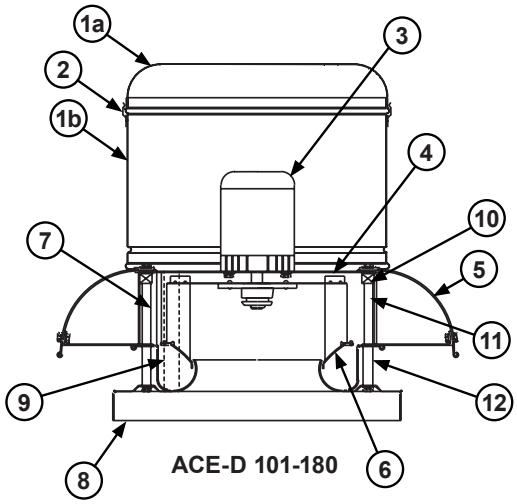
Troubleshooting

Problem and Potential Cause
Low Capacity or Pressure: • Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. • Poor fan inlet conditions. There should be a straight clear duct at the inlet. • Improper wheel alignment.
Excessive Vibration and Noise: • Damaged or unbalanced wheel. • Belts too loose; worn or oily belts. • Speed too high. • Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. • Bearings need lubrication or replacement. • Fan surge.
Overheated Motor: • Motor improperly wired. • Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. • Cooling air diverted or blocked. • Improper inlet clearance. • Incorrect fan RPMs. • Incorrect voltage.
Overheated Bearings: • Improper bearing lubrication • Excessive belt tension

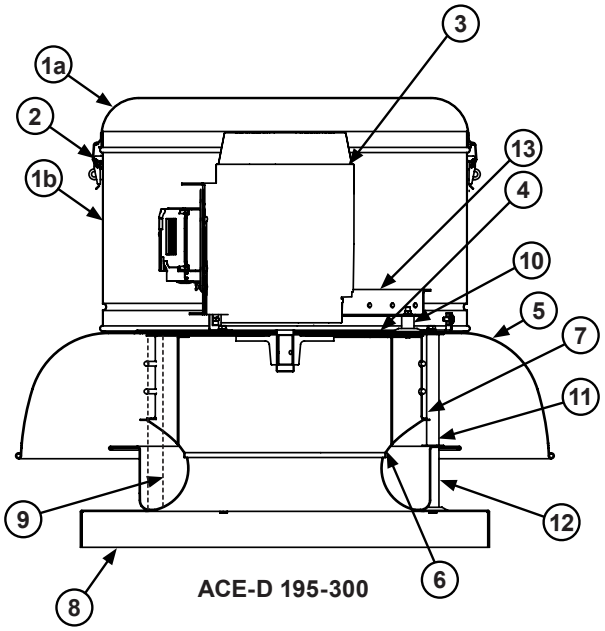
ACE-D Parts



ACE-D 70-100



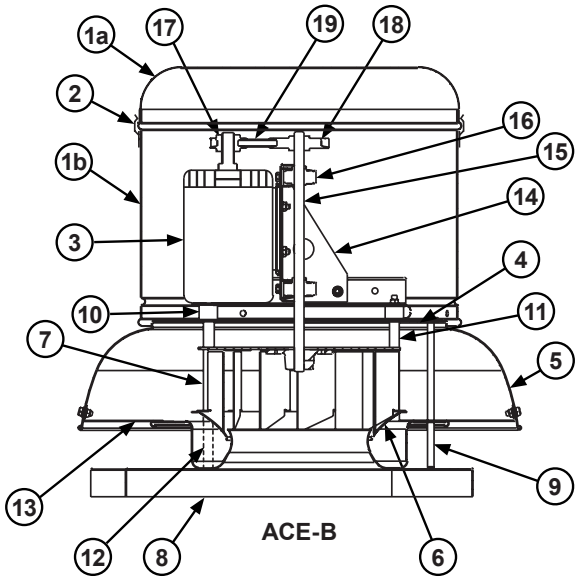
ACE-D 101-180



ACE-D 195-300

Item #	ACE-D Description			
	70-100	101-180	150-245	270-300
1a	Top Cap	Top Cap Lid	Top Cap Lid	Top Cap Lid
1b		Top Cap Cylinder	Top Cap Cylinder	Top Cap Cylinder
2	Bolts (4)	Top Cap Clip (4)	Top Cap Clip (4)	Top Cap Clip (4)
3	Motor	Motor	Motor	Motor
4	Motor Plate	Motor Plate	Motor Plate	Motor Plate
5	Baffle	Baffle	Baffle	Baffle
6	Wheel Assembly	Wheel Assembly	Wheel Assembly	Wheel Assembly
7	Bird Screen	Bird Screen	Bird Screen	Bird Screen
8	Base	Base	Base	Base
9	Conduit	Conduit	Conduit	Conduit
10	Spacer (4)	Spacer (4)	Spacer (4)	Spacer (4)
11	Post (4)	Upper Post (4)	Upper Post (4)	Upper Post (8)
12	-	Lower Post (4)	Lower Post (4)	Lower Post (8)
13	-	-	Power Assembly	Power Assembly

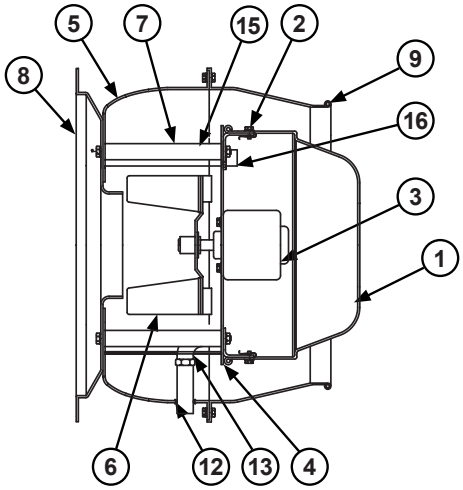
ACE-B Parts



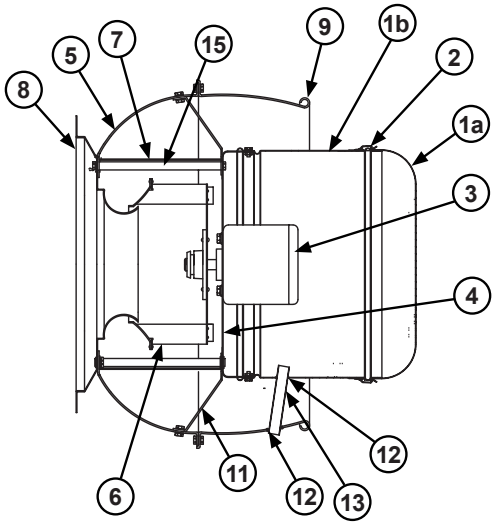
ACE-B

Item #	ACE-B Parts Description			
	60-100	120-245	270-300	330-540
1a	Top Cap Lid	Top Cap Lid	Top Cap Lid	Top Cap Lid
1b	Top Cap Cylinder	Top Cap Cylinder	Top Cap Cylinder	Top Cap Cylinder
2	Top Cap Clip (4)	Top Cap Clip (4)	Top Cap Clip (8)	Top Cap Clip (8)
3	Motor	Motor	Motor	Motor
4	-	Motor Plate	Motor Plate	Motor Plate
5	Baffle	Baffle	Baffle	Baffle
6	Wheel Assembly	Wheel Assembly	Wheel Assembly	Wheel Assembly
7	Bird Screen	Bird Screen	Bird Screen	Bird Screen
8	Base	Base	Base	Base
9	Conduit	Conduit	Conduit	Conduit
10	Spacer (4)	Spacer (4)	Spacer (4)	Spacer (4)
11	Upper Post (4)	Upper Post (4)	Upper Post (8)	Upper Post (8)
12	Lower Post (4)	Lower Post (4)	Lower Post (8)	Lower Post (8)
13	-	-	-	Brace (8)
14	Power Assembly	Power Assembly	Power Assembly	Power Assembly
15	Shaft	Shaft	Shaft	Shaft
16	Bearing	Bearing	Bearing	Bearing
17	Drive Sheave	Drive Sheave	Drive Sheave	Drive Sheave
18	Driven Sheave	Driven Sheave	Driven Sheave	Driven Sheave
19	Belt Set	Belt Set	Belt Set	Belt Set

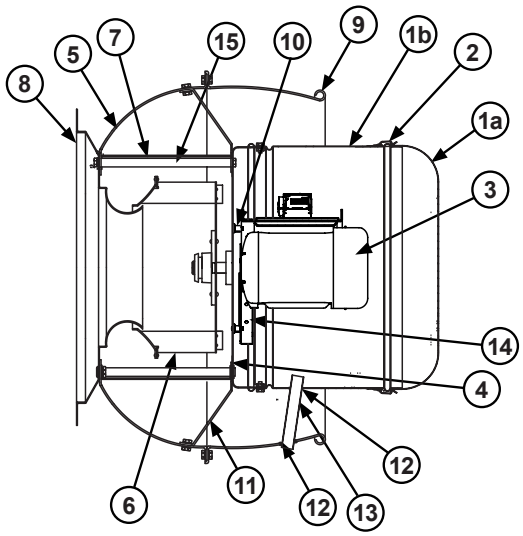
ACW-D Parts



ACW-D 70-100



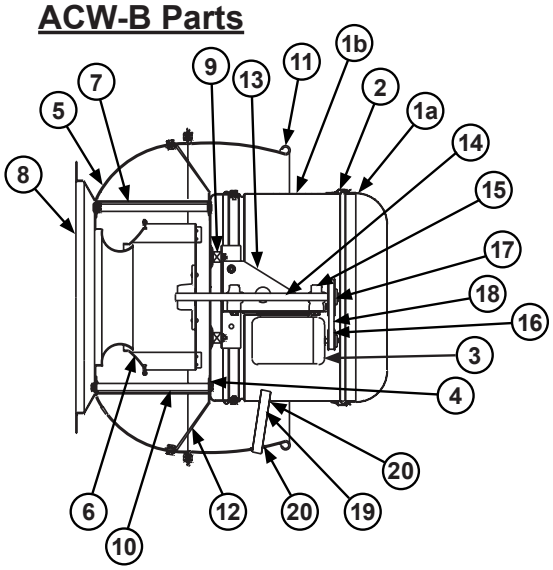
ACW-D 101-195
C-Face Mount



ACW-D 150-245
Base Mount

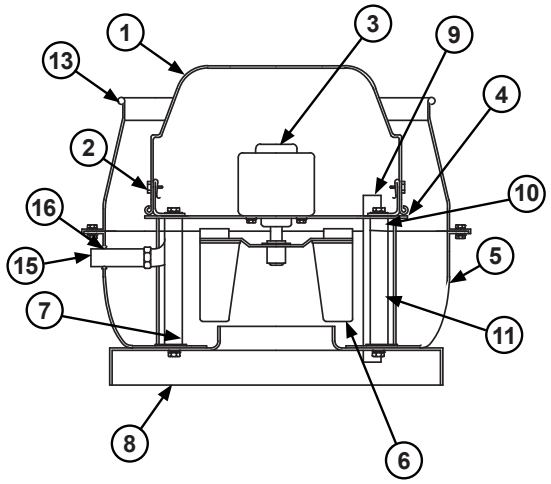
Item #	ACW-D Description		
	70-100	101-195	150-245
1a	Top Cap	Top Cap Lid	Top Cap Lid
1b		Top Cap Cylinder	Top Cap Cylinder
2	Bolts (4)	Top Cap Clip (4)	Top Cap Clip (4)
3	Motor	Motor	Motor
4	Motor Plate	Motor Plate	Motor Plate
5	Baffle	Baffle	Baffle
6	Wheel Assembly	Wheel Assembly	Wheel Assembly
7	Bird Screen	Bird Screen	Bird Screen
8	Wall Flange	Wall Flange	Wall Flange
9	Windband	Windband	Windband
10	-	Spacer (4)	Spacer (8)
11	-	Brace (4)	Brace (4)(150-195) Brace (8)(210-245)
12	Grommet (2)	Grommet (2)	Grommet (2)
13	Cooling Tube-Angled	Cooling Tube	Cooling Tube
14	-	-	Power Assembly
15	Post (4)	Post (4)	Post (4) 150-195 Post (8) 210-245
16	Conduit	-	-

ACW-B Parts



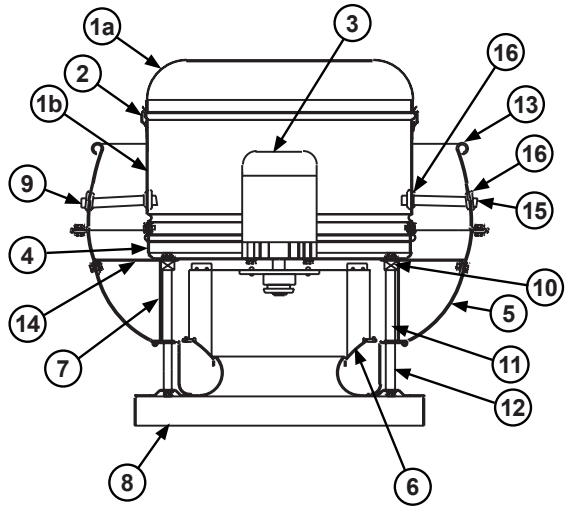
Item #	ACW-B Parts Description		
	100	120-165	180-245
1a	Top Cap Lid	Top Cap Lid	Top Cap Lid
1b	Top Cap Cylinder	Top Cap Cylinder	Top Cap Cylinder
2	Top Cap Clip (4)	Top Cap Clip (4)	Top Cap Clip (8)
3	Motor	Motor	Motor
4	Motor Plate	Motor Plate	Motor Plate
5	Baffle	Baffle	Baffle
6	Wheel Assembly	Wheel Assembly	Wheel Assembly
7	Bird Screen	Bird Screen	Bird Screen
8	Wall Flange	Wall Flange	Wall Flange
9	Spacer (4)	Spacer (4)	Spacer (4)
10	Post (4)	Post (4)	Post (8)
11	Wind Band	Wind Band	Wind Band
12	-	Brace (4)	Brace (8)
13	Power Assembly	Power Assembly	Power Assembly
14	Shaft	Shaft	Shaft
15	Bearing (2)	Bearing (2)	Bearing (2)
16	Drive Sheave	Drive Sheave	Drive Sheave
17	Driven Sheave	Driven Sheave	Driven Sheave
18	Belt Set	Belt Set	Belt Set
19	Vent Tube	Vent Tube	Vent Tube
20	Grommet (2)	Grommet (2)	Grommet (2)

ACRU-D Parts

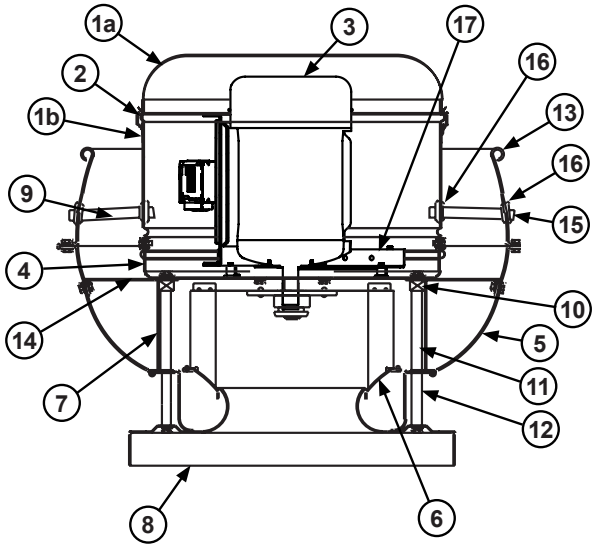


ACRU-D Sizes 70-100

Item #	ACRU-D Parts Description		
	70-100	101-195	150-300
1a	Top Cap	Top Cap Lid	Top Cap Lid
1b	-	Top Cap Cylinder	Top Cap Cylinder
2	Bolts (4)	Top Cap Clip (4)	Top Cap Clip (8)
3	Motor	Motor	Motor
4	Motor Plate	Motor Plate	Motor Plate
5	Baffle	Baffle	Baffle
6	Wheel Assembly	Wheel Assembly	Wheel Assembly
7	Bird Screen	Bird Screen	Bird Screen
8	Base	Base	Base
9	Conduit	Conduit	Conduit
10	Spacer (4)	Spacer (4)	Spacer (8)
11	Post (4)	Upper Post (4)	Upper Post (8)
12	-	Lower Post (4)	Lower Post (8)
13	Wind Band	Wind Band	Wind Band
14	-	Brace (4)	Brace (8)
15	Vent Tube-Angled	Vent Tube-Angled	Vent Tube-Angled
16	Grommet (2)	Grommet (2)	Grommet (2)

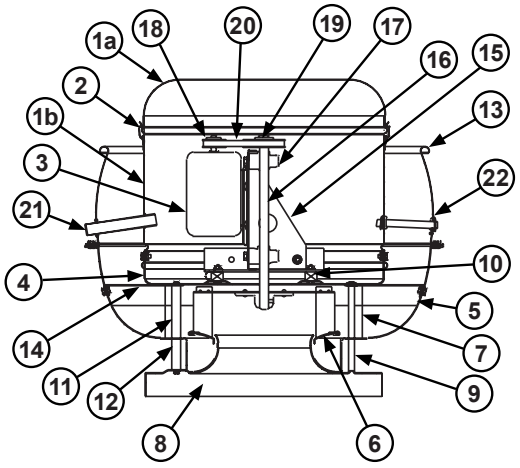


ACRU-D Sizes 101-195 C-Face



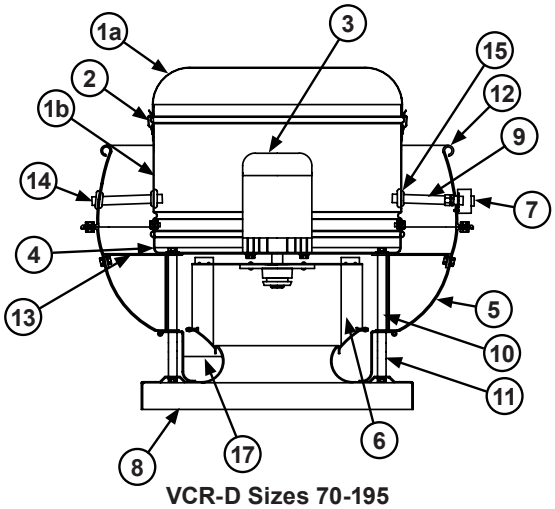
ACRU-D Sizes 150-300 Base Mount

ACRU-B Parts

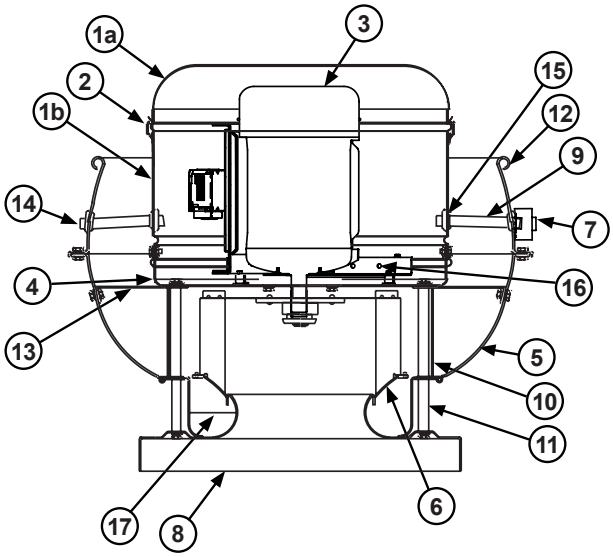


Item #	ACRU-B Parts Description		
	100	120-245	270-490
1a	Top Cap Lid	Top Cap Lid	Top Cap Lid
1b	Top Cap Cylinder	Top Cap Cylinder	Top Cap Cylinder
2	Top Cap Clip (4)	Top Cap Clip (4)	Top Cap Clip (8)
3	Motor	Motor	Motor
4	Motor Plate	Motor Plate	Motor Plate
5	Baffle	Baffle	Baffle
6	Wheel Assembly	Wheel Assembly	Wheel Assembly
7	Bird Screen	Bird Screen	Bird Screen
8	Base	Base	Base
9	Conduit	Conduit	Conduit
10	Spacer (4)	Spacer (4)	Spacer (8)
11	Upper Post (4)	Upper Post (4)	Upper Post (8)
12	Lower Post (4)	Lower Post (4)	Lower Post (8)
13	Wind Band	Wind Band	Wind Band
14	-	Brace (4)	Brace (8)
15	Power Assembly	Power Assembly	Power Assembly
16	Shaft	Shaft	Shaft
17	Bearing (2)	Bearing (2)	Bearing (2)
18	Drive Sheave	Drive Sheave	Drive Sheave
19	Driven Sheave	Driven Sheave	Driven Sheave
20	Belt Set	Belt Set	Belt Set
21	Vent Tube	Vent Tube	Vent Tube
22	Grommet (2)	Grommet (2)	Grommet (2)

VCR-D Parts



VCR-D Sizes 70-195

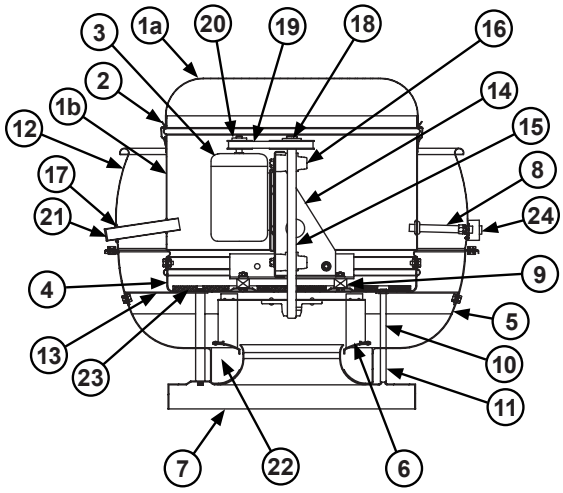


VCR-D Sizes 210-300

Item #	VCR-D Parts Description	
	101-195	210-300
1a	Top Cap Lid	Top Cap Lid
1b	Top Cap Cylinder	Top Cap Cylinder
2	Top Cap Clip (4)	Top Cap Clip (4) (210-245) Top Cap Clip (8) (270-300)
3	Motor	Motor
4	Motor Plate	Motor Plate
5	Baffle	Baffle
6	Wheel Assembly	Wheel Assembly
7	NEMA 3 Junction	NEMA 3 Junction
8	Base	Base
9	Conduit	Conduit
10	Upper Post (4)	Upper Post (4) (210-245) Upper Post (8) (270-300)
11	Lower Post (4)	Lower Post (8)
12	Wind Band	Wind Band
13	Brace (4)	Brace (8)
14	Vent Tube	Vent Tube
15	Grommet (2)	Grommet (2)
16	-	Power Assembly
17	Cut Off*	Cut Off*

*Cut off Plate is only on the VCR-HP and VCR-XP.

VCR-B Parts

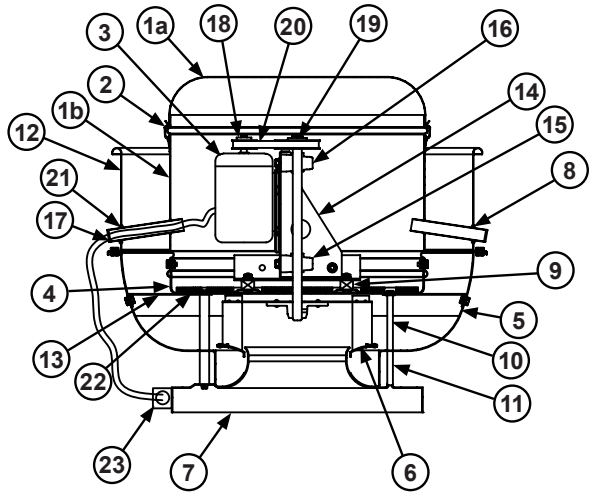


VCR-B Sizes 100-490

Item #	VCR-B Parts Description		
	100-225	245	270-490
1a	Top Cap Lid	Top Cap Lid	Top Cap Lid
1b	Top Cap Cylinder	Top Cap Cylinder	Top Cap Cylinder
2	Top Cap Clip (4)	Top Cap Clip (4)	Top Cap Clip (8)
3	Motor	Motor	Motor
4	Motor Plate	Motor Plate	Motor Plate
5	Baffle	Baffle	Baffle
6	Wheel Assembly	Wheel Assembly	Wheel Assembly
7	Base	Base	Base
8	Conduit	Conduit	Conduit
9	Spacer (4)	Spacer (4)	Spacer (4)
10	Upper Post (4)	Upper Post (4)	Upper Post (8)
11	Lower Post (4)	Lower Post (4)	Lower Post (8)
12	Wind Band	Wind Band	Wind Band
13	Brace (4)	Brace (4)	Brace (8)
14	Power Assembly	Power Assembly	Power Assembly
15	Shaft	Shaft	Shaft
16	Bearing (2)	Bearing (2)	Bearing (2)
17	Vent Tube	Vent Tube	Vent Tube
18	Driven Sheave	Driven Sheave	Driven Sheave
19	Belt Set	Belt Set	Belt Set
20	Drive Sheave	Drive Sheave	Drive Sheave
21	Grommet (2)	Grommet (2)	Grommet (2)
22	Cut Off*	Cut Off*	Cut Off*
23	Insulation	Insulation	Insulation
24	NEMA 3 Junction Box	NEMA 3 Junction Box	NEMA 3 Junction Box

*Cut off Plate is only on the VCR-HP and VCR-XP.

ACSC Parts



ACSC-D Sizes 100-490

Item #	ACSC-B Parts Description		
	100-225	245	270-490
1a	Top Cap Lid	Top Cap Lid	Top Cap Lid
1b	Top Cap Cylinder	Top Cap Cylinder	Top Cap Cylinder
2	Top Cap Clip (4)	Top Cap Clip (4)	Top Cap Clip (8)
3	Motor	Motor	Motor
4	Motor Plate	Motor Plate	Motor Plate
5	Baffle	Baffle	Baffle
6	Wheel Assembly	Wheel Assembly	Wheel Assembly
7	Base	Base	Base
8	Conduit	Conduit	Conduit
9	Isolator (4)	Isolator (4)	Isolator (8)
10	Upper Post (4)	Upper Post (4)	Upper Post (8)
11	Lower Post (4)	Lower Post (4)	Lower Post (8)
12	Wind Band	Wind Band	Wind Band
13	Brace (4)	Brace (4)	Brace (8)
14	Power Assembly	Power Assembly	Power Assembly
15	Shaft	Shaft	Shaft
16	Bearing (2)	Bearing (2)	Bearing (2)
17	Liquid Tite Conduit	Liquid Tite Conduit	Liquid Tite Conduit
18	Driven Sheave	Driven Sheave	Driven Sheave
19	Belt Set	Belt Set	Belt Set
20	Vent Tube	Vent Tube	Vent Tube
21	Grommet (2)	Grommet (2)	Grommet (2)
22	Insulation	Insulation	Insulation
23	NEMA 3 Junction Box	NEMA 3 Junction Box	NEMA 3 Junction Box

Limited Warranty

Loren Cook Company warrants that your Loren Cook fan was manufactured free of defects in materials and workmanship, to the extent stated herein. For a period of one (1) year after date of shipment, we will replace any parts found to be defective without charge, except for shipping costs which will be paid by you. This warranty is granted only to the original purchaser placing the fan in service. This warranty is void if the fan or any part thereof has been altered or modified from its original design or has been abused, misused, damaged or is in worn condition or if the fan has been used other than for the uses described in the company manual. This warranty does not cover defects resulting from normal wear and tear. To make a warranty claim, notify Loren Cook Company, General Offices, 2015 East Dale Street, Springfield, Missouri 65803-4637, explaining in writing, in detail, your complaint and referring to the specific model and serial numbers of your fan. Upon receipt by Loren Cook Company of your written complaint, you will be notified, within thirty (30) days of our receipt of your complaint, in writing, as to the manner in which your claim will be handled. If you are entitled to warranty relief, a warranty adjustment will be completed within sixty (60) business days of the receipt of your written complaint by Loren Cook Company. This warranty gives only the original purchaser placing the fan in service specifically the right. You may have other legal rights which vary from state to state. For fans provided with motors, the motor manufacturer warrants motors for a designated period stated in the manufacturer's warranty. Warranty periods vary from manufacturer to manufacturer. Should motors furnished by Loren Cook Company prove defective during the designated period, they should be returned to the nearest authorized motor service station. Loren Cook Company will not be responsible for any removal or installation costs.

LOREN COOK COMPANY

Corporate Offices: 2015 E. Dale St. Springfield, MO 65803
Phone 417-869-6474 | Fax 417-862-3820 | lorencook.com

CA/CF/CP

Centrifugal Blower

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

This publication contains the installation, operation and maintenance instructions for standard units of the *CA, CF, and CP: Centrifugal Blowers*.

- CA/CF SWSI
- CA-4 SWSI
- CA DWDI
- CA-4 DWDI
- CPFD
- CPFB
- CAF-DW
- CPA/CPA-A/CPS/ CPS-A/CPV

Carefully read this publication and any supplemental documents prior to any installation or maintenance procedure.

Loren Cook catalogs, *CA/CF* and *CP,* provide additional information describing the equipment, fan performance, available accessories and specification data.

For additional safety information, refer to AMCA Publication 410-96, *Safety Practices for Users and Installers of Industrial and Commercial Fans*.

All of the publications listed above can be obtained from:

- lorencook.com
- *info@lorencook.com*
- 417-869-6474 ext. 166

For information and instructions on special equipment, contact Loren Cook Company at 417-869-6474.

Receiving and Inspection

Carefully inspect the fan and accessories for any damage and shortage immediately upon receipt of the fan.

- Turn wheel by hand to ensure it turns freely and does not bind
- Inspect dampers (if supplied) for free operation of all moving parts
- Record on the *Delivery Receipt* any visible sign of damage

Handling

Lift the fan by the base or lifting eyes.

NOTICE! Never lift by the shaft, motor or housing.

CA SWSI Shown

⚠WARNING

Rotating Parts & Electrical Shock Hazard:

Fans should be installed and serviced by qualified personnel only.

Disconnect electric power before working on unit (prior to removal of guards or entry into access doors).

Follow proper lockout/tagout procedures to ensure the unit cannot be energized while being installed or serviced.

A disconnect switch should be placed near the fan in order that the power can be swiftly cut off, in case of an emergency and in order that maintenance personnel are provided complete control of the power source.

Grounding is required. All field-installed wiring must be completed by qualified personnel. All field installed wiring must comply with National Electric Code (NFPA 70) and all applicable local codes. Ensure the power supply (voltage, frequency and current carrying capacity of wires) is in accordance with the motor nameplate.

Fans and blowers create pressure at the discharge and vacuum at the inlet. This may cause objects to get pulled into the unit and objects to be propelled rapidly from the discharge. The discharge should always be directed in a safe direction and inlets should not be left unguarded. Any object pulled into the inlet will become a projectile capable of causing serious injury or death.

When air is allowed to move through a non-powered fan, the impeller can rotate, which is referred to as windmilling. Windmilling will cause hazardous conditions due to unexpected rotation of components. Impellers should be blocked in position or air passages blocked to prevent draft when working on fans.

Friction and power loss inside rotating components will cause them to be a potential burn hazard. All components should be approached with caution and/or allowed to cool before contacting them for maintenance.

Under certain lighting conditions, rotating components may appear stationary. Components should be verified to be stationary in a safe manner, before they come into contact with personnel, tools or clothing.

Failure to follow these instructions could result in death or serious injury.

The attachment of roof mounted fans to the roof curb as well as the attachment of roof curbs to the building structure must exceed the structural requirements based on the environmental loading derived from the applicable building code for the site. The local code official may require variations from the recognized code based on local data. The licensed engineer of record will be responsible for prescribing the correct attachment based on construction materials, code requirements and environmental effects specific to the installation.

Storage

If the fan is stored for any length of time prior to installation, completely fill the bearings with grease or moisture-inhibiting oil (refer to *Lubrication*, pages 6–7). Rotate the wheel several revolutions every three to five days to keep a coating of grease on all internal bearing parts.

Store the fan in its original crate and protect it from dust, debris and weather.

Outdoor Storage

To maintain good working condition of the fan when it is stored outdoors, follow the additional instructions below.

- Coat the shaft with grease or a rust preventative compound
- Wrap bearings for weather protection
- Cover the inlet and outlet to prevent the accumulation of dirt and moisture in the housing
- Periodically rotate the wheel and operate dampers (if supplied)
- Periodically inspect the unit to prevent damaging conditions

Installation

Motor Installation

Most motors are shipped mounted on the fans with belts and drives installed. However, extremely heavy motors and drives are shipped separately. These motors and drives will require field installation.

Foundation

This fan requires a strong, level foundation of reinforced poured concrete. A correctly designed concrete foundation provides the best means for mounting floor units. The foundation's size is determined by fan size and arrangement, motor size and position and the specific location of the installation.

Use the following guidelines to calculate foundation size.

- The overall dimensions of the foundation should extend at least six inches beyond the outline of the fan and its motor
- The weight of the foundation should be two to three times the weight of the unit and its motor

Isolation

NOTICE! Although a certain amount of vibration is inherent in operating centrifugal fans, extreme vibration is a serious problem that may cause structural and mechanical failure.

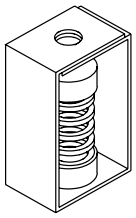
Isolation Base

To prevent vibration and noise from being transferred to the building isolators are recommended. Arrangement 1, 2 and 3 (CA or CF) fans require an isolation base to effectively isolate the fan system which includes the fan, base, motor, drive, guards, etc. Bases must have sufficient rigidity to resist belt pull and prevent drive distortion which can lead to excessive belt and bearing wear; its perimeter should contain all base angles and rotating parts. Arrangement 9 or 10 fans (CA, CF and CP) above size 270 require isolation rails. Please consult factory for isolation of arrangement 9 fans due to the potential of uneven loading caused by the motors and drives. Isolators should be located between the fan system and the support structure.

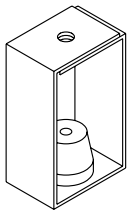
Ceiling Mounted Spring and Rubber-in-Shear (RIS) Isolators

NOTICE! Under no circumstance is the fan to be mounted inverted and hung by its base angles.

1. Mount fan on isolation base or rails.
2. Elevate fan to operating height and brace.
3. Attach threaded rod to overhead support structure directly above each mounting hole. Rod should extend to within a few feet of fan.
4. Attach isolator to end of threaded rod using a nut on each side of isolator bracket.
5. Insert another section of threaded rod through the fan mounting hole and isolator.
6. Attach two nuts to threaded rod isolator.
7. Place adjusting nut and locking nut on threaded rod near fan mounting bracket.
8. Alternately rotate adjusting nut at each mounting location until the fan weight is uniformly transferred to the isolators. Remove bracing.



Ceiling Mounted Spring Isolator

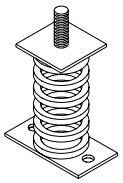


Rubber-in-Shear Ceiling Isolator

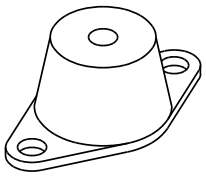
Figure 1- Ceiling Mount Isolators

Floor Mounted Spring Isolators

1. Mount fan and motor on isolation base or rails (if supplied).
2. Elevate fan (or isolation base/rails) to operating height and insert blocks to hold in position.
3. Position isolators under the fan (or isolation base/rails) and vertically align by inserting leveling bolt through mounting holes in the fan or the base. The isolator must be installed on a level surface.
4. Adjust the isolators by turning the leveling nut counter clockwise several turns at a time alternately on each isolator until the fan weight is transferred onto the isolators and the fan raises uniformly off the blocks. Then remove the blocks.
5. Turn lock nut onto leveling bolt and secure firmly in place against the top of the mounting flange or frame.
6. Secure isolators to mounting surface.



Spring Isolator



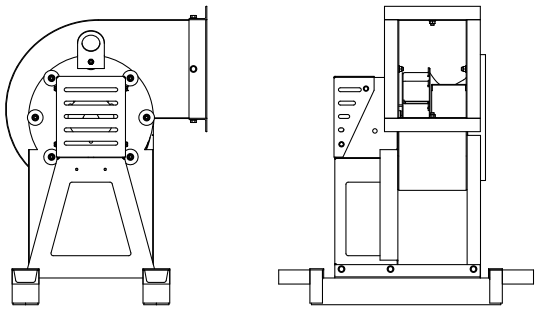
Rubber-in-Shear Isolator

Figure 2- Floor Mount Isolators

Floor Mounted Rubber-In-Shear (RIS) Isolators

1. Mount fan and motor on isolation base or rails (if supplied).
2. Elevate fan (or isolation base/rails) to provide room to insert isolators between the base and foundation and block in position.

3. Position isolators under fan (or isolation base/rails) and secure bolts.
4. Remove blocks and allow fan to rest on floor. Isolators must be installed on a level surface (leveling should not be required).
5. Secure isolators to mounting surface.

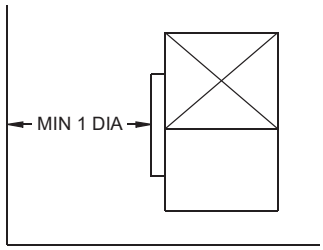


Duct Installation

Efficient fan performance relies on the proper installation of inlet and discharge ducts. Be sure your fan conforms to the guidelines below.

Non-Ducted Inlet Clearance

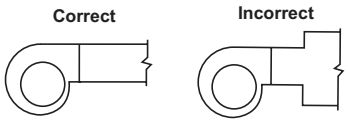
If your fan has an open inlet (no duct work), the fan must be placed 1 fan wheel diameter away from walls and bulkheads. An inlet bell should be used in this case.



Non-Ducted Inlet Clearance

Free Discharge

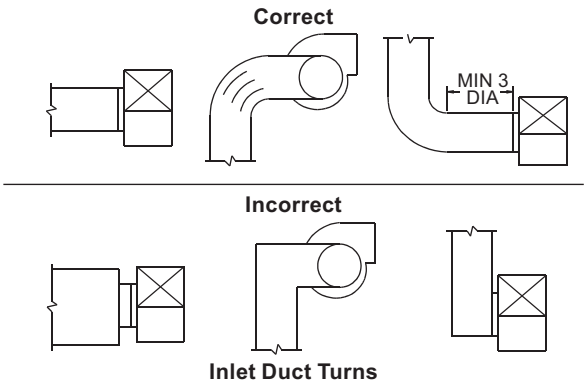
Avoid a free discharge into the plenum. This will result in lost efficiency because it doesn't allow for a static regain.



Free Discharge

Inlet Duct Turns

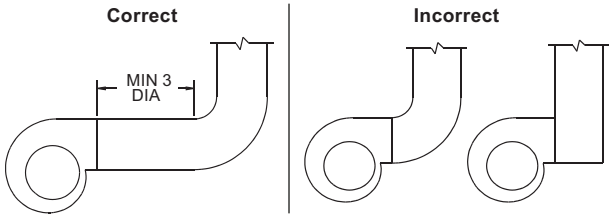
For ducted inlets, allow at least 3 fan wheel diameters between duct turns or elbows and the fan inlet.



Inlet Duct Turns

Discharge Duct Turns

Make sure that duct turns located near the fan discharge curve in the direction of the fan's rotation.

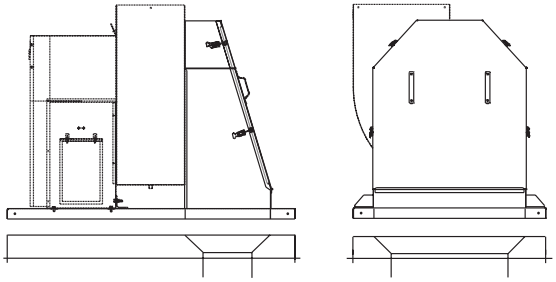


Discharge Duct Turns

CP with Optional Curb Cap and Inlet Box

NOTICE! UL 762/NFPA96 and local codes may dictate additional or modifications to this installation.

The installation diagram below has a solid curb cap duct adapter placed over the top of the curb. The welded grease duct with recommended transition is either welded or sealed with UL recognized fire caulk to both the curb cap duct adapter and the bottom of the fan. A minimum of two separate outlines of caulk is recommended at the outer portion of the curb cap duct adapter.



Wheel-to-Inlet Clearance

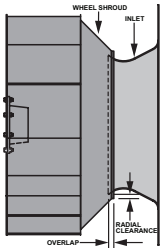
The correct wheel-to-inlet clearance is critical to proper fan performance. This clearance should be verified before initial start-up since rough handling during shipment could cause a shift in fan components. Refer to the wheel/inlet drawing for correct overlap.

Adjust the overlap by loosening the wheel hub and moving the wheel along the shaft to obtain the correct value.

A uniform radial gap (space between the edge of the cone and the edge of the inlet) is obtained by loosening the inlet cone bolts and repositioning the inlet cone.

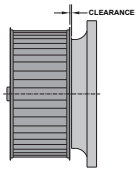
CA, CF and CP

Size	Overlap
60–165	3/16"
180–245	1/4"
270–300	5/16"
330–365	3/8"
402	7/16"
445–490	1/2"
540–730	13/16"



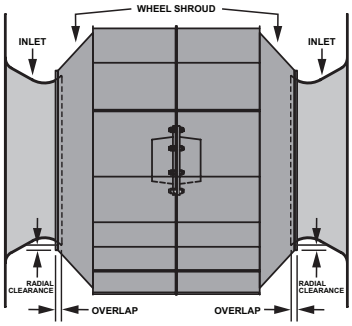
CPFD, CPFB

Size	Gap/Clearance
100 - 150	1/4
180	3/16
220	1/2
250 - 300	3/4



CAF-DW

Size	Overlap
120	1/8”
135–165	5/32”
180	1/4”
195	5/32”
210	1/4”
225	5/32”
245	9/32”
270–445	1/4”
490	17/32”
540–600	27/32”
660–730	25/32”



Wiring Installation

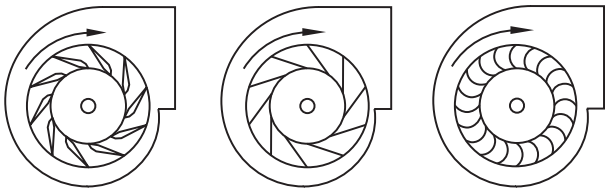
Leave enough slack in the wiring to allow for motor movement when adjusting belt tension. Some fractional motors have to be removed in order to make the connection with the terminal box at the end of the motor. To remove motor, remove bolts securing motor base to power assembly. Do not remove motor mounting bolts.

Units with Arrangement 10 have a hole provided at the base of the bearing pedestal to accommodate wiring.

NOTICE! Follow the wiring diagram in the disconnect switch and the wiring diagram provided with the motor. Correctly label the circuit on the main power box and always identify a closed switch to promote safety (i.e., red tape over a closed switch).

Wheel Rotation

Test the fan to ensure the rotation of the wheel is the same as indicated by the arrow marked *Rotation*.



Airfoil | Backward Inclined | Forward Curved

115 and 230 Single Phase Motors

Fan wheel rotation is set correctly at the factory. Changing the rotation of this type of motor should only be attempted by a qualified electrician.

208, 230 and 460 3 Phase Motors

These motors are electrically reversible by switching two of the supply leads. For this reason, the rotation of the fan cannot be restricted to one direction at the factory. See *Wiring Diagrams*, page 5, for specific information on reversing wheel direction.

NOTICE! Do not allow the fan to run in the wrong direction. This will overheat the motor and cause serious damage. For 3-phase motors, if the fan is running in the wrong direction, check the control switch. It is possible to interchange two leads at this location so that the fan is operating in the correct direction.

Belt and Pulley Installation

Belt tension is determined by the sound the belts make when the fan is first started. Belts will produce a loud squeal which dissipates after the fan is operating at full capacity. If the belt tension is too tight or too loose, lost efficiency and possible damage can occur.

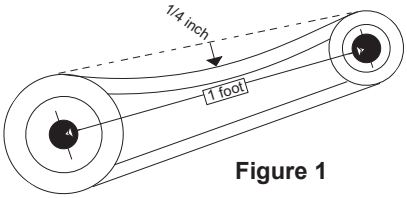


Figure 1

Do not change the pulley pitch diameter to change tension. This will result in a different fan speed.

1. Loosen motor plate adjustment bolts and move motor in order that the belts can easily slip into the grooves on the pulleys. Never pry, roll or force the belts over the rim of the pulley.
2. Slide the motor plate back until proper tension is reached. For proper tension, a deflection of approximately 1/4” per foot of center distance should be obtained by firmly pressing the belt. Refer to *Figure 1*.
3. Lock the motor plate adjustment bolts in place.
4. Ensure pulleys are properly aligned. Refer to *Figure 2*.

Tolerance

Center Distance	Max. Gap
Up through 12”	1/16”
12” through 48”	1/8”
Over 48”	1/4”

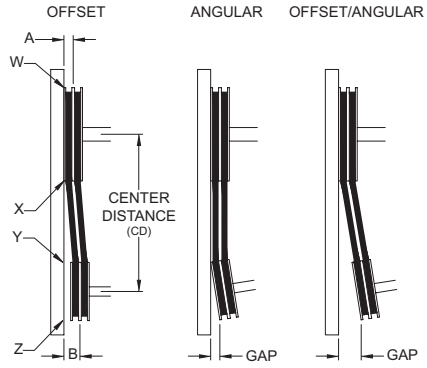


Figure 2

Pulley Alignment

Pulley alignment is adjusted by loosening the motor pulley setscrew and by moving the motor pulley on the motor shaft.

Figure 2 indicates where to measure the allowable gap for the drive alignment tolerance. All contact points (indicated by WXYZ) are to have a gap less than the tolerance shown in the table. When the pulleys are not the same width, the allowable gap must be adjusted by half of the difference in width (as shown in A & B of *Figure 2*). *Figure 3* illustrates using a carpenter’s square to adjust the position of the motor pulley until the belt is parallel to the longer leg of the square.

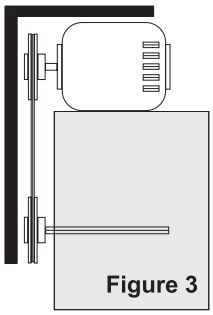


Figure 3

Final Installation Steps

1. Inspect fasteners and setscrews, particularly fan mounting and bearing fasteners, and tighten according to the table, *Recommended Torque for Setscrews/Bolts*.
2. Inspect for correct voltage with voltmeter.
3. Ensure all accessories are installed.

Recommended Torque for Setscrews/Bolts (IN-LB)

Setscrews				Hold Down Bolts	
Size	Key Hex Across Flats	Recommended Torque Min.	Recommended Torque Max.	Size	Recommended Torque
#8	5/64”	15	21	3/8”-16	324
#10	3/32”	27	33	1/2”-13	780
1/4	1/8”	70	80	5/8”-11	1440
5/16	5/32”	140	160	3/4”-10	2400
3/8	3/16”	250	290	7/8”-9	1920
7/16	7/32”	355	405	1”-8	2700
1/2	1/4”	560	640	1-1/8”-7	4200
5/8	5/16”	1120	1280	1-1/4”-7	6000
3/4	3/8”	1680	1920	-	-
7/8	1/2”	4200	4800	-	-
1	9/16”	5600	6400	-	-

Operation

Pre-Start Checks

1. Lock out all the primary and secondary power sources.
2. Ensure fasteners and setscrews, particularly those used for mounting the fan, are tightened.
3. Inspect belt tension and pulley alignment.
4. Inspect motor wiring.
5. Ensure belt touches only the pulleys.
6. Ensure fan and ductwork are clean and free of debris.
7. Inspect wheel-to-inlet clearance. The correct wheel-to-inlet clearance is critical to proper fan performance.
8. Close and secure all access doors.
9. Restore power to fan.

Start-Up

Turn on the fan. In variable speed units, set fan to its lowest speed and inspect for the following:

- Direction of rotation
- Excessive vibration
- Unusual noise
- Bearing noise
- Improper belt alignment or tension (listen for squealing)
- Improper motor amperage or voltage

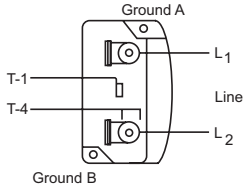
NOTICE! If a problem is discovered, immediately shut off the fan. Lock out all electrical power and check for the cause of the trouble. Refer to Troubleshooting.

Wiring Diagrams

Vari-Flow

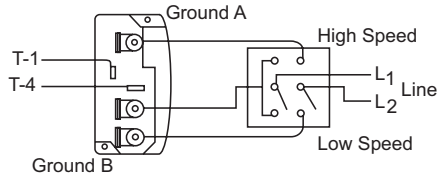
For EC or VF see EC Motor Wiring supplement. For VF2 see PM wiring supplement.

Single Speed, Single Phase Motor



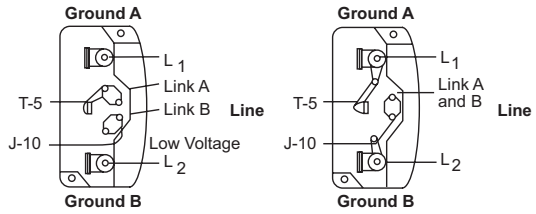
When ground is required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-1 and T-4.

2 Speed, 2 Winding, Single Phase Motor



When ground is required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-1 and T-4 leads.

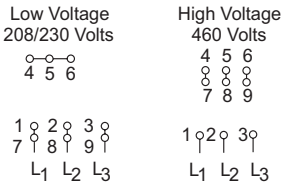
Single Speed, Single Phase, Dual Voltage



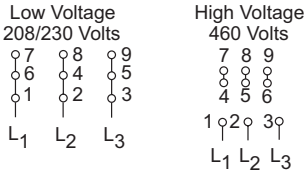
When ground is required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-5 and J-10 leads.

3 Phase, 9 Lead Motor

Y-Connection

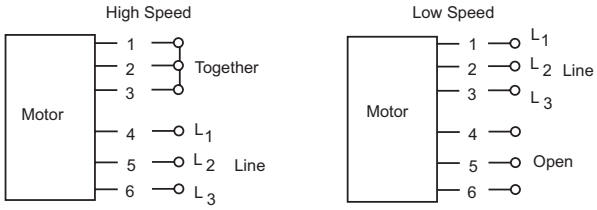


Delta-Connection



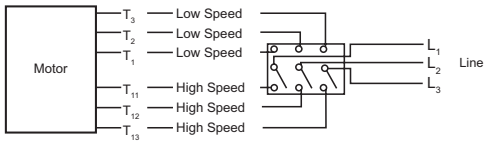
To reverse, interchange any two line leads.

2 Speed, 1 Winding, 3 Phase Motor



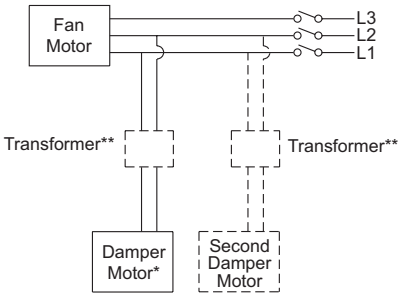
To reverse, interchange any two line leads. Motors require magnetic control.

2 Speed, 2 Winding, 3 Phase



To reverse:
High Speed - interchange leads T_{11} and T_{12}.
Low Speed - interchange leads T_1 and T_2.
Both Speeds - interchange any two line leads.

Typical Damper Motor Schematic



For 3-Phase, damper motor voltage should be the same between L_1 and L_2. For single phase application, disregard L_3.
*Damper motors may be available in 115, 230 or 460 volt models. The damper motor nameplate voltage should be verified prior to connection.
**A transformer may be provided in some installations to correct the damper motor voltage to the specified voltage.

Use of Variable Frequency Drives

Motors

Motors that are to be operated using a Variable Frequency Drive (VFD) must be VFD compatible. Motors that are not supplied by Loren Cook Company should have the recommendation of the motor manufacturer for use with a VFD.

Grounding

The fan frame, motor and VFD must be connected to a common earth ground to prevent transient voltages from damaging rotating elements.

Wiring

Line reactors may be required to reduce over-voltage spikes in the motors. The motor manufacturer should be consulted for recommended line impedance and usage of line reactors or filters if the lead length between the VFD and the motor exceeds 10 ft (3m).

Fan

It is the responsibility of the installing body to perform coast-down tests and identify any resonant frequencies after the equipment is fully installed. These resonant frequencies are to be removed from the operating range of the fan by using the "skip frequency" function in the VFD programming. Failure to remove resonant frequencies from the operating range will decrease the operating life of the fan and void the warranty.

Inspection

Inspection of the fan should be conducted at the first **30 minute**, **8 hour** and **24 hour** intervals of satisfactory operation. During the inspections, stop the fan and inspect as per the *Conditions Chart*.

30 Minute Interval

Inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.

8 Hour Interval

Inspect belt alignment and tension. Adjust and tighten as necessary.

24 Hour Interval

Inspect belt tension, bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.

Maintenance

Establish a schedule for inspecting all parts of the fan. The frequency of inspection depends on the operating conditions and location of the fan.

Inspect fans exhausting corrosive or contaminated air within the first month of operation. Fans exhausting contaminated air (airborne abrasives) should be inspected every three months.

Regular inspections are recommended for fans exhausting non-contaminated air.

It is recommended the following inspections be conducted twice per year:

- Inspect bolts and setscrews for tightness. Tighten as necessary. Worn setscrews should be replaced immediately
- Inspect belt wear and alignment. Replace worn belts with new belts and adjust alignment as needed. Refer to *Belt and Pulley Installation*
- Bearings should be inspected as recommended in the Lubrication *Conditions Chart*
- Inspect variable inlet vanes for freedom of operation and excessive wear. The vane position should agree with the position of the control arm. As the variable inlet vanes close, the entering air should spin in the same direction as the wheel
- Inspect springs and rubber isolators for deterioration and replace as needed
- Inspect for cleanliness. Clean exterior surfaces only. Removing dust and grease on motor housing assures proper motor cooling. Removing dirt from the wheel and housing prevent imbalance and damage

Lubrication

Fan Bearings

Greasable fan bearings are lubricated through a grease fitting on the bearing.

Lubrication Conditions Chart

Fan Class	Fan Status	Shaft Size	Maximum Interval (operation hrs)
Centrifugal Blower Class I	Normal Conditions (clean, dry & smooth)	>1-1/2"	10,000
		<1-1/2"	2,000
	Extreme Conditions (dirty/wet/rough)	>1-1/2"	2,000
		<1-1/2"	400
Centrifugal Blower Class II	Normal Conditions (clean, dry & smooth)	>2"	7500
		<2"	1000
	Extreme Conditions (dirty/wet/rough)	>2"	1500
		<2"	200
Centrifugal Blower Class III	Normal Conditions (clean, dry & smooth)	>2"	3000
		<2"	500
	Extreme Conditions (dirty/wet/rough)	>2"	500
		<2"	1000

Exceptions to the greasing interval chart:

- **Periodic Applications (any break of one week or more):** it is recommended that full lubrication be performed prior to each break in operation
- **Higher Temperature:** it is recommended to halve the intervals for every 30°F increase in operating temperature above 120°F not to exceed 230°F for standard bearings; high temperature bearings (optional) can operate up to 400°F
- **Vertical Shaft:** it is recommended that the intervals should be halved.

For best results, lubricate the bearing while the fan is in operation. Pump grease in slowly until a slight bead forms around the bearing seals. Excessive grease can burst seals thus reducing bearing life.

Before lubricating, the grease nipple and immediate vicinity should be thoroughly cleaned without the use of high pressure equipment. The grease should be supplied slowly as the bearing rotates until fresh grease slips past the seal. Excessive pressure should be avoided to prevent seal damage.

In the event the bearing cannot be seen, use no more than three injections with a hand-operated grease gun.

⚠ ***NOTICE! Loren Cook Company uses petroleum lubricant in a lithium base. Other types of grease should not be used unless the bearings and lines have been flushed clean. If another type of grease is used, it should be a lithium-based grease conforming to NLGI grade 2 consistency. An NLGI grade 2 grease is a light viscosity, low-torque, rust-inhibiting lubricant that is water resistant. Its temperature range is from -30°F to +200°F and capable of intermittent highs of +250°F. For temperatures above 250°F Mobiltemp SHC 32 is recommended.***

Motor Bearings

Motors are provided with prelubricated bearings. Any lubrication instructions shown on the motor nameplate supersede instructions below. Motor bearings without provisions for relubrication will operate up to 10 years under normal conditions with no maintenance. In severe applications, high temperatures or excessive contaminates, it is advisable to have the maintenance department disassemble and lubricate the bearings after three years of operation to prevent interruption of service.

For motors with provisions for relubrication, follow intervals of the table below.

Relubrication Intervals

Service Conditions	Nema Frame Size					
	Up to and Including 184T		213T-365T		404T and Larger	
	1800 RPM & Less	Over 1800 RPM	1800 RPM & Less	Over 1800 RPM	1800 RPM & Less	Over 1800 RPM
Standard	3 yrs.	6 months	2 yrs.	6 months	1 yr.	3 months
Severe	1 yr.	3 months	1 yr.	3 months	6 months	1 month

Motors are provided with a polyurea mineral oil NGLI #2 grease. All additions to the motor bearings are to be with a compatible grease such as Exxon Mobil Polyrex EM and Chevron SRI.

The above intervals should be reduced to half for vertical shaft installations.

Motor Services

Should the motor prove defective within a one-year period, contact your local Loren Cook representative or your nearest authorized electric motor service representative.

Changing Shaft Speed

All belt driven fans with motors up to and including 5HP (184T max) are equipped with variable pitch pulleys. To change the fan speed, perform the following:

1. Loosen setscrew on driver (motor) pulley and remove key, if equipped.
2. Turn the pulley rim to open or close the groove facing. If the pulley has multiple grooves, all must be adjusted to the same width.
3. After adjustment, inspect for proper belt tension.

Speed Reduction

Open the pulley in order that the belt rides deeper in the groove (smaller pitch diameter).

Speed Increase

Close the pulley in order that the belt rides higher in the groove (larger pitch diameter). Ensure that the RPM limits of the fan and the horsepower limits of the motor are maintained.

Maximum RPM

CA SWSI, CPS-A, CPA-A

Size	Max. RPM		
	Class I	Class II	Class III
120	3348	4368	5503
135	2976	3883	4892
150	2678	3494	4403
165	2435	3177	4002
180	2114	2757	3474
195	1951	2545	3207
210	1812	2363	2978
225	1691	2206	2779
245	1553	2026	2553
270	1419	1851	2332
300	1277	1666	2099
330	1161	1514	1908
365	1064	1388	1749
402	965	1259	1586
445	873	1138	1434
490	793	1034	1303
540	719	938	1182
600	647	844	1094
660	588	768	967
730	532	694	874

CA and CAF DWDI

Size	Max. RPM		
	Class I	Class II	Class III
120	3714	4846	6105
135	3307	4315	5436
150	2575	3357	4230
165	2374	3095	3901
180	2176	2839	3577
195	2009	2621	3302
210	1865	2434	3066
225	1741	2271	2862
245	1631	2128	2681
270	1443	1883	2372
300	1262	1647	2074
330	1147	1496	1885
365	1038	1354	1706
402	941	1228	1547
445	851	1110	1399
490	773	1009	1271
540	702	916	1164
600	631	823	1037
660	574	749	944
730	519	677	853

CF SWSI, CPS, CPA

Size	Max. RPM		
	Class I	Class II	Class III
60-100*	4230	5519	6953
120	3404	4441	5595
135	3026	3948	4974
150	2723	3553	4476
165	2476	3230	4069
180	2269	2961	3730
195	2095	2733	3443
210	1795	2341	2950
225	1675	2185	2753
245	1539	2007	2529
300	1257	1639	2065
330	1142	1490	1877
365	1023	1334	1681
402	939	1225	1543
445	849	1108	1396
490	771	1006	1268
540	700	913	1150
600	630	822	1035
660	573	747	941
730	518	675	851

*Sizes 60 through 100 only applies to CPS and CPA.

CPV

Size	Max. RPM	
	Standard	Reinforced
60-100*	2719	-
120	2527	
135	2093	
150	2035	
165	1766	
180	1588	
195	1429	1571
210	1277	1407
225	1152	1265
245	1015	1260
270	876	1091
300	837	1006
330	716	869
365	624	805
402	539	701
445	463	660
490	360	576

RPM Derating Factor

Temperature (°F)	RPM Factor	
	Steel	Aluminum
70	1.00	1.00
200	0.98	0.93
300	0.96	0.79
400	0.94	**
500	0.91	
600	0.87	
700	0.81	
800	0.75	

**Aluminum wheels are not available above 300°.

For elevated airstream temperatures, the maximum fan speed limits must be derated by the factors above.

Pulley and Belt Replacement

1. Remove pulleys from their respective shafts.
2. Clean the motor and fan shafts.
3. Clean bores of pulleys and coat the bores with heavy oil.
4. Remove grease, rust or burrs from the pulleys and shafts.
5. Remove burrs from shaft by sanding.
6. Place fan pulley on fan shaft and motor pulley on its shaft. Damage to the pulleys can occur when excessive force is used in placing the pulleys on their respective shafts.
7. Tighten in place.
8. Install belts on pulleys and align as described in *Belt and Pulley Installation*.

Bearing Replacement

The fan bearings are pillow block ball bearings.

An emery cloth or file may be needed to remove imperfections in the shaft left by the setscrews.

For Arrangement 1, 2, 9 and 10:

1. Mark the position on the shaft of both bearing races, setscrews, and the wheel and pulley. Mark the location and orientation of the inlet cone. Note the clearance between the wheel and inlet cone.
2. Remove the fan pulley and inlet cone.
3. Remove the wheel from the shaft. A 2-jaw puller may be needed.
4. Remove bearing hold-down bolts. Remove shaft and bearings as one unit.
5. Remove the anti-corrosion coating from the shaft with a suitable degreaser.
6. Remove the bearing from the shaft using a bearing puller. If a bearing puller is not available, tap on the bearing with a wood block and hammer to remove it.
7. Smooth and clean the shaft and bearing bore thoroughly.

8. Place the bearings into position making sure they are not on a worn section of the shaft. Tapping the inner ring face with a soft driver may be required.

NOTICE! Do not hammer the bearing housing.

9. The outer ring of the bearing is spherical and swivels in the housing to compensate for misalignment. Secure hold-down bolts, but do not fully tighten.
10. Align the setscrews on the bearings and tighten one setscrew on each bearing.
11. Rotate the shaft to allow the bearing outer rings to find their center of free movement.
12. Install the wheel on the shaft. Install the inlet cone in its original location. And adjust bearing position and inlet cone to center the wheel in the inlet cone.
13. Tighten hold-down bolts to proper torque.
14. Turn the shaft by hand. Resistance should be the same as it was before hold-down bolts were fully tightened.
15. Tighten bearing setscrews to specified torque. Refer to the *Recommended Torque* chart.
16. Re-install the pulley and adjust the belt tension.
17. Test run and retighten all setscrews and bolts; trim balance as necessary (.0785 in/sec max.).

After 24 hours of operation, retighten the setscrews to the appropriate torque. This assures full locking of the inner race to the shaft. Make sure the socket key or driver is in good condition with no rounded corners. The key should be fully engaged in the setscrew and held squarely to prevent rounding out of the setscrew socket when applying maximum torque.

For Arrangement 3:

Bearings should be replaced individually for each side of fan.

1. Loosen and remove belts.
2. If replacing drive side bearing, mark location of pulley and then remove.
3. Mark bearing location on bearing support and loosen bearing hold down bolts.
4. Support shaft to remove weight from bearing.
5. Remove anti-corrosion coating from the shaft with a suitable de-greaser.
6. Remove bearing from the shaft using a bearing puller. If a bearing puller is not available, tap on the bearing with a wood block and hammer to remove it.
7. Smooth and clean the shaft and bearing bore thoroughly.
8. Place the bearing into position making sure it is not on a worn section of the shaft. Tapping the inner ring face with a soft driver may be required. Do not hammer on the housing.
9. The outer ring of the bearing is spherical and swivels in the housing to compensate for misalignment. Secure hold-down bolts, but do not fully tighten.
10. Align setscrews on the bearings and tighten one setscrew on bearing.
11. Rotate the shaft to allow the bearing outer ring to find its center of free movement.
12. Tighten hold-down bolts to proper torque. Refer to *Recommended Torque* chart.
13. Turn the shaft by hand. Resistance should be the same as it was before hold-down bolts were fully tightened.
14. Tighten bearing setscrews to specified torque.
15. Re-install the pulley if required.
16. Repeat process for opposite bearing.
17. Adjust the belt tension.
18. Test run and retighten all setscrews and bolts; trim balance as necessary (.0785 in/sec max.).

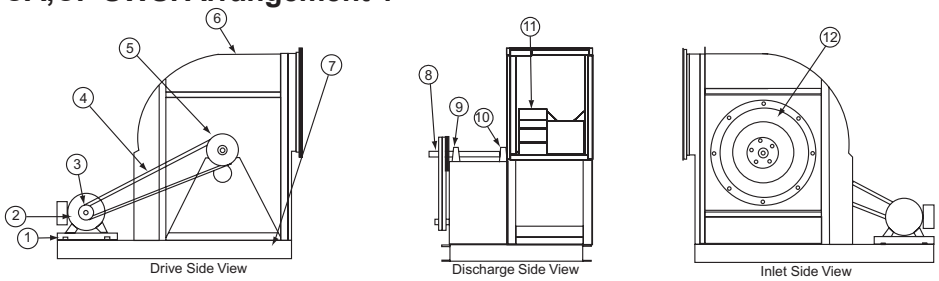
After 24 hours of operation, retighten the setscrews to the appropriate torque. This assures full locking of the inner race to the shaft. Make sure the socket key or driver is in good condition with no rounded corners. The key should be fully engaged in the setscrew and held squarely to prevent rounding out of the setscrew socket when applying maximum torque.

Troubleshooting

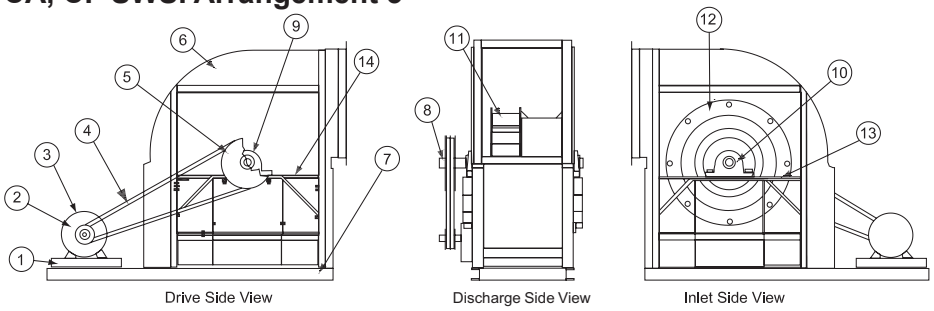
Problem and Potential Cause
Low Capacity or Pressure: • Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly • Poor fan inlet conditions. There should be a straight clear duct at the inlet • Improper wheel alignment
Excessive Vibration and Noise: • Damaged or unbalanced wheel • Belts too loose; worn or oily belts • Speed too high • Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly • Bearings need lubrication or replacement • Fan surge or incorrect inlet or outlet conditions
Overheated Motor: • Motor improperly wired • Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly • Cooling air diverted or blocked • Improper inlet clearance • Incorrect fan RPMs • Incorrect voltage
Overheated Bearings: • Improper bearing lubrication • Excessive belt tension

Parts List

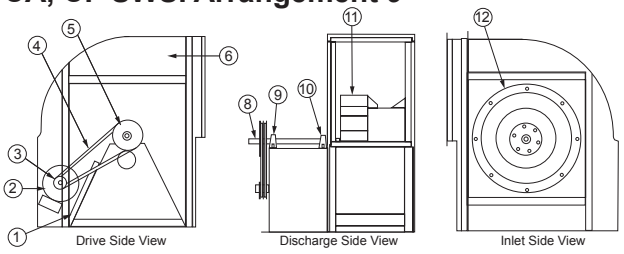
CA,CF SWSI Arrangement 1



CA, CF SWSI Arrangement 3

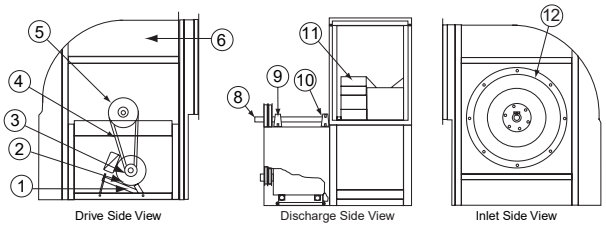


CA, CF SWSI Arrangement 9

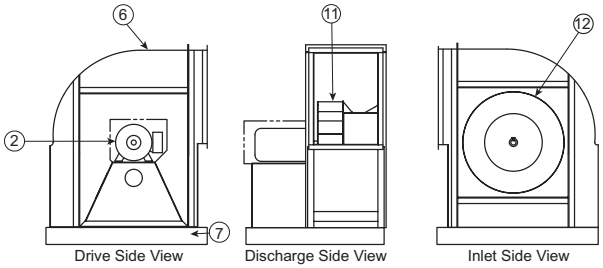


Part No.	Arr. 1	Arr. 3	Arr. 9
1	Motor Slide Base		
2	Motor		
3	Motor Sheave		
4	Belt Set		
5	Fan Sheave		
6	Housing		
7	Isolation Base (optional)		-
8	Shaft		
9	Outboard Bearing	Drive Side Bearing	Outboard Bearing
10	Inboard Bearing	Free Side Bearing	Inboard Bearing
11	Wheel		
12	Inlet Cone		
13	-	Free Side Bearing Support	-
14	-	Drive Side Bearing Support	-

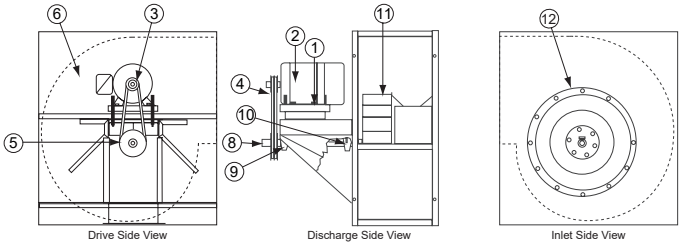
CA, CF SWSI Arrangement 10



CA, CF SWSI Arrangement 4

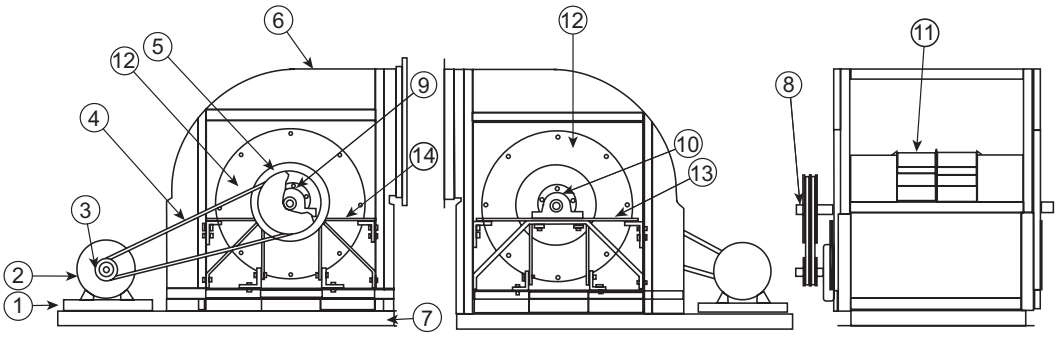


CA-4 SWSI, CF-4 SWSI



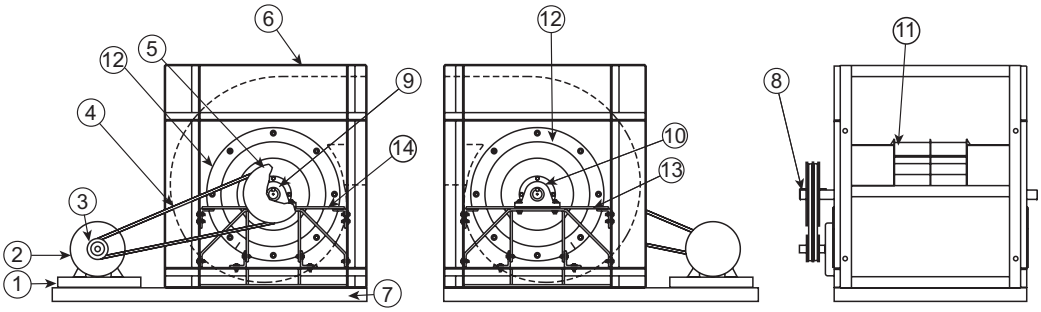
Part No.	Arr. 10, CA-4 SWSI, CF-4 SWSI	Arr. 4
1	Motor Plate	-
2	Motor	
3	Motor Sheave	-
4	Belt Set	-
5	Fan Sheave	-
6	Housing	
7	-	Isolation Base (optional)
8	Shaft	-
9	Outboard Bearing	-
10	Inboard Bearing	-
11	Wheel	
12	Inlet Cone	

CA DWDI



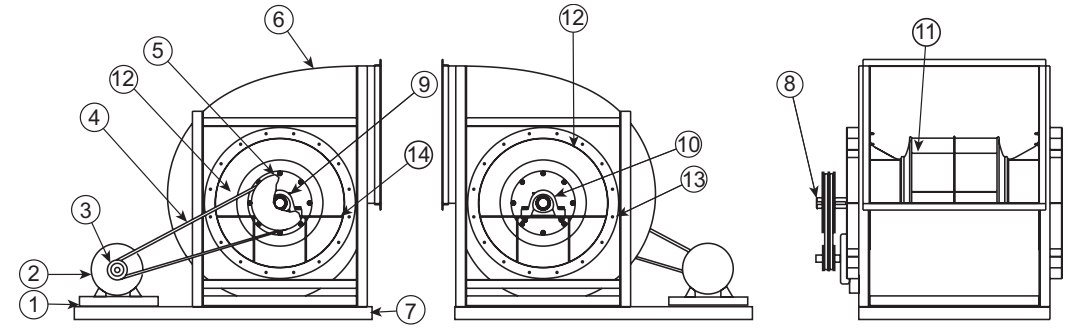
Drive Side View Free Side View Discharge Side View

CA-4 DWDI



Drive Side View Free Side View Discharge Side View

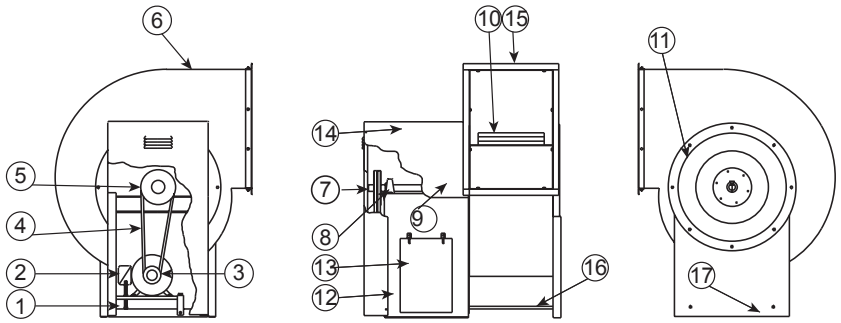
CAF-DWDI



Drive Side View Free Side View Discharge Side View

Part No.	CA DWDI	CAF-DW	CA-4 DWDI
1	Motor Slide Base		
2	Motor		
3	Motor Sheave		
4	Belt Set		
5	Fan Sheave		
6	Housing		
7	Isolation Base (optional)		
8	Shaft		
9	Drive Side Bearing		
10	Free Side Bearing		
11	Wheel/Wheel Assembly		
12	Inlet Cone		
13	Free Side Bearing Support		
14	Drive Side Bearing Support		

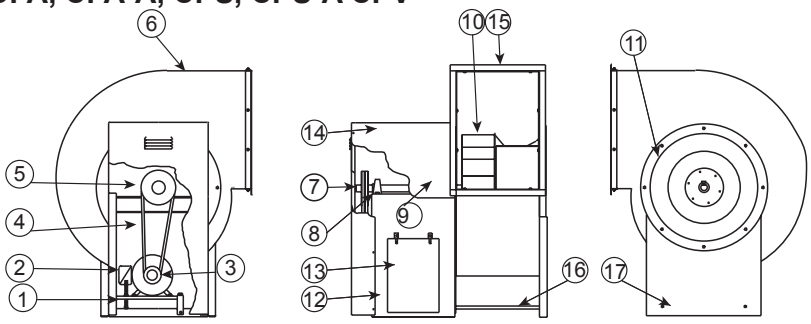
CPFB



Drive Side View Discharge Side View Inlet Side View

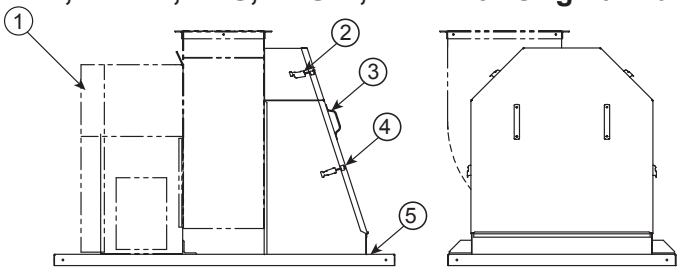
Part No.	CPFB, CPA, CPA-A, CPS, CPS-A, CPV Arr. 4
1	Motor Plate
2	Motor
3	Motor Sheave
4	Belt Set
5	Fan Sheave
6	Housing
7	Shaft
8	Outboard Bearing
9	Inboard Bearing
10	Wheel
11	Inlet Cone
12	Pedestal
13	Optional Side Cover (2)
14	Optional Weather Cover
15	Discharge Flange
16	Spreader Bar (2)
17	Inlet Side Support

CPA, CPA-A, CPS, CPS-A CPV



Drive Side View Discharge Side View Inlet Side View

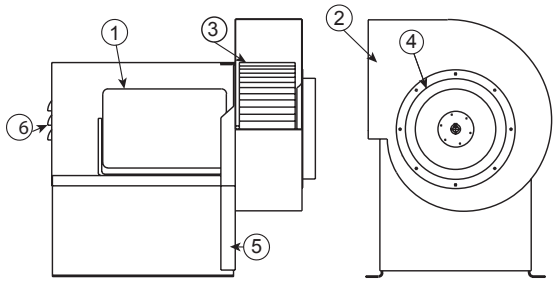
CPA, CPA-A, CPS, CPS-A, CPV with Original Curb Cap and Inlet Box Accessory



Side View Inlet Side View

Part No.	CPA, CPA-A, CPS, CPS-A, CPV with Optional Curb Cap and Inlet Box Accessory Parts List
1	CP Vent Set
2	Adjustable Draw Latch
3	Access Door Assembly
4	Latch Keeper
5	Curb Cap/Plenum Box Assembly
6	Foam Tape (not shown)

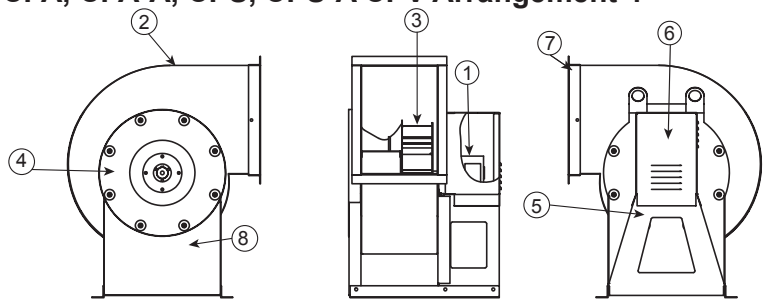
CPFD



Discharge Side View Inlet Side View

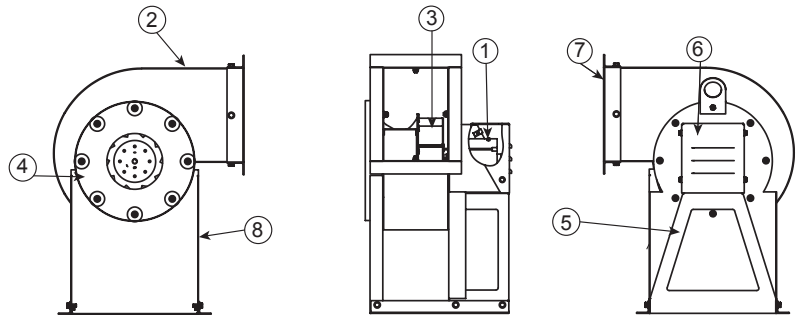
Part No.	CPFD	CPA, CPA-A, CPS, CPS-A, CPV Arr 4 & CPV-EC
1	Motor	
2	Housing	
3	Wheel	
4	Inlet Cone	
5	Pedestal	
6	Optional Weather Cover	
7	-	Discharge Flange
8	-	Inlet Side Support

CPA, CPA-A, CPS, CPS-A CPV Arrangement 4



Inlet Side View Discharge Side View Drive Side View

CPV-EC



Inlet Side View Discharge Side View Drive Side View

Limited Warranty

Loren Cook Company warrants that your Loren Cook fan was manufactured free of defects in materials and workmanship, to the extent stated herein. For a period of one (1) year after date of shipment, we will replace any parts found to be defective without charge, except for shipping costs which will be paid by you. This warranty is granted only to the original purchaser placing the fan in service. This warranty is void if the fan or any part thereof has been altered or modified from its original design or has been abused, misused, damaged or is in worn condition or if the fan has been used other than for the uses described in the company manual. This warranty does not cover defects resulting from normal wear and tear. To make a warranty claim, notify Loren Cook Company, General Offices, 2015 East Dale Street, Springfield, Missouri 65803-4637, explaining in writing, in detail, your complaint and referring to the specific model and serial numbers of your fan. Upon receipt by Loren Cook Company of your written complaint, you will be notified, within thirty (30) days of our receipt of your complaint, in writing, as to the manner in which your claim will be handled. If you are entitled to warranty relief, a warranty adjustment will be completed within sixty (60) business days of the receipt of your written complaint by Loren Cook Company. This warranty gives only the original purchaser placing the fan in service specifically the right. You may have other legal rights which vary from state to state. For fans provided with motors, the motor manufacturer warrants motors for a designated period stated in the manufacturer's warranty. Warranty periods vary from manufacturer to manufacturer. Should motors furnished by Loren Cook Company prove defective during the designated period, they should be returned to the nearest authorized motor service station. Loren Cook Company will not be responsible for any removal or installation costs.

LOREN COOK COMPANY

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AWII-I-O_100160827_2000000330_Rev AK

ARMOR™
CONDENSING WATER HEATER

Installation & Operation Manual
Models: 151 - 801

⚠ WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

-- This water heater MUST NOT be installed in any location where gasoline or flammable vapors are likely to be present.

-- **WHAT TO DO IF YOU SMELL GAS**

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

DESIGN CERTIFIED®

CERTIFIED®

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

⚠ WARNING This manual must only be used by a qualified heating installer / service technician. Read all instructions, including this manual and the Armor Water Heater Service Manual, before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

Contents

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

⚠ DANGER DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

Please read before proceeding

⚠WARNING **Installer** – Read all instructions, including this manual and the Armor Water Heater Service Manual, before installing. Perform steps in the order given.

Have this water heater serviced/inspected by a qualified service technician, at least annually.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE When calling or writing about the water heater – Please have the water heater model and serial number from the water heater rating plate.

Consider piping and installation when determining water heater location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.

⚠WARNING Failure to adhere to the guidelines on this page can result in severe personal injury, death, or substantial property damage.

⚠WARNING If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

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- If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

⚠WARNING DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 11). Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠WARNING The California Safe Drinking Water and Toxic Enforcement Act requires the Governor of California to publish a list of substances known to the State of California to cause cancer, birth defects, or other reproductive harm, and requires businesses to warn of potential exposure to such substances.

This product contains a chemical known to the State of California to cause cancer, birth defects, or orther reproductive harm. This water heater can cause low level exposure to some of the substances listed in the Act.

When servicing the water heater –

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow the water heater to cool before performing maintenance.

Water heater operation –

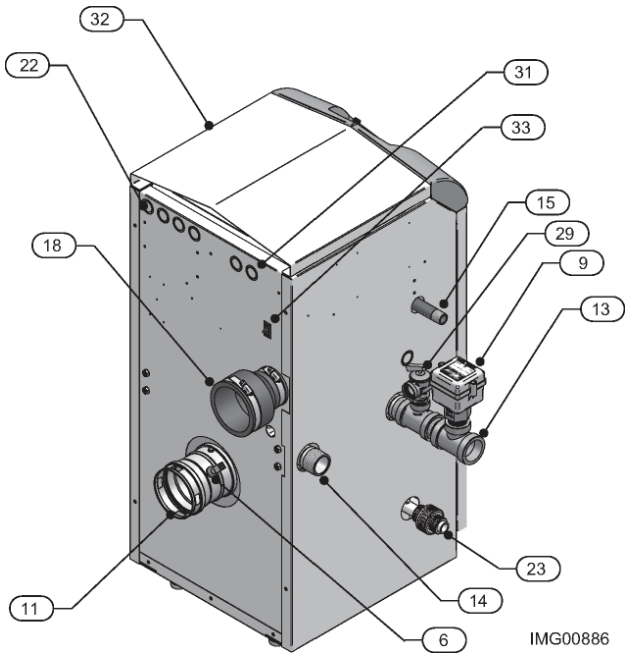
- Do not block flow of combustion or ventilation air to the water heater.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this water heater if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

The Armor Water Heater - How it works...

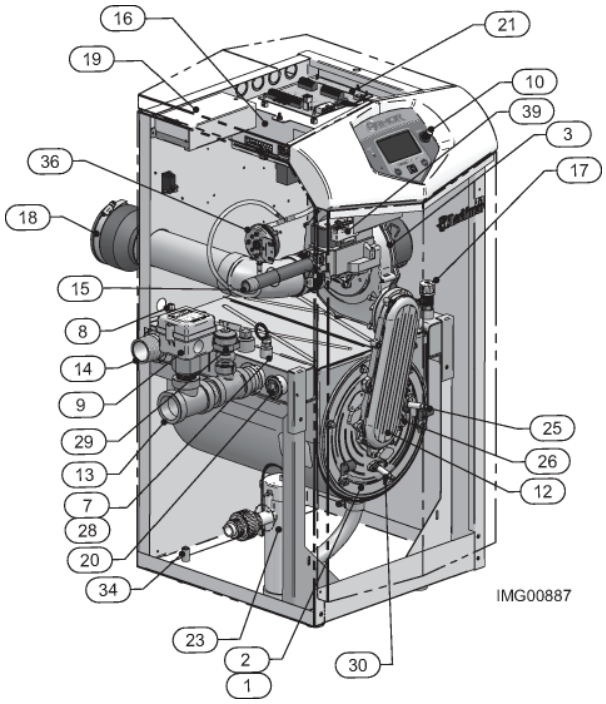
1. **Stainless steel heat exchanger**
   Allows water to flow through specially designed coils for maximum heat transfer, while providing protection against flue gas corrosion. The coils are encased in a jacket that contains the combustion process.
2. **Combustion chamber access cover**
   Allows access to the combustion side of the heat exchanger coils.
3. **Blower**
   The blower pulls in air and gas through the venturi (item 5). Air and gas mix inside the blower and are pushed into the burner, where they burn inside the combustion chamber.
4. **Gas valve**
   The gas valve senses the negative pressure created by the blower, allowing gas to flow only if the gas valve is powered and combustion air is flowing.
5. **Venturi**
   The venturi controls air and gas flow into the burner.
6. **Flue gas (limit rated)**
   This sensor monitors the flue gas exit temperature. The control module will modulate and shut down the water heater if the flue gas temperature gets too hot. This protects the flue pipe from overheating.
7. **Water heater outlet temperature sensor (housed with the high limit sensor)**
   This sensor monitors water heater outlet water temperature (system supply). If selected as the controlling sensor, the control module adjusts water heater firing rate so the outlet temperature is correct.
8. **Water heater inlet temperature sensor**
   This sensor monitors return water temperature (system return). If selected as the controlling sensor, the control module adjusts the water heater firing rate so the inlet temperature is correct.
9. **Flow Switch**
   The flow switch is a safety device that ensures flow through the heat exchanger during operation. This appliance is low mass and should never be operated without flow. The flow switch makes contact when flow is detected and allows the unit to operate. If flow is discontinued during operation for any reason the flow switch will break the control circuit and the unit will shut down.
10. **Electronic LCD display**
    The electronic display consists of 4 buttons, a navigation dial and a multiple line liquid crystal display.
11. **Flue pipe adapter**
    Allows for the connection of the PVC vent pipe system to the water heater.
12. **Burner (not shown)**
    Made with metal fiber and stainless steel construction, the burner uses pre-mixed air and gas and provides a wide range of firing rates.
13. **Water outlet**
    NPT water connection that supplies hot water to the tank.
14. **Water inlet**
    NPT water connection that returns water from the tank to the heat exchanger.
15. **Gas connection pipe**
    Threaded pipe connection. This pipe should be connected to the incoming gas supply for the purpose of delivering gas to the water heater.
16. **SMART SYSTEM Control Module**
    The SMART SYSTEM Control responds to internal and external signals and controls the blower, gas valve, and pumps to meet the demand.
17. **Manual air vent**
    Designed to remove trapped air from the heat exchanger coils.
18. **Air intake adapter**
    Allows for the connection of the PVC air intake pipe to the water heater.
19. **High voltage junction box**
    The junction box contains the connection points for the line voltage power and the pump.
20. **Water heater drain port**
    Location from which the heat exchanger can be drained.
21. **Low voltage connection board**
    The connection board is used to connect external low voltage devices.
22. **Low voltage wiring connections (knockouts)**
    Conduit connection points for the low voltage connection board.
23. **Condensate drain connection**
    Connects the condensate drain line to a 1/2" PVC union.
24. **Access cover - front (not shown)**
    Provides access to the gas train and the heat exchanger.
25. **Ignition electrode**
    Provides direct spark for igniting the burner.
26. **Flame inspection window**
    The quartz glass window provides a view of the burner surface and flame.
27. **Gas shutoff valve**
    Manual valve used to isolate the gas valve from the gas supply.
28. **High limit sensor (housed with the outlet temperature sensor)**
    Device that monitors the outlet water temperature. If the temperature exceeds its setting, the integrated control will break the control circuit, shutting the water heater down.
29. **Relief valve**
    Protects the heat exchanger from over pressure and temperature conditions. The relief valve is set at 150 PSI.
30. **Flame sensor**
    Used by the control module to detect the presence of burner flame.
31. **Line voltage wiring connections (knockouts)**
    Conduit connection points for the high voltage junction box.
32. **Top panel**
    Removable panel to gain access to the internal components.
33. **Power switch**
    Turns 120 VAC ON/OFF to the water heater.
34. **Leveling legs**
    Used to allow the heat exchanger to be leveled. This is needed for the proper draining of the condensate from the combustion chamber.
35. **Air shroud (501 Model Only)**
    The air shroud directs air and gas flow into the burner.
36. **Air pressure switch**
    The air pressure switch detects blocked inlet or outlet conditions.
37. **Pump relay (not shown)**
    The pump relay is used to control the circulation pump.
38. **Transformer**
    The transformer provides 24V power to the integrated control.
39. **Gas shutoff switch**
    An electrical switch designed to cut power to the gas valve to prevent releasing any gas.
40. **Over-temp switch (Models 286 - 801) (located underneath access cover)**
    An electrical switch designed to shut down water heater operation in the event the outer back of the heat exchanger, directly above the flue connection exceeds 604°F (318°C). This is a one time switch and could warrant a heat exchanger replacement. Check the integrity of the rear refractory at the back of the upper coil if the switch opens.
41. **Burner door temperature switch (Models 286 - 801 Only)**
    An electrical switch designed to shut down water heater operation in the event the combustion chamber access cover exceeds 500°F (260°C). This switch may only be reset by a qualified service technician AFTER the underlying cause has been identified and corrected. Check the integrity of the front refractory on the inside of the combustion chamber access cover if the switch opens.

The Armor Water Heater - How it works... *(continued)*

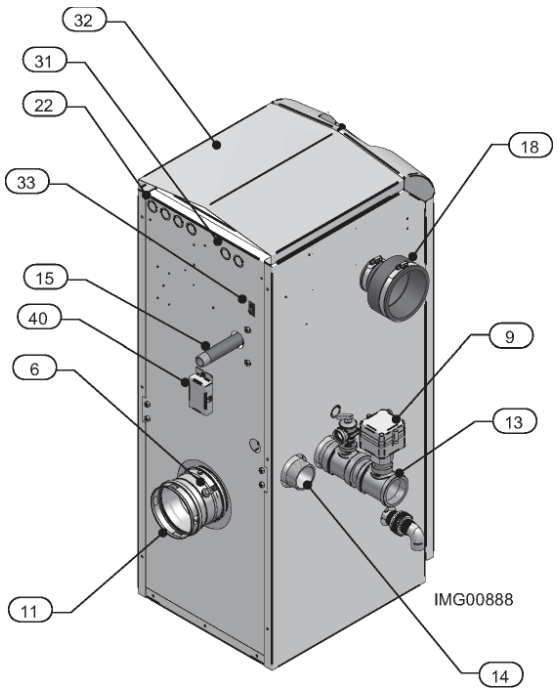
Models 151 - 200



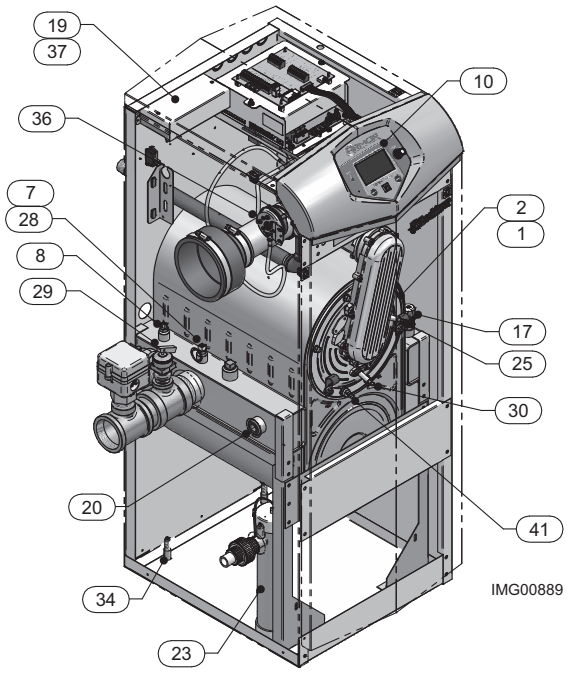
Rear View - Models 151 - 200



Left Side (inside unit) - Models 151 - 200



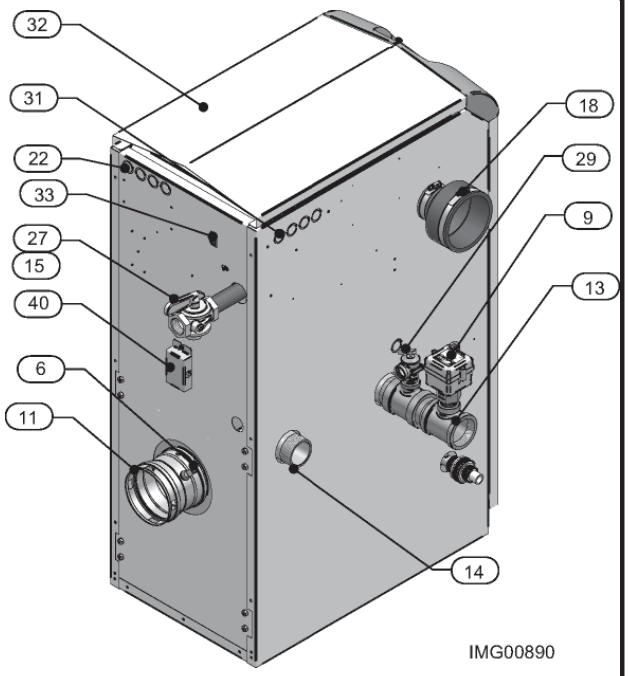
Rear View - Model 286



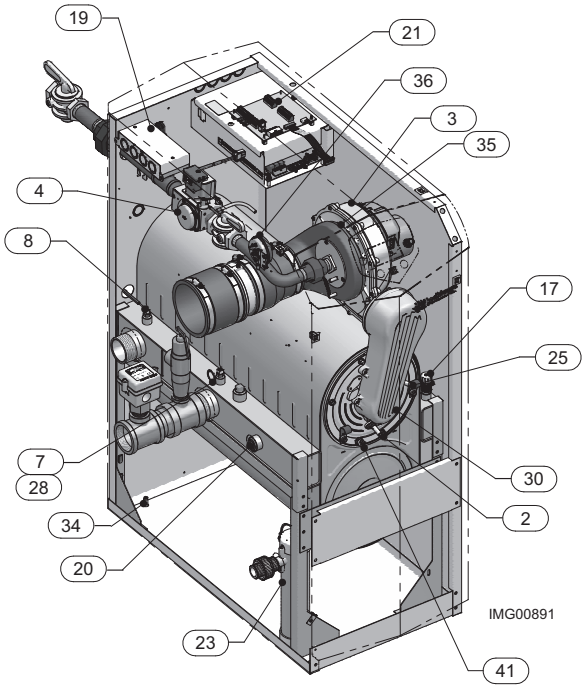
Left Side (inside unit) - Model 286

The Armor Water Heater - How it works...

Models 400 - 501

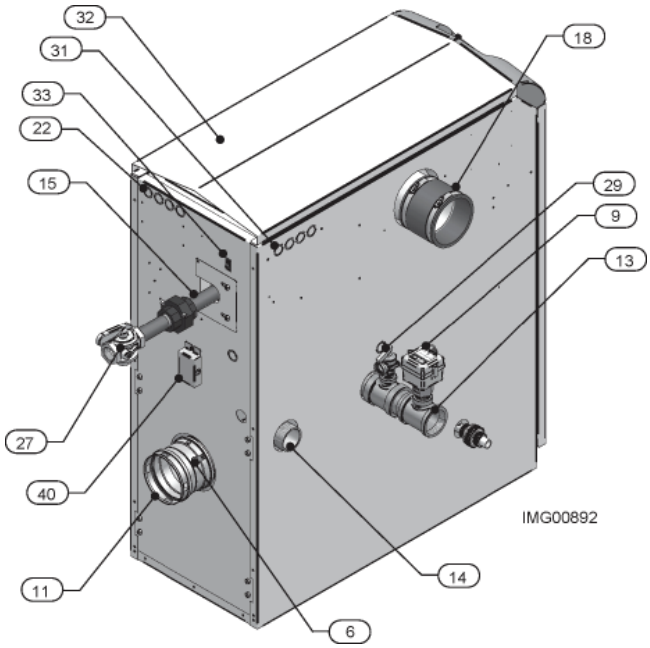


Rear View - Models 400 - 501

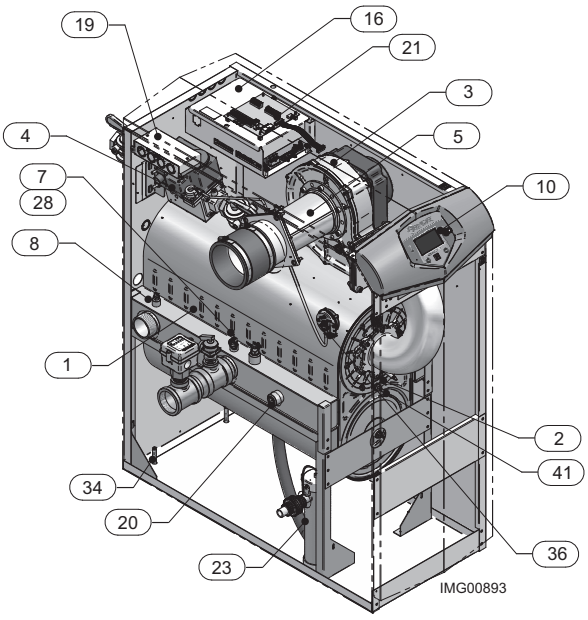


Left Side (inside unit) - Models 400 - 501

Models 601 - 801



Rear View - Models 601 - 801



Left Side (inside unit) - Models 601 - 801

Ratings

HLW

LOW LEAD CONTENT

Model Number Note: Change "N" to "L" for L.P. gas models.	CSA Input Modulation Btu/hr (Note 2, 3)	Water Content Gallons	Water Connections	Gas Connections	Vent/Air Size (Note 1,5)
AWN151PM	30,000 - 150,000	1.3	1-1/4"	1/2"	3"/3"
AWN200PM	39,800 - 199,000	1.8	1-1/4"	1/2"	3"/3"
AWN286PM	57,000 - 285,000	2.5	2"	3/4"	4"/4"
AWN400PM	79,800 -399,000	3.4	2"	1"	4"/4"
AWN501PM	100,000 - 500,000	3.9	2"	1"	4"/4"
AWN601PM	120,000 - 600,000	3.9	2"	1"	4"/4"
AWN701PM	140,000 - 700,000	4.4	2"	1"	6"/4"
AWN801PM	160,000 - 800,000	4.9	2"	1"	6"/4"

NOTICE Maximum allowed working pressure is located on the rating plate.

Notes:

1. Armor water heaters require special gas venting. Use only the vent materials and methods specified in the Armor Installation and Operation Manual.
2. Standard Armor water heaters are equipped to operate from sea level to 4,500 feet **only** with no adjustments. The water heater will de-rate by 4% for each 1,000 feet above sea level up to 4,500 feet.
3. High altitude Armor water heaters are equipped to operate from 3,000 to 12,000 feet **only**. The water heater will de-rate by 2% for each 1,000 feet above sea level. High altitude models are manufactured with a different control module for altitude operation, but the operation given in this manual remains the same as the standard models. A high altitude label (as shown in FIG. A) is also affixed to the unit.

   Derate values are based on proper combustion calibration and CO_2's adjusted to the recommended levels.
4. The manual reset high limit provided with the Armor is listed to UL353. The auto reset high limit is listed to ANSI Z21.87.
5. The Armor 286 model can be alternatively vented using a 3" vent/air size. If the 3" vent/air size is used, the maximum vent/air pipe lengths are limited to 60 equivalent feet each.

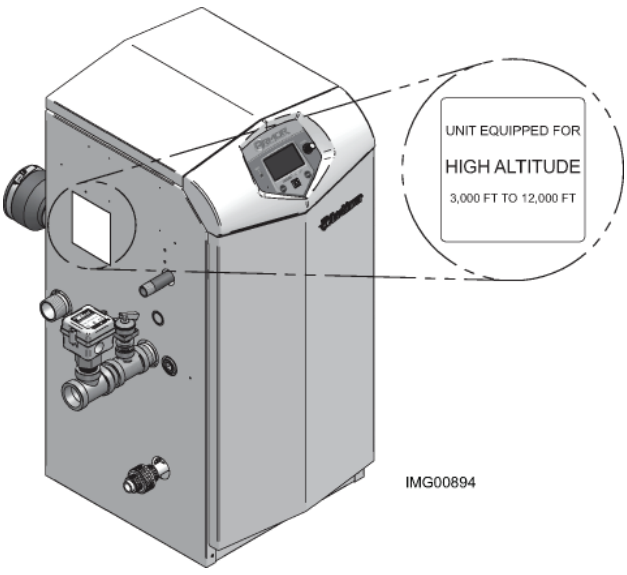


Figure A *High Altitude Label Location*

1 Determine water heater location

Installation must comply with:

- Local, state, provincial, and national codes, laws, regulations, and ordinances.
- National Fuel Gas Code, ANSI Z223.1 – latest edition.
- National Electrical Code.
- For Canada only: B149.1 Installation Code, CSA C22.1 Canadian Electrical Code Part 1 and any local codes.

NOTICE The Armor water heater gas manifold and controls met safe lighting and other performance under tests specified in ANSI Z21.10.3 – latest edition.

Before locating the water heater, check:

1. Check for nearby connection to:
   - Water piping
   - Venting connections
   - Gas supply piping
   - Electrical power
2. Locate the appliance so that if water connections should leak, water damage will not occur. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. The pan must not restrict combustion air flow. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this appliance, or any of its components.
3. Check area around the water heater. Remove any combustible materials, gasoline and other flammable liquids.

⚠WARNING Failure to keep water heater area clear and free of combustible materials, gasoline, and other flammable liquids and vapors can result in severe personal injury, death, or substantial property damage.

4. The Armor water heater must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.
5. If a new water heater will replace an existing water heater, check for and correct system problems, such as:
   - System leaks causing oxygen corrosion or heat exchanger cracks from hard water deposits.
6. Check around the water heater for any potential air contaminants that could risk corrosion to the water heater or the water heater combustion air supply (see Table 1A on page 11). Prevent combustion air contamination. Remove any of these contaminants from the water heater area.

⚠WARNING DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 11). Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠WARNING This appliance is certified as an indoor appliance. Do not install the appliance outdoors or locate where the appliance will be exposed to freezing temperatures or to temperatures that exceed 100°F.

Do not install the appliance where the relative humidity may exceed 93%. Do not install the appliance where condensation may form on the inside or outside of the appliance, or where condensation may fall onto the appliance.

Failure to install the appliance indoors could result in severe personal injury, death, or substantial property damage.

⚠WARNING This appliance requires a special venting system. If using PVC the vent connection to the appliance must be made with the starter CPVC pipe section provided with the appliance. The field provided vent fittings must be cemented to the CPVC pipe section. Use only the vent materials, primer and cement specified in this manual to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

Closet and alcove installations

A closet is any room the water heater is installed in which is less than 86 cubic feet for AWN151 models, 106 cubic feet for AWN200models, 120 cubic feet for AWN286 models, 165 cubic feet for AWN400 models, 191 cubic feet for AWN501 models, 223 cubic feet for AWN601 models, 247 cubic feet for AWN701 models and 278 cubic feet for AWN801 models.

An alcove is any room which meets the criteria for a closet with the exception that it does not have a door.

Example: Room dimensions = 4 feet long, 5 feet wide, and 9 foot ceiling = 4 x 5 x 9 = 180 cubic feet.

⚠WARNING For closet and alcove installations as shown in FIG.'s 1-1 and 1-2, CPVC vent material must be used inside the structure. The ventilating air openings shown in FIG.'s 1-1 and 1-2 are required for this arrangement. Failure to follow this warning could result in fire, personal injury, or death.

Provide clearances:

Clearances from combustible materials

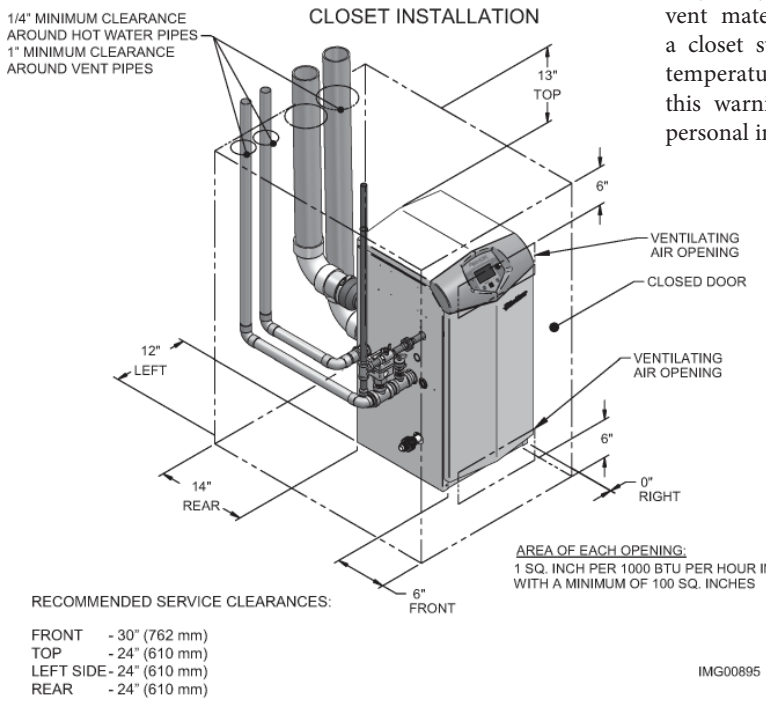
1. Hot water pipes—at least 1/4" from combustible materials.
2. Vent pipe – at least 1" from combustible materials.
3. See FIG.'s 1-1 and 1-2 on page 9 for other clearance minimums.

Clearances for service access

1. See FIG.'s 1-1 and 1-2 on page 9 for recommended service clearances. If you do not provide the minimum clearances shown, it may not be possible to service the water heater without removing it from the space.

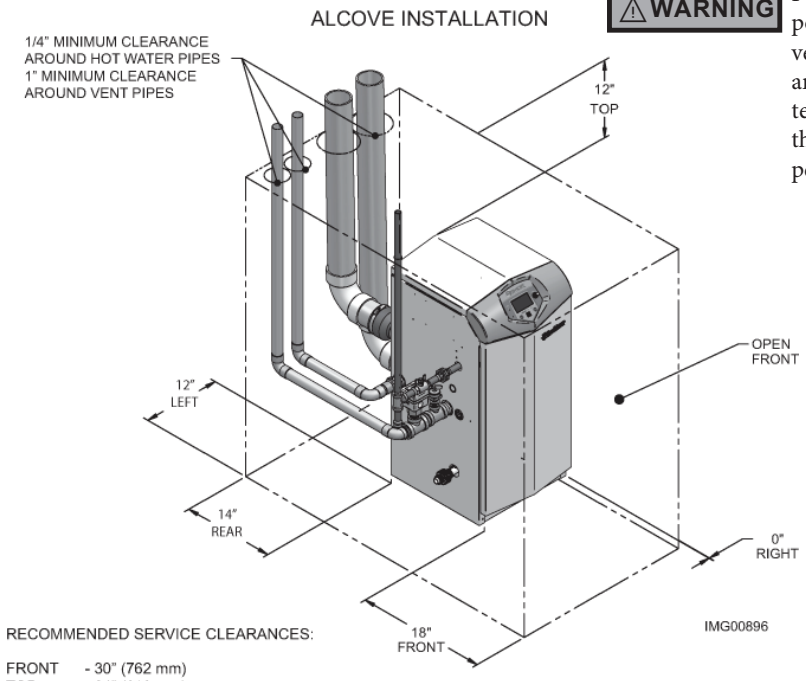
1 Determine water heater location *(continued)*

Figure 1-1 *Closet Installation - Minimum Required Clearances*



⚠WARNING For closet installations, CPVC, polypropylene or stainless steel vent material MUST BE used in a closet structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

Figure 1-2 *Alcove Installation - Minimum Required Clearances*



⚠WARNING For alcove installations, CPVC, polypropylene or stainless steel vent material MUST BE used in an alcove structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

1 Determine water heater location

Provide air openings to room:

Armor water heater alone in equipment room

1. No air ventilation openings into the equipment room are needed when clearances around the Armor water heater are at least equal to the SERVICE clearances shown in FIG.'s 1-1 and 1-2. For spaces that do NOT supply this clearance, provide two openings as shown in FIG. 1-1. Each opening must provide one square inch free area per 1,000 Btu/hr of water heater input.

Armor water heater in same space with other gas or oil-fired appliances

1. Follow the National Fuel Gas Code (U.S.) or CSA B149.1 (Canada) to size/verify size of the combustion/ventilation air openings into the space.

⚠WARNING The space must be provided with combustion/ventilation air openings correctly sized for all other appliances located in the same space as the Armor water heater.

Do not install the water heater in an attic.

Failure to comply with the above warnings could result in severe personal injury, death, or substantial property damage.

2. Size openings only on the basis of the other appliances in the space. No additional air opening free area is needed for the Armor water heater because it takes its combustion air from outside (direct vent installation).

Flooring and foundation

Flooring

The Armor water heater is approved for installation on combustible flooring, but must never be installed on carpeting.

⚠WARNING Do not install the water heater on carpeting even if foundation is used. Fire can result, causing severe personal injury, death, or substantial property damage.

If flooding is possible, elevate the water heater sufficiently to prevent water from reaching the water heater.

Residential garage installation

Precautions

Take the following precautions when installing the appliance in a residential garage. If the appliance is located in a residential garage, it should be installed in compliance with the latest edition of the National Fuel Gas Code, ANSI Z223.1 and/or CAN/CGA-B149 Installation Code.

- Appliances located in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling shall be installed so that all burners and burner ignition devices are located not less than 18 inches (46 cm) above the floor.
- The appliance shall be located or protected so that it is not subject to physical damage by a moving vehicle.

Vent and air piping

The Armor water heater requires a special vent system, designed for pressurized venting.

The water heater is to be used for either direct vent installation or for installation using indoor combustion air. When room air is considered, see the General Venting Section. Note prevention of combustion air contamination below when considering vent/air termination.

Vent and air must terminate near one another and may be vented vertically through the roof or out a side wall, unless otherwise specified. You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Armor water heater using any other means.

Be sure to locate the water heater such that the vent and air piping can be routed through the building and properly terminated. The vent/air piping lengths, routing and termination method must all comply with the methods and limits given in this manual.

Prevent combustion air contamination

Install air inlet piping for the Armor water heater as described in this manual. Do not terminate vent/air in locations that can allow contamination of combustion air. Refer to Table 1A, page 11 for products and areas which may cause contaminated combustion air.

⚠WARNING You must pipe combustion air to the water heater air intake. Ensure that the combustion air will not contain any of the contaminants in Table 1A, page 11. Contaminated combustion air will damage the water heater, resulting in possible severe personal injury, death or substantial property damage. Do not pipe combustion air near a swimming pool, for example. Also avoid areas subject to exhaust fumes from laundry facilities. These areas will always contain contaminants.

1 Determine water heater location *(continued)*

Table 1A Corrosive Contaminants and Sources

Products to avoid:
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

When using an existing vent system to install a new water heater:

⚠WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

Check the following venting components before installing:

- **Material** - For materials listed for use with this appliance, see Section 3 - General Venting. For polypropylene or stainless steel venting, an adapter of the same manufacturer must be used at the flue collar connection.
- **Size** - To ensure proper pipe size is in place, see Table 3A. Check to see that this size is used throughout the vent system.
- **Manufacturer** - For a stainless steel or polypropylene application, you must use only the listed manufacturers and their type product listed in Tables 3E and 3G for CAT IV positive pressure venting with flue producing condensate.
- **Supports** - Non-combustible supports must be in place allowing a minimum 1/4" rise per foot. The supports should adequately prevent sagging and vertical slippage, by distributing the vent system weight. For additional information, consult the vent manufacturer's instructions for installation.
- **Terminations** - Carefully review Sections 3 through 5 to ensure requirements for the location of the vent and air terminations are met and orientation of these fit the appropriate image from the Horizontal or Vertical options listed in the General Venting Section. For stainless steel vent, only use terminations listed in Table 3I for the manufacturer of the installed vent.
- **Seal** - With prior requirements met, the system should be tested to the procedure listed in parts (c) through (f) of the Removal of an Existing Water Heater Section on page 12.

With polypropylene and stainless steel vent, seal and connect all pipe and components as specified by the vent manufacturer used; with PVC/CPVC vent, see the Installing Vent or Air Piping Section on page 21.

⚠WARNING If any of these conditions are not met, the existing system must be updated or replaced for that concern. Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

1 Determine water heater location

When removing a water heater from existing common vent system:

⚠ DANGER Do not install the Armor water heater into a common vent with any other appliance. This will cause flue gas spillage or appliance malfunction, resulting in possible severe personal injury, death, or substantial property damage.

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

At the time of removal of an existing water heater, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

a. Seal any unused openings in the common venting system.

b. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, or other deficiencies, which could cause an unsafe condition.

c. Test vent system – Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

d. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

e. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.

f. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined herein, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous conditions of use.

g. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code.

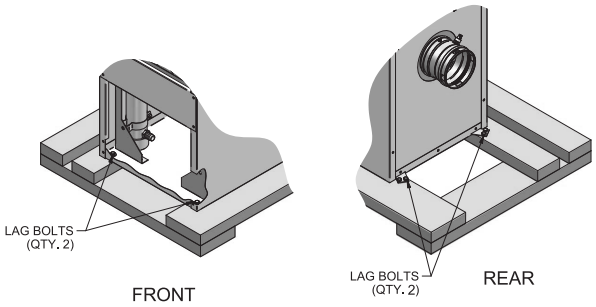
2 Prepare water heater

Remove water heater from wood pallet

1. After removing the outer shipping carton from the water heater, remove the parts box.
2. Remove the front door to access the lag bolts in front of the unit (FIG. 2-1).
3. To remove the water heater from the pallet (after removing the front door):
   a. Remove the two lag bolts from the wood pallet inside the water heater (FIG. 2-1).
   b. Detach the water heater from the lag bolts in the rear of the unit, see FIG. 2-1.

NOTICE Do not drop the water heater or bump the jacket on the floor or pallet. Damage to the water heater can result.

Figure 2-1 *Water heater Mounted on Shipping Pallet*



Gas conversions

⚠WARNING For a water heater already installed, you must turn off gas supply, turn off power and allow the water heater to cool before proceeding. You must also completely test the water heater after conversion to verify performance as described under Start-up, Section 10 of this manual. Failure to comply could result in severe personal injury, death, or substantial property damage.

For Models 151 - 400 you must install a propane orifice to operate the Armor water heater on propane gas. Verify when installing that the orifice size marking matches water heater size (Models 151 – 400, Table 2A).

The 501 - 801 Models do not require an orifice installation for propane operation, but they will require a valve adjustment.

Table 2A *LP Conversion Table*

LP Conversion Table	
Model	**LP Orifice Stamping**
151	**150**
200	**210 / W150**
286	**285**
400	**8.0**

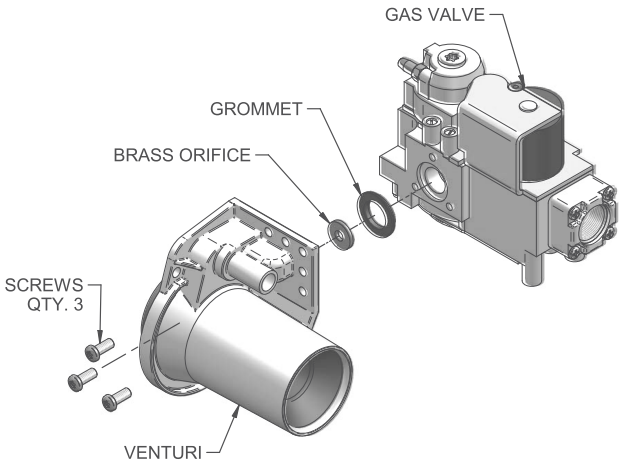
Models 151 - 286

1. Remove the top and front access covers from the unit (no tools required for removal).
2. Remove the three screws securing the gas valve to the venturi (FIG. 2-2).
3. Locate the propane orifice disk from the conversion kit bag. Verify that the stamping on the orifice disk matches the water heater size (151 – 286) (see Table 2A above).

   Place the orifice into the black rubber grommet in the side of the gas valve and secure in the valve (FIG. 2-2).
4. Reposition the gas valve against the venturi and replace the screws (FIG. 2-2) securing the valve to the venturi.
5. After installation is complete, attach the propane conversion label (in the conversion kit bag) next to the water heater rating plate. Attach the LP caution label (in the conversion kit bag) to the left side of the unit in the lower left corner.
6. Replace the top and front access covers.

⚠WARNING After converting to LP, check combustion per the Start-up procedure in Section 10 of this manual. Failure to check and verify combustion could result in severe personal injury, death, or substantial property damage.

Figure 2-2 *Installing Propane Orifice - Models 151 - 286*



2 Prepare water heater

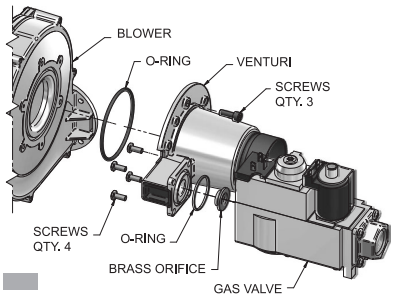
Model 400

1. Remove the top and front access covers from the unit (no tools required for removal).
2. Remove the three screws securing the venturi to the blower.
   Note: When separating the venturi from the blower, take care not to damage the O-ring inside the blower (FIG. 2-3).
3. Remove the four screws securing the gas valve to the venturi (FIG. 2-3).
4. Locate the propane orifice disk from the conversion kit bag. Verify that the stamping on the orifice disk matches the water heater size (see Table 2A on page 13).
5. Remove the existing orifice from the O-ring in the side of the gas valve and replace it with the orifice from the kit. Position and secure the orifice in the valve as shown in FIG. 2-3.
6. Reposition the gas valve against the venturi and replace the screws (FIG. 2-3) securing the valve to the venturi.
7. Inspect the O-ring inside the blower. Handle the O-ring with care, do not damage. Reposition the venturi against the blower and replace the screws securing the venturi to the blower (FIG. 2-3).
8. After installation is complete, attach the propane conversion label (in the conversion kit bag) next to the water heater rating plate. Attach the LP caution label (in the conversion kit bag) to the left side of the unit in the lower left corner.
9. Replace the top and front access covers.

⚠WARNING After converting to LP, check combustion per the Start-up procedure in Section 10 of this manual. Failure to check and verify combustion could result in severe personal injury, death, or substantial property damage.

⚠ DANGER Armor 400: Inspect the O-ring when the blower is disassembled. The O-ring must be in good condition and must be installed. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

Figure 2-3 *Installing Propane Orifice - Model 400*

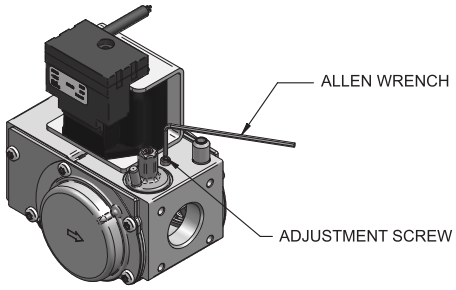


Model 501

1. Remove the top access cover from the unit (no tools required for removal).
2. Turn the adjustment screw on the gas valve clockwise until it stops. Then turn the adjustment screw counterclockwise four and three quarter (4 3/4) turns (see FIG. 2-4).
3. Use a combustion analyzer to verify CO_2 is within the range of 9.6 – 10.5%. If not, adjust the screw **counterclockwise** incrementally to raise CO_2 and **clockwise** to lower CO_2 (FIG. 2-4).
4. After adjustment is complete, attach the propane conversion label (in the conversion kit bag) next to the water heater rating plate. Attach the LP caution label (in the conversion kit bag) to the left side of the unit in the lower left corner.
5. Replace the top access cover.

⚠WARNING After converting to LP, check combustion per the Start-up procedure in Section 10 of this manual. Failure to check and verify combustion could result in severe personal injury, death, or substantial property damage.

Figure 2-4 *Gas Valve Adjustment - Model 501*



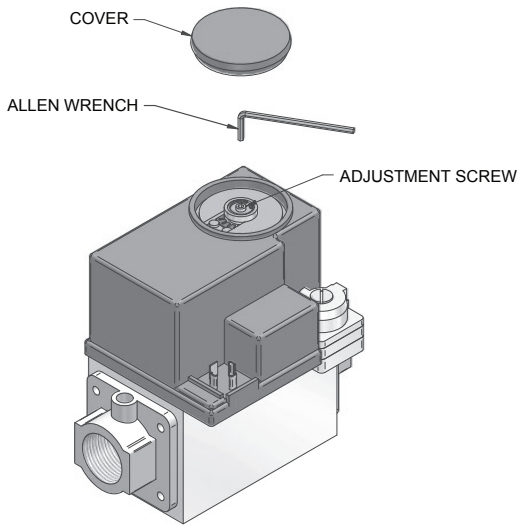
2 Prepare water heater *(continued)*

Models 601 - 801

1. Remove the top access cover from the unit (no tools required for removal).
2. Remove the cover on top of the gas valve (FIG. 2-5).
3. Turn the adjustment screw on top of the gas valve clockwise one and three quarter (1 3/4) turns on the 601 Model, one and a half (1 1/2) turns on the 701 Model, and one turn on the 801 Model (see FIG. 2-5).
4. Use a combustion analyzer to verify CO_2 is within the range of 9.6 – 10.5%. If not, adjust the screw **counterclockwise** incrementally to raise CO_2 and **clockwise** to lower CO_2 (FIG. 2-5).
5. After adjustment is complete, attach the propane conversion label (in the conversion kit bag) next to the water heater rating plate. Attach the LP caution label (in the conversion kit bag) to the left side of the unit in the lower left corner.
6. Replace the gas valve cover along with the top access cover.

⚠WARNING After converting to LP, check combustion per the Start-up procedure in Section 10 of this manual. Failure to check and verify combustion could result in severe personal injury, death, or substantial property damage.

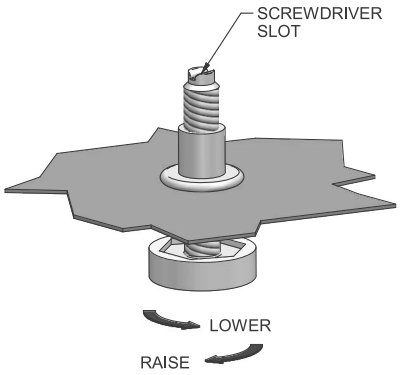
Figure 2-5 *Gas Valve Adjustment - Models 601 - 801*



Leveling the water heater

1. Set the water heater in place and check level.
   a) Adjust legs if necessary to level the water heater, see FIG. 2-6 below.

Figure 2-6 *Leveling Legs on the Water Heater*



3 General venting

Direct venting options - Sidewall Vent

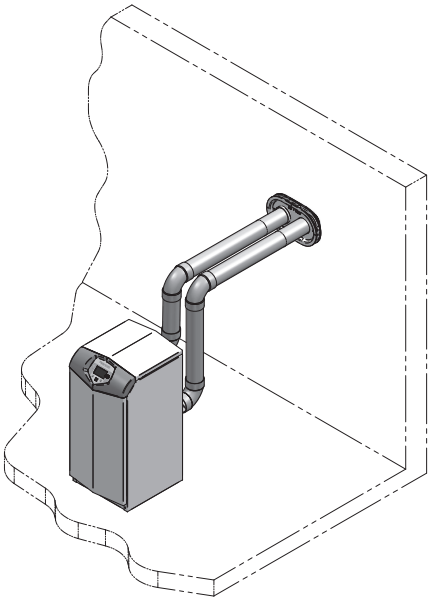


Figure 3-1 *Two-Pipe Sidewall Termination - See page 24 for more details*

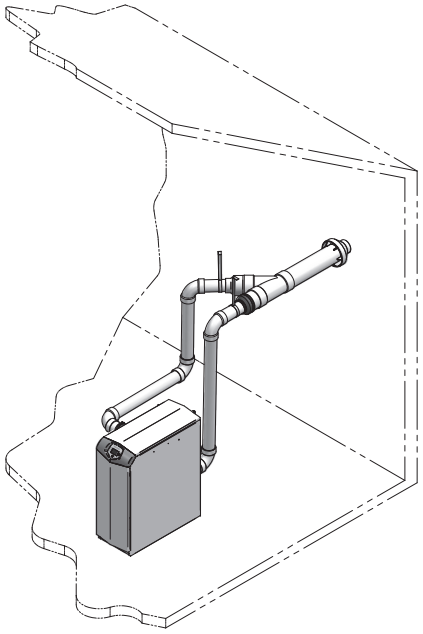


Figure 3-2 *PVC/CPVC Concentric Sidewall Termination (Models 151 - 601 Only) - See page 31 for more details*

Direct venting options - Vertical Vent

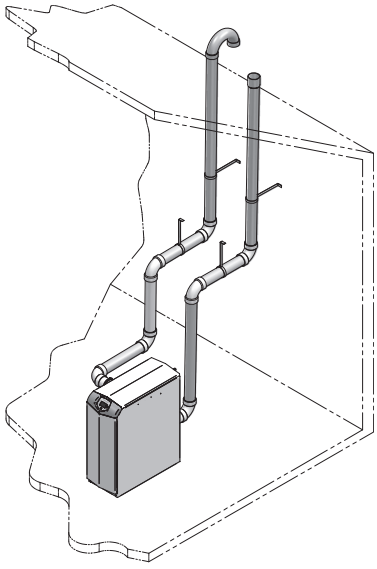


Figure 3-3 *Two-Pipe Vertical Termination - See page 34 for more details*

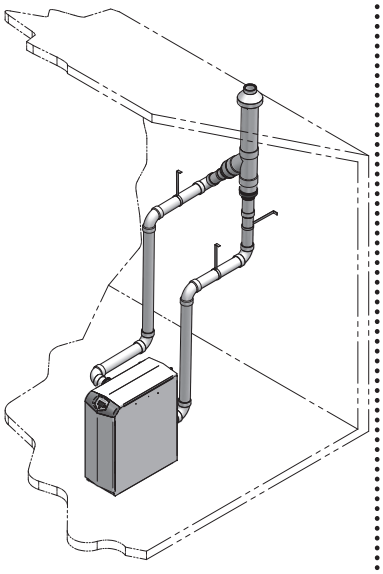


Figure 3-4 *PVC/CPVC Concentric Vertical Termination (Models 151 - 601 Only) - See page 36 for more details*

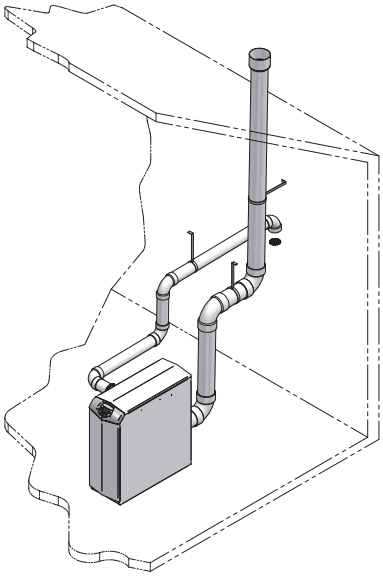


Figure 3-5 *Vertical Vent, Sidewall Air*

3 General venting *(continued)*

Install vent and combustion air piping

⚠ DANGER The Armor water heater must be vented and supplied with combustion and ventilation air as described in this section. Ensure the vent and air piping and the combustion air supply comply with these instructions regarding vent system, air system, and combustion air quality. See also Section 1 of this manual.

Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of applicable codes.

Failure to provide a properly installed vent and air system will cause severe personal injury or death.

⚠ WARNING This appliance requires a special venting system. Use only approved stainless steel, PVC, CPVC or polypropylene pipe and fittings listed in Tables 3D, 3E, and 3G for vent pipe, and fittings. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING DO NOT mix components from different systems. The vent system could fail, causing leakage of flue products into the living space. Mixing of venting materials will void the warranty and certification of the appliance.

NOTICE Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

⚠ WARNING For closet and alcove installations, CPVC, polypropylene or stainless steel material MUST BE used in a closet/alcove structure. Failure to follow this warning could result in fire, personal injury, or death.

⚠ CAUTION Improper installation of venting systems may result in injury or death.

NOTICE Follow the instructions in Section 1, page 12 of this manual when removing a water heater from an existing vent system.

⚠ WARNING Do not connect any other appliance to the vent pipe or multiple water heaters to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.

The Armor water heater vent and air piping can be installed through the roof or through a sidewall. Follow the procedures in this manual for the method chosen. Refer to the information in this manual to determine acceptable vent and air piping length.

You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Armor water heater using any other means.

You must also install air piping from outside to the water heater air intake adapter unless following the Optional Room Air instructions on page 20 of this manual. The resultant installation is direct vent (sealed combustion).

Air intake/vent connections

1. **Combustion Air Intake Connector** (FIG. 3-6 thru 3-7) - Used to provide combustion air directly to the unit from outdoors. A fitting is provided on the unit for final connection. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.
2. **Vent Connector** (FIG.'s 3-8 thru 3-12) - Used to provide a passageway for conveying combustion gases to the outside. A transition fitting is provided on the unit for final connection. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

Figure 3-6 *Near Water Heater Air Piping Models 151 - 200*

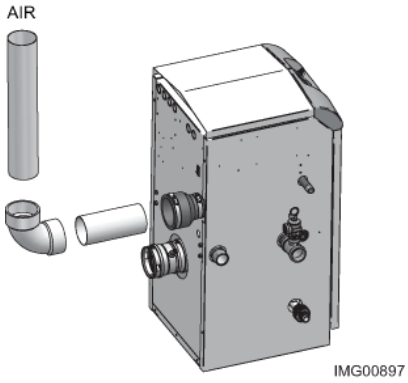
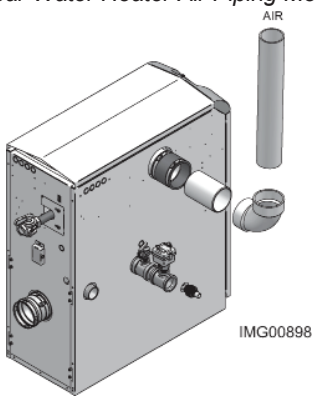


Figure 3-7 *Near Water Heater Air Piping Models 286 - 601*



3 General venting

Requirements for installation in Canada

1. Installations must be made with a vent pipe system certified to ULC-S636.

   IPEX is an approved vent manufacturer in Canada supplying vent material listed to ULC-S636.

2. The first three (3) feet of plastic vent pipe from the appliance flue outlet must be readily accessible for visual inspection.

3. The components of the certified vent system must not be interchanged with other vent systems or unlisted pipe/fittings. For concentric vent installations, the inner vent tube must be replaced with field supplied certified vent material to comply with this requirement.

4. The 3 and 4" Concentric Vent Kit available from Lochinvar (see Section 4 – *Sidewall Termination – Optional Concentric Vent*) and the 3 and 4" Concentric Vent Kit available from IPEX are both approved for use on the Armor water heater. Both kits are listed to the ULC-S636 standard for use in Canada.

Sizing

The Armor water heater uses model specific combustion air intake and vent piping sizes as detailed in Table 3A below.

Table 3A *Air Intake/Vent Piping Sizes*

Model	Air Intake	Vent
151 - 200	3 inches	3 inches
286 - 601	4 inches	4 inches
701 - 801	4 inches	6 inches

NOTICE Increasing or decreasing combustion air or vent piping sizes is not authorized, unless referenced in manual..

Minimum / Maximum allowable combustion air and vent piping lengths are as follows:

Combustion Air = 12 equivalent feet minimum / 100 equivalent feet maximum

Vent = 12 equivalent feet minimum / 100 equivalent feet maximum

NOTICE When using the alternative 3" vent and combustion air piping with an Armor 286 model, the maximum allowable combustion air and vent piping lengths are limited to 60 equivalent feet each. The minimum allowable combustion air and vent pipe lengths remain 12 equivalent feet each.

When determining equivalent combustion air and vent length, add 5 feet for each 90° elbow and 3 feet for each 45° elbow.

EXAMPLE: 20 feet of PVC pipe + (4) 90° elbows + (2) 45° elbows + (1) concentric vent kit (100140480) = 49 equivalent feet of piping.

NOTICE The appliance output rating will reduce by up to 1.5% for each 25 feet of vent length, except when using the alternative 3" vent for the Armor 286 model which may de-rate by up to 4% for each 25 feet of vent length.

Table 3B *Concentric Vent Kit Equivalent Vent Lengths*

Model	Kit Number	Equivalent Vent Length
151 - 200	100140480	3 feet
286	100140484	3 feet
400	100140484	5 feet
501 - 601	100140484	30 feet

3 General venting *(continued)*

Air inlet pipe materials:

The air inlet pipe(s) must be sealed. Choose acceptable combustion air inlet pipe materials from the following list:

PVC, CPVC, Polypropylene or ABS
Dryer Vent or Sealed Flexible Duct (not recommended for rooftop air inlet)
Galvanized steel vent pipe with joints and seams sealed as specified in this section.
Type "B" double-wall vent with joints and seams sealed as specified in this section.
AL29-4C, stainless steel material to be sealed to specification of its manufacturer.

*Plastic pipe may require an adapter (not provided) to transition between the air inlet connection on the appliance and the plastic air inlet pipe.

⚠WARNING Using air intake materials other than those specified can result in personal injury, death or property damage.

NOTICE The use of double-wall vent or insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

Sealing of Type "B" double-wall vent material or galvanized vent pipe material used for air inlet piping on a sidewall or vertical rooftop Combustion Air Supply System:

a. Seal all joints and seams of the air inlet pipe using either Aluminum Foil Duct Tape meeting UL Standard 723 or 181A-P or a high quality UL Listed silicone sealant such as those manufactured by Dow Corning or General Electric.
b. Do not install seams of vent pipe on the bottom of horizontal runs.
c. Secure all joints with a minimum of three (3) sheet metal screws or pop rivets. Apply Aluminum Foil Duct Tape or silicone sealant to all screws or rivets installed in the vent pipe.
d. Ensure that the air inlet pipes are properly supported.

The PVC, CPVC, or ABS air inlet pipe should be cleaned and sealed with the pipe manufacturer's recommended solvents and standard commercial pipe cement for the material used. The PVC, CPVC, ABS, Dryer Vent or Flex Duct air inlet pipe should use a silicone sealant to ensure a proper seal at the appliance connection and the air inlet cap connection. Dryer vent or flex duct should use a screw type clamp to seal the vent to the appliance air inlet and the air inlet cap. Proper sealing of the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.

Follow the polypropylene manufacturer's instructions when using polypropylene material as an inlet pipe.

When a sidewall or vertical rooftop combustion air supply system is disconnected for any reason, the air inlet pipe must be resealed to ensure that combustion air will be free of contaminants and supplied in proper volume.

⚠ DANGER Failure to properly seal all joints and seams as required in the air inlet piping may result in flue gas recirculation, spillage of flue products and carbon monoxide emissions causing severe personal injury or death.

3 General venting

Vent, air piping, and termination:

The Armor water heater vent and air piping can be installed through the roof or through a sidewall. Follow the procedures in this manual for the method chosen. This unit requires Category IV venting. Refer to the information in this manual to determine acceptable vent and air piping length.

Optional room air

NOTICE Optional room air is intended for commercial applications. Combustion air piping to the outside is recommended for residential applications.

Commercial applications utilizing the Armor water heater may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room. In order to use the room air venting option the following conditions and considerations must be followed.

- The unit MUST be installed with the appropriate room air kit (Table 3C).
- The equipment room MUST be provided with properly sized openings to assure adequate combustion air. Refer to the instructions provided with the room air kit.
- There will be a noticeable increase in the noise level during normal operation from the inlet air opening.
- Using the room air kit makes the unit vulnerable to combustion air contamination from within the building. Please review Section 1, Prevent Combustion Air Contamination, to ensure proper installation.
- Vent system and terminations must comply with the standard venting instructions set forth in this manual.

⚠WARNING When utilizing the single pipe method, provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

***Table 3C** Optional Room Air Kit*

Model	Kit Number	Description
151 - 200	100157615	Room Air Kit
286 - 801	100157616	Room Air Kit
400 - 801	100157617	Room Air Filter Kit

Air contamination

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the water heater, they can form strong acids. The acid can eat through the water heater wall, causing serious damage and presenting a possible threat of flue gas spillage or appliance water leakage into the building.

Please read the information given in Table 1A, page 11, listing contaminants and areas likely to contain them. If contaminating chemicals will be present near the location of the water heater combustion air inlet, have your installer pipe the water heater combustion air and vent to another location, per this manual.

⚠WARNING If the water heater combustion air inlet is located in a laundry room or pool facility, for example, these areas will always contain hazardous contaminants.

⚠WARNING To prevent the potential of severe personal injury or death, check for areas and products listed in Table 1A, page 11 before installing the water heater or air inlet piping.

If contaminants are found, you MUST:

- Remove contaminants permanently.

—OR—

- Relocate air inlet and vent terminations to other areas.

PVC/CPVC

This product has been approved for use with the PVC/CPVC vent materials listed in Table 3D.

Installing vent and air piping

⚠WARNING The vent connection to the appliance must be made with the starter CPVC pipe section provided with the appliance if PVC/CPVC vent is to be used. The field provided vent fittings must be cemented to the CPVC pipe section using an "All Purpose Cement" suitable for PVC and CPVC pipe. Use only the vent materials, primer, and cement specified in Table 3D to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

NOTICE Use only cleaners, primers, and solvents that are approved for the materials which are joined together.

NOTICE All PVC vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the water heater (to allow drainage of condensate).

3 General venting *(continued)*

⚠WARNING Insulation should not be used on PVC or CPVC venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

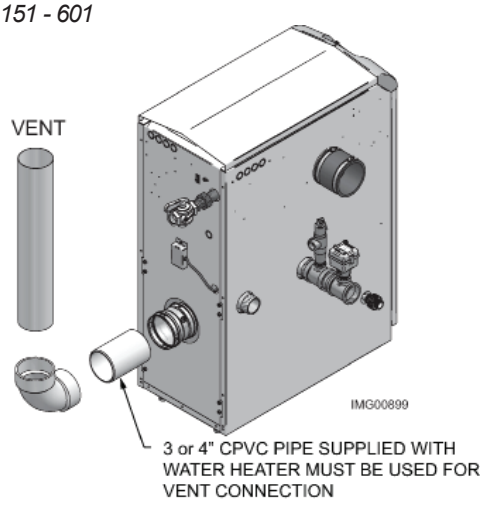
***Table 3D** PVC/CPVC Vent Pipe, and Fittings*

Approved PVC/CPVC Vent Pipe and Fittings		
Item	**Material**	**Standard**
Vent pipe	PVC Schedule 40, 80	ANSI/ASTM D1785
	PVC - DWV	ANSI/ASTM D2665
	CPVC Schedule 40, 80	ANSI/ASTM F441
Vent fittings	PVC Schedule 40	ANSI/ASTM D2466
	PVC Schedule 80	ANSI/ASTM D2467
	CPVC Schedule 40	ANSI/ASTM F438
	CPVC Schedule 80	ANSI/ASTM F439
	PVC - DWV	ANSI/ASTM D2665
Pipe Cement / Primer	PVC	ANSI/ASTM D2564
	CPVC	ANSI/ASTM F493
NOTICE: DO NOT USE CELLULAR (FOAM) CORE PIPE		

NOTE: In Canada, CPVC and PVC vent pipe, fittings and cement/primer must be ULC-S636 certified.

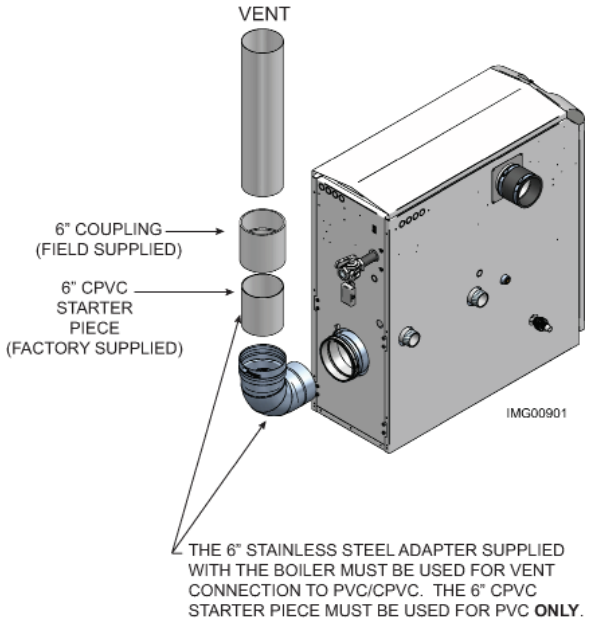
1. Work from the water heater to vent or air termination. Do not exceed the lengths given in this manual for the air or vent piping.
2. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends.
3. Chamfer outside of each pipe end to ensure even cement distribution when joining.
4. Clean all pipe ends and fittings using a clean dry rag. (Moisture will retard curing and dirt or grease will prevent adhesion.)
5. Dry fit vent or air piping to ensure proper fit up before assembling any joint. The pipe should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
6. Priming and Cementing:
   a. Handle fittings and pipes carefully to prevent contamination of surfaces.
   b. Apply a liberal even coat of primer to the fitting socket and to the pipe end to approximately 1/2" beyond the socket depth.
   c. Apply a second primer coat to the fitting socket.
   d. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket along with an even coat of approved cement to the fitting socket.
   e. Apply a second coat of cement to the pipe.
   f. While the cement is still wet, insert the pipe into the fitting, if possible twist the pipe a 1/4 turn as you insert it. **NOTE:** If voids are present, sufficient cement was not applied and joint could be defective.
   g. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

***Figure 3-8** Near Water Heater PVC/CPVC Venting - Models 151 - 601*



NOTE: CPVC VENT PIPE AND VENT FITTINGS MUST BE USED IN CLOSET AND ALCOVE INSTALLATIONS.

***Figure 3-9** Near Water Heater PVC/CPVC Venting Models 701 - 801*



3 General venting

Polypropylene

This product has been approved for use with polypropylene vent with the manufacturers listed in Table 3E.

All terminations must comply with listed options in this manual and be a single-wall vent offering.

For support and special connections required, see the manufacturer's instructions. All vent is to conform to standard diameter and equivalent length requirements established.

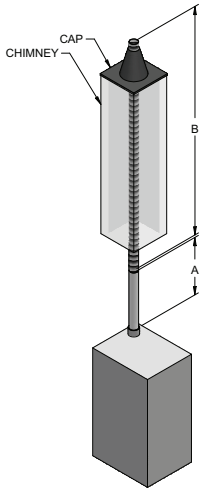
When determining equivalent combustion air and vent length for polypropylene single-wall piping:

- 1 foot of Duravent 4 inch single-wall pipe is equivalent to 1.6 feet of piping

Flexible polypropylene

For use of flex pipe, it is recommended to have the vent material in 32°F or higher ambient space before bending at installation. No bends should be made to greater than 45° and ONLY installed in vertical or near vertical installations (FIG. 3-10).

Figure 3-10 *Near Boiler Flexible Polypropylene Venting*



Duravent 3"

"A" DIM	"B" DIM	
3" RIGID	3" FLEX	4" FLEX
10 FT	60 FT	90 FT
20 FT	53 FT	80 FT
30 FT	47 FT	70 FT
40 FT	40 FT	60 FT
50 FT	33 FT	50 FT
60 FT	27 FT	40 FT
70 FT	20 FT	30 FT
80 FT	13 FT	20 FT
90 FT	7 FT	10 FT

Duravent 4"

"A" DIM	"B" DIM	
4" RIGID	4" FLEX	5" FLEX
10 FT	30 FT	90 FT
20 FT	27 FT	80 FT
30 FT	23 FT	70 FT
40 FT	20 FT	60 FT
50 FT	17 FT	50 FT
60 FT	13 FT	40 FT
70 FT	10 FT	30 FT
80 FT	7 FT	20 FT
90 FT	3 FT	10 FT

Centrotherm 3"

"A" DIM	"B" DIM	
3" RIGID	3" FLEX	4" FLEX
10 FT	45 FT	90 FT
20 FT	40 FT	80 FT
30 FT	35 FT	70 FT
40 FT	30 FT	60 FT
50 FT	25 FT	50 FT
60 FT	20 FT	40 FT
70 FT	15 FT	30 FT
80 FT	10 FT	20 FT
90 FT	5 FT	10 FT

Centrotherm 4"

"A" DIM	"B" DIM
4" RIGID	4" FLEX
10 FT	33 FT
20 FT	29 FT
30 FT	26 FT
40 FT	22 FT
50 FT	18 FT
60 FT	15 FT
70 FT	11 FT
80 FT	7 FT
90 FT	4 FT

*NOTES: 1) FLEX PIPE MAY ONLY BE RUN IN A VERTICAL ORIENTATION
2) ALL VENT LENGTHS REPRESENTED IN ABOVE CHARTS ARE EQUIVALENT LENGTHS.
3) SECTION A IS EQUIVALENT FEET OF RIGID PIPE, WHICH MAY INCLUDE 45 AND 90° ELBOWS. PLEASE SEE SIZING SECTION FOR DETERMINING EQUIVALENT FEET.

IMG00840

Table 3E *Polypropylene Vent Pipe and Fittings*

Approved Polypropylene Vent Manufacturers	
Make	**Model**
Centrotherm Eco Systems	InnoFlue SW/Flex
Duravent (M & G Group)	PolyPro Single-Wall / PolyPro Flex

NOTICE The installer must use a specific vent starter adapter at the flue collar connection. This adapter is supplied by the vent manufacturer to adapt to its vent system. See Table 3F for approved vent adapters. Discard CPVC starter piece.

NOTICE All vent connections MUST be secured by the vent manufacturer's joint connector (FIG. 3-11).

⚠WARNING Insulation should not be used on polypropylene venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

⚠WARNING Use only the adapters and vent system listed in Tables 3E and 3F. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Installations must comply with applicable national, state, and local codes. For Canadian installation, polypropylene vent must be listed as a ULC-S636 approved system.

NOTICE Installation of a polypropylene vent system should adhere to the vent manufacturer's installation instructions supplied with the vent system.

Figure 3-11 *Near Water Heater Polypropylene Venting*

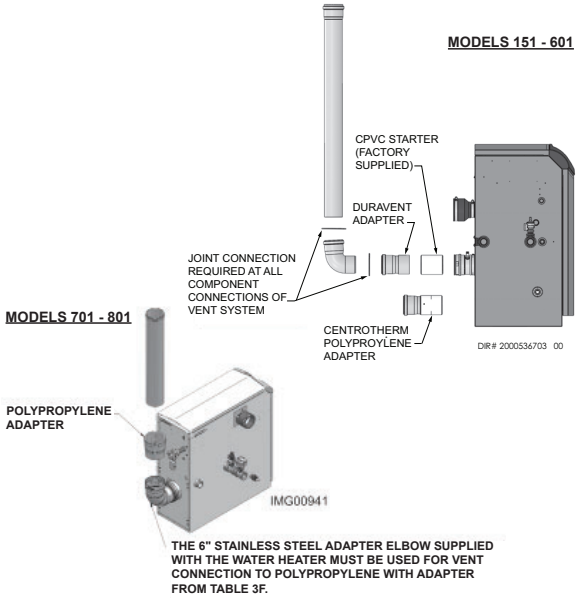


Table 3F *Approved PolypropyleneTerminations*

Model	Centrotherm InnoFlue SW				Duravent Polypro		
	Polypropylene Adapter	Joint Connector	Sidewall Retaining Bracket*	Sidewall Adapter*	Polypropylene Adapter	Joint Connector	Sidewall Kit*
151-200	ISAAL0303	IANS03	IATP0303	ISTAGL0303	3PPS-AD-M	3PPS-LB	3PPS-HLK
400-601	ISAAL0404	IANS04	IATP0404	ISTAGL0404	4PPS-AD-M	4PPS-LB	4PPS-HLK
701-801	ISAAL0606	Not Required	IATP0606	ISTAGL0606	6PPS-06PVCM-6PPF	Not Required	6PPK-HLK

* These parts are only needed if the sidewall termination assembly is used (see FIG. 4-5B on page 27).

3 General venting *(continued)*

Stainless steel vent

This product has been approved for use with stainless steel using the manufacturers listed in Table 3G.

⚠ WARNING Use only the materials, vent systems, and terminations listed in Tables 3G and 3I. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE The installer must use a specific vent starter adapter at the flue collar connection, supplied by the vent manufacturer to adapt to its vent system. See Table 3I for approved vent adapters. Discard CPVC starter piece.

NOTICE Installations must comply with applicable national, state, and local codes. Stainless steel vent systems must be listed as a UL-1738 approved system for the United States and a ULC-S636 approved system for Canada.

NOTICE Installation of a stainless steel vent system should adhere to the stainless steel vent manufacturer's installation instructions supplied with the vent system.

Figure 3-12 *Near Water Heater Stainless Steel Venting Models 286 - 601*

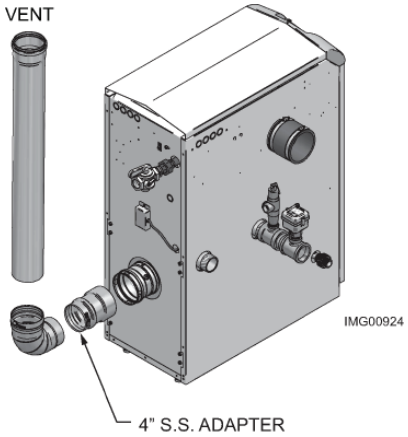


Table 3G *Stainless Steel Vent Pipe and Fittings*

Approved Stainless Steel Vent Manufacturers	
Make	**Model**
Dura Vent (M & G Group)	FasNSeal Vent / FasNSeal Flex* Vent
Z-Flex (Nova Flex Group)	Z-Vent
Heat Fab (Selkirk Corporation)	Saf-T Vent
Metal Fab	Corr/Guard
Security Chimney	Secure Seal
ICC	VIC

*Use of FasNSeal Flex smooth inner wall vent is to be used in vertical or near vertical sections only, taking precaution to ensure no sagging occurs of the vent system. Connect to the FasNSeal rigid vent using specially designed adapters and sealing method, see manufacturer's instructions.

Table 3H *Stainless Steel Sidewall Vent Termination Kit(s)*

Model	Kit Number
701 - 801	100157755

Table 3I *Approved Stainless Steel (S.S.) Terminations and Adapters*

Model	ProTech FasNSeal			Heat Fab Saf-T Vent			Z Flex Z-Vent		
	S.S. Adapter	Flue Termination	Intake Air Termination	S.S. Adapter	Flue Termination	Intake Air Termination	S.S. Adapter	Flue Termination	Intake Air Termination
151 - 200	300715	FSBS3 FSRC3	303889	9301PVC	9392 5300CI	9314TERM	2SVSLA03	2SVSTP03 2SVSRCX03	2SVSTEX0390
286-601	F303759	FSBS4 FSRC4	FSAIH04 303888	9401PVC	9492 5400CI	9414TERM	2SVSLA04	2SVSTP04 2SVSRCX04	2SVSTEX0490
701-801	F303759 (Intake Only)	FSBS6	FSAIH04 303888	9601MAD	9690 9692	9614TERM			
	Metal Fab Corr/Guard			**Security Chimney** Secure Seal			**ICC** VIC		
151 - 200	3CGPVCA	3CGSWHT 3CGSWC	3CGSW90LT	--	--	--	--	--	--
286-601	4CGPVCA	4CGSWHT 4CGSWC	4CGSW90LT	SS4PVCU	SS4STU SS4RCBU	SS4ST90AU	--	--	--
701-801	6FCGPVCA	6FCGSWMC 6FCGSWC	6FCGSW90L	SS6PVCU	SS6STU SS6RCBU	SS6ST90AU	HE-6DSA-F	HE-6MC-F HE-6RC-F	HE-6E90-F HE-6SCR-F

4 Sidewall direct venting

Vent/air termination – sidewall

⚠WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage.

⚠WARNING A gas vent extending through an exterior wall shall not terminate adjacent to a wall or below building extensions such as eaves, parapets, balconies, or decks. Failure to comply could result in severe personal injury, death, or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 22 of this manual.
2. You must consider the surroundings when terminating the vent and air:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants, or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or pets.
   e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.

⚠WARNING Sidewall vent and air inlet terminations must terminate in the same pressure zone.

   f. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
   g. Locate or guard vent to prevent condensate damage to exterior finishes.
   h. Do not locate the terminations over public walkways.
   i. Do not locate the terminations near soffit vents, crawl space vents, or other areas where condensate or vapor could create a nuisance, hazard, or cause property damage.
   j. Do not locate the terminations where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Figure 4-1A *PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent*

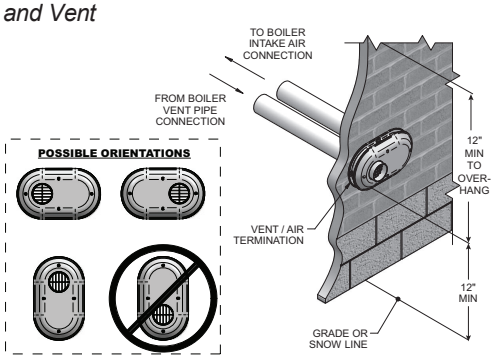


Table 4A *Sidewall Vent Kits*

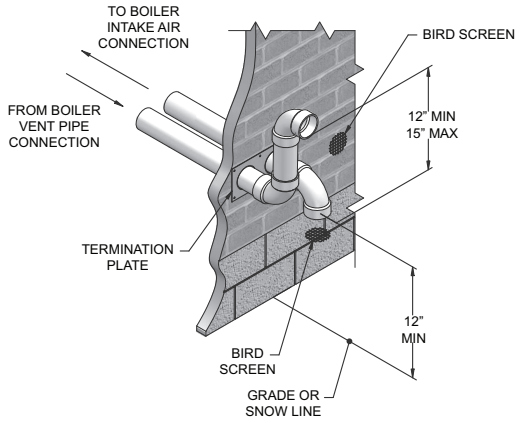
Model	Kit Number	Vent Size
151 - 200	100157610	3 inch vent
286 - 601	100157611	4 inch vent
701 - 801	100157613	6 inch vent

If using the alternate sidewall termination:

3. The air piping must terminate in a down-turned elbow as shown in FIG. 4-1B. This arrangement avoids recirculation of flue products into the combustion air stream.
4. The vent piping must terminate in an elbow pointed outward or away from the air inlet, as shown in FIG. 4-1B.

⚠WARNING Do not exceed the maximum lengths of the outside vent piping shown in FIG. 4-1B. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential water heater shutdown.

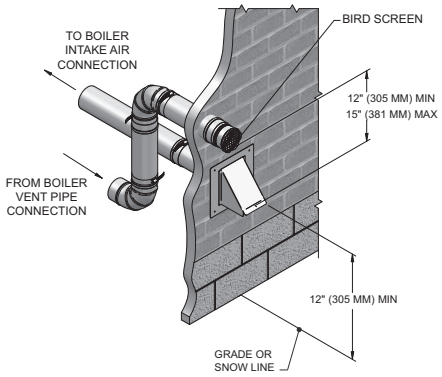
Figure 4-1B *Alternate PVC/CPVC Sidewall Termination of Air and Vent w/Field Supplied Fittings*



4 Sidewall direct venting *(continued)*

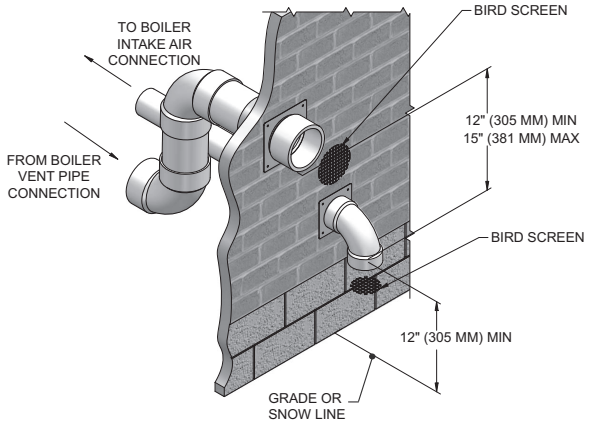
Vent/air termination – sidewall

Figure 4-1C *Alternate PVC/CPVC/SS Vent Termination - Typical Stainless Steel Sidewall Termination of Air and Vent Models 151 - 801 w/Field Supplied Fittings*



NOTICE PVC/CPVC or ABS is acceptable air inlet pipe material.

Figure 4-2 *Alternate PVC/CPVC/SS/ Polypropylene Sidewall Termination Models 151 - 801 w/Field Supplied Fittings*



5. Maintain clearances as shown in FIG.'s 4-1A thru 4-5B, pages 24 thru 29. Also maintain the following:
   a. Vent must terminate:
      • At least 6 feet from adjacent walls.
      • No closer than 12 inches below roof overhang.
   b. Air inlet must terminate at least 12 inches above grade or snow line; at least 12 inches below the vent termination; and the vent pipe must not extend more than 24 inches vertically outside the building as shown in FIG. 4-1B.
   c. Do not terminate closer than 4 feet horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 4 feet horizontally.
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

Figure 4-3A *Clearance to Gravity Air Inlets*

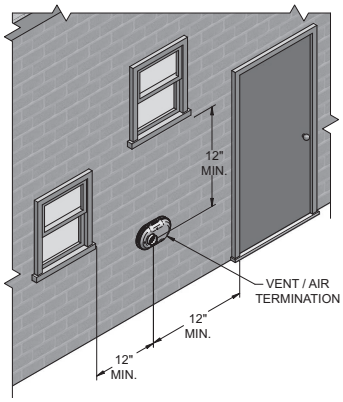
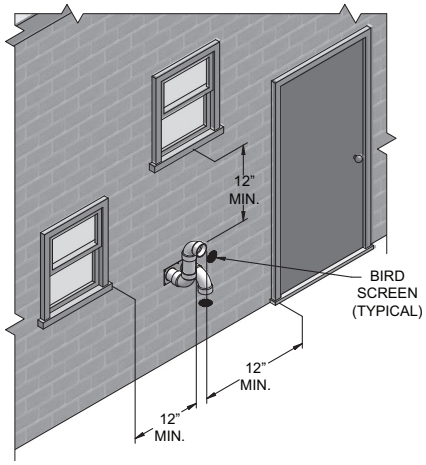


Figure 4-3B *Alternate Clearance to Gravity Air Inlets w/ Field Supplied Fittings*



4 Sidewall direct venting

Figure 4-4A *Direct Vent Terminal Clearances*

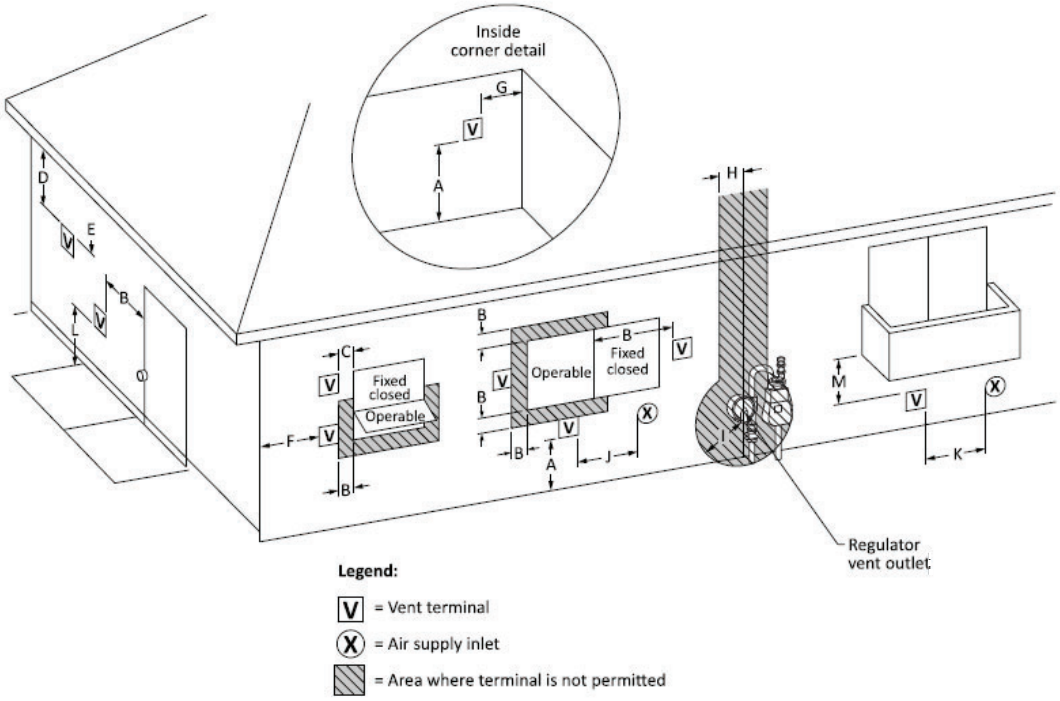


Table 4B *Direct Vent Terminal Clearances*

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B =	Clearance to window or door that may be opened	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal.	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	*	*
I =	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*

4 Sidewall direct venting *(continued)*

***Table 4B** Direct Vent Terminal Clearances (continued)*

J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	*
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm)‡	*

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

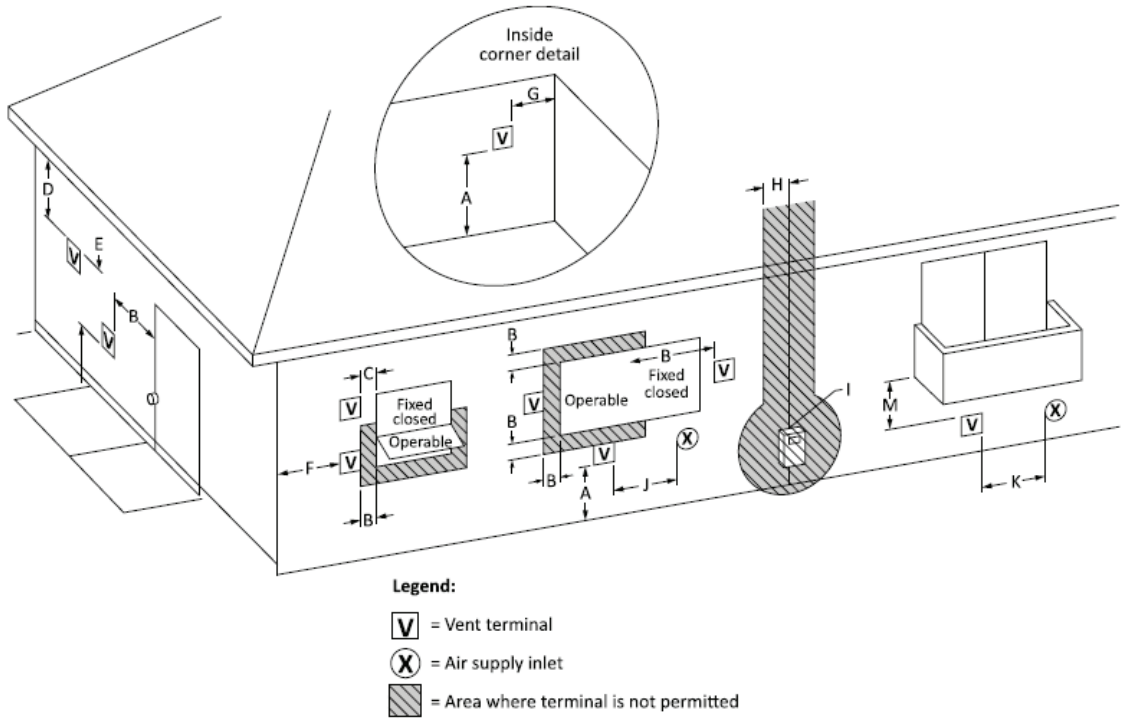
‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath he floor.

NOTES:

1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

2) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

***Figure 4-4B** Other than Direct Vent Terminal Clearances*



4 Sidewall direct venting

Table 4C *Other than Direct Vent Terminal Clearances*

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B =	Clearance to window or door that may be opened	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal.	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	*	*
I =	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*
J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	7 ft (2.13 m)
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm)‡	*

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath he floor.

NOTES:

1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

2) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

4 Sidewall direct venting *(continued)*

Prepare wall penetrations

1. Use the factory supplied wall plate as a template to locate the vent and air intake holes and mounting holes.

   Air pipe penetration:

   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.

   Vent pipe penetration:

   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      - 4½ inch hole for 3 inch vent pipe
      - 5½ inch hole for 4 inch vent pipe
      - 7½ inch hole (191 mm) hole for 6 inch (152 mm) vent pipe

   Drill 3/16" diameter holes for inserting the plastic anchors into the wall.
2. For Polypropylene Only: Install the vent and air intake sidewall adapters from Table 3F on page 22 into the vent plate. Slide the sidewall retaining bracket down the sidewall adapters flush to the vent plate.
3. For PVC/CPVC Only: Install the vent and air intake piping through the wall into the vent plate openings. Use RTV silicone sealant to seal the air pipe. Use the cement/primer listed in Table 3D on page 21 to seal the vent pipe.
4. Mount and secure the vent plate to the wall using stainless steel screws. Seal around the plate to the wall assuring no air gaps.
5. Seal all gaps between the pipes and wall. Seal around the plate to the wall assuring no air gaps.
6. Assemble the vent cap to the vent plate. Insert the stainless steel screws into the vent cap screw hole openings and securely attach the vent cap to the vent plate.
7. Seal all wall cavities.
8. PVC/CPVC terminations are designed to accommodate any wall thickness of standard constructions per the directions found in this manual.
9. Stainless steel terminations are designed to penetrate walls with a thickness up to 9.25 inches of standard construction.

Figure 4-5A *Sidewall Termination Assembly*

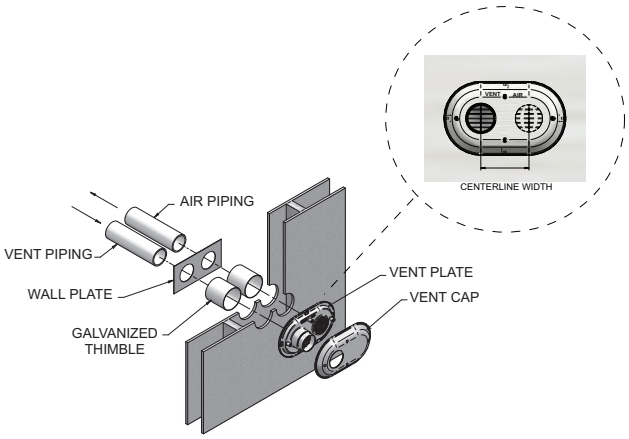
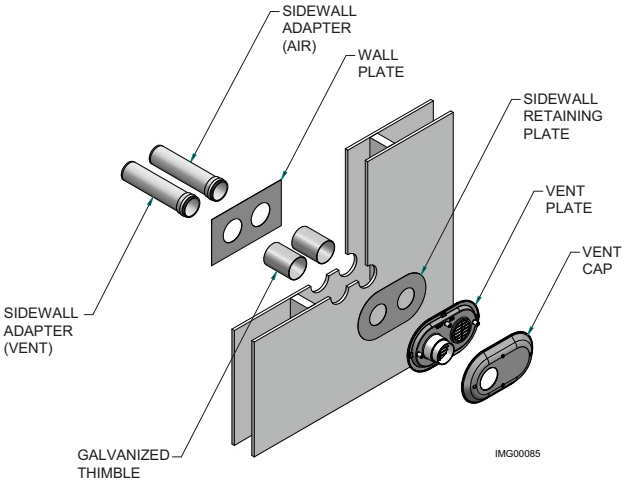


Table 4D *Sidewall Vent Centerline Dimensions*

Model	Air	Vent	Centerline Width
151 - 200	3"	3"	5 5/8"
286 - 601	4"	4"	5 5/8"
701 - 801	4"	6"	7 3/4"

Figure 4-5B *Polypropylene Sidewall Termination Assembly*

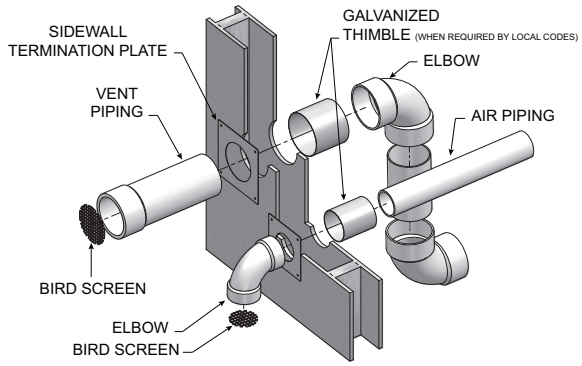


4 Sidewall direct venting

Prepare wall penetrations (Alternate - Field Supplied Option)

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      • 4½ inch hole for 3 inch vent pipe
      • 5½ inch hole for 4 inch vent pipe
      • 7½ inch hole (191 mm) hole for 6 inch (152 mm) vent pipe
   b. Insert a galvanized metal thimble in the vent pipe hole as shown in FIG. 4-5C.
3. Use a sidewall termination plate as a template for correct location of hole centers.
4. Follow all local codes for isolation of vent pipe when passing through floors or walls.
5. Seal exterior openings thoroughly with exterior caulk.

Figure 4-5C *A Typical Sidewall Termination Assembly - Models 151 - 801 PVC/CPVC or Stainless Steel*



Multiple vent/air terminations

1. When terminating multiple Armor water heaters terminate each vent/air connection as described in this manual (FIG. 4-6A).

⚠WARNING All vent pipes and air inlets must terminate at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place wall penetrations to obtain minimum clearance of 12 inches between edge of air inlet and adjacent vent outlet, as shown in FIG. 4-6A for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet of a Armor water heater is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent water heater vents.

Figure 4-6A *Multiple Vent Terminations (must also comply with* ***Figure 4-1A****)*

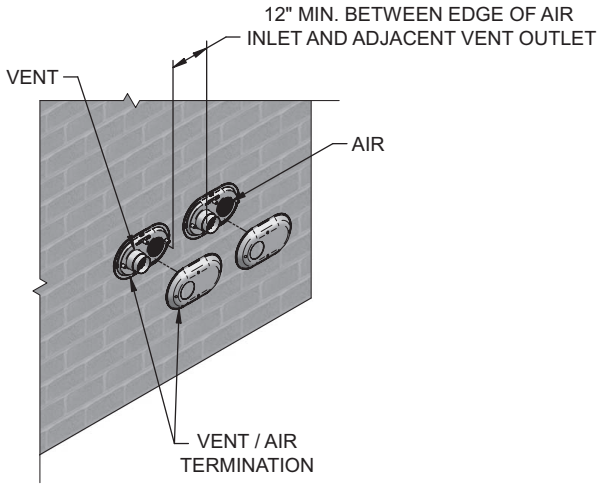
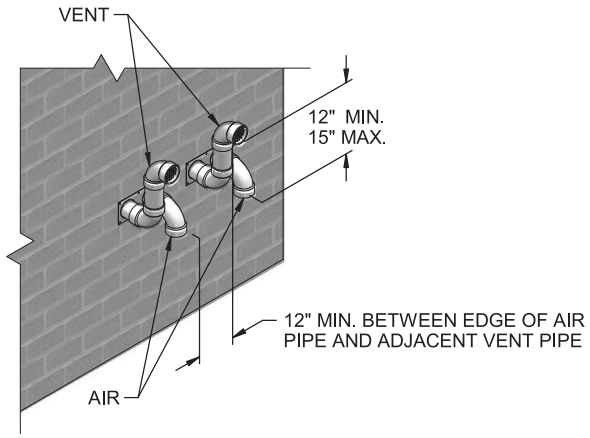


Figure 4-6B *Alternate Multiple Vent Terminations w/Field Supplied Fittings (must also comply with* ***Figure 4-1B****)*



4 Sidewall direct venting *(continued)*

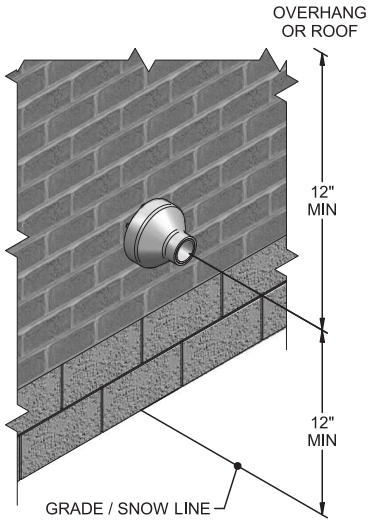
Sidewall termination – optional concentric vent: Models 151 - 601

Description and usage

Lochinvar offers optional concentric combustion air and vent pipe termination kits (Factory Kit #100140480 for 3" diameter - Models 151 - 200 and #100140484 for 4" diameter - Models 286 - 601). Both combustion air and vent pipes must attach to the termination kit. The termination kits must terminate outside the structure and must be installed as shown below in FIG. 4-7.

The required combustion vent pipe materials are listed in Table 3D, on page 21 of this manual.

Figure 4-7 *Concentric Sidewall Termination*



Sidewall termination installation

1. Determine the best location for the termination kit (see FIG. 4-7).
2. Reference the *Determine Location Section* on page 24 of this manual for general termination considerations.
4. Cut one (1) hole (5 inch diameter for #100140480 installations or 7 inch diameter for #100140484 installations) into the structure to install the termination kit.
5. Partially assemble the concentric vent termination kit. Clean and cement using the procedures found in these instructions.
   a. Cement the Y concentric fitting to the larger kit pipe (FIG.'s 4-8 and 4-9).
   b. Cement the rain cap to the smaller diameter kit pipe (FIG.'s 4-8 and 4-9).

Figure 4-8 *Kit Contents_100140480 - Models 151 - 200*

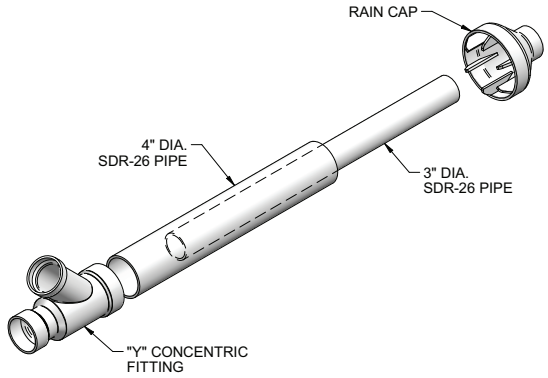
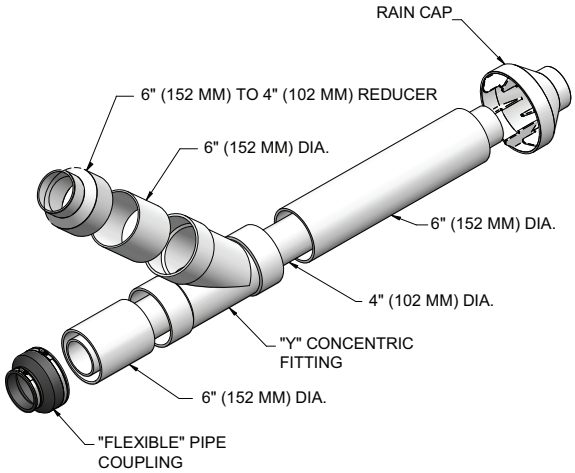


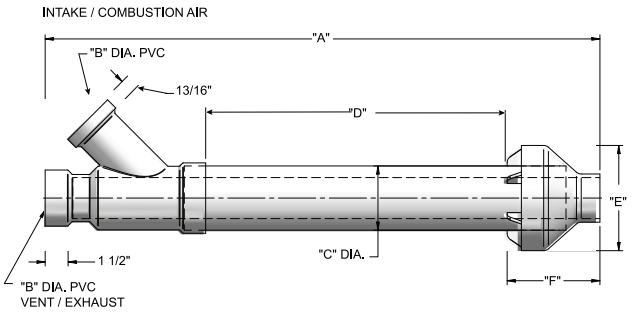
Figure 4-9 *Kit Contents_100140484 - Models 286 - 601*



4 Sidewall direct venting

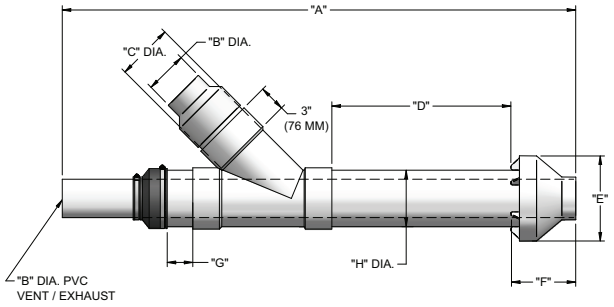
Sidewall termination – optional concentric vent: Models 151 - 601

Figure 4-10 *Concentric Vent Dimensional Drawing - Models 151 - 200*



A	B	C	D*	E	F
38 7/8"	3"	4 1/2"	21 1/8"	7 3/8"	6 1/2"

Figure 4-11 *Concentric Vent Dimensional Drawing - Models 286 - 501*



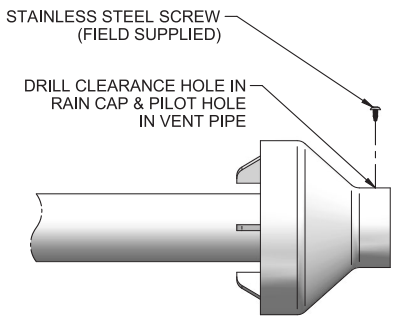
A	B	C	D	E	F	G	H
60"	4"	6"	21 1/8"	10"	7 5/8"	3"	6 5/8"

NOTICE Instead of cementing the smaller pipe to the rain cap, a field-supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 4-12).

⚠WARNING When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

⚠WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

Figure 4-12 *Rain Cap to Vent Pipe Alternate Assembly*



6. Install the Y concentric fitting and pipe assembly through the structure's hole.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

7. Install the rain cap and small diameter pipe assembly into the Y concentric fitting and large pipe assembly. Ensure small diameter pipe is bottomed and cemented in the Y concentric fitting for #100140480 installations and fastened tightly into the rubber adapter for #100140484 installations.

8. Secure the assembly to the structure as shown in FIG. 4-13 using field-supplied metal strapping or equivalent support material.

NOTICE Ensure termination location clearance dimensions are as shown in FIG. 4-7.

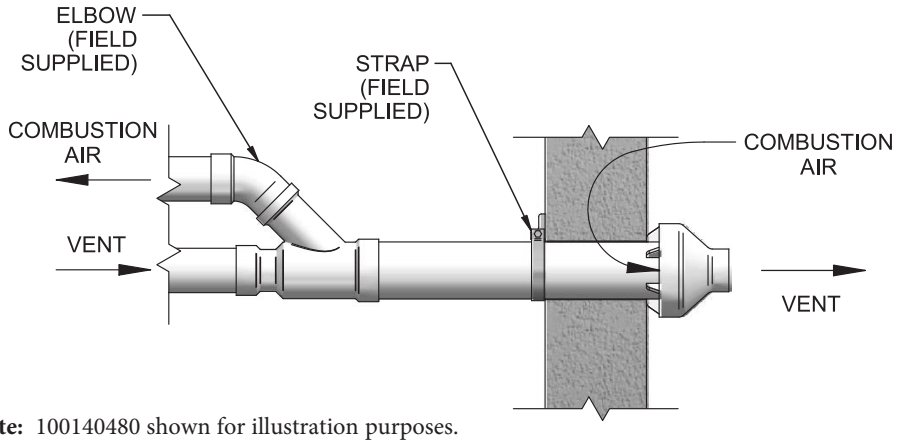
NOTICE If assembly needs to be extended to allow sidewall thickness requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field-supplied SDR-26 PVC (D2241) pipe for 100140480 and standard schedule 40 PVC for 100140484. Do not extend dimension D* more than 60 inches (see FIG.'s 4-10 and 4-11).

NOTICE If assembly depth needs to be reduced, dimension D can be as short as possible.

4 Sidewall direct venting *(continued)*

Sidewall termination – optional concentric vent: Models 151 - 601

Figure 4-13 *Concentric Vent Sidewall Attachment*



Note: 100140480 shown for illustration purposes.

CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur and may cause intermittent operation.

9. Cement appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 4-13 for proper pipe attachment.

10. Operate the appliance one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing sidewall terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 4-14). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 4-14. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

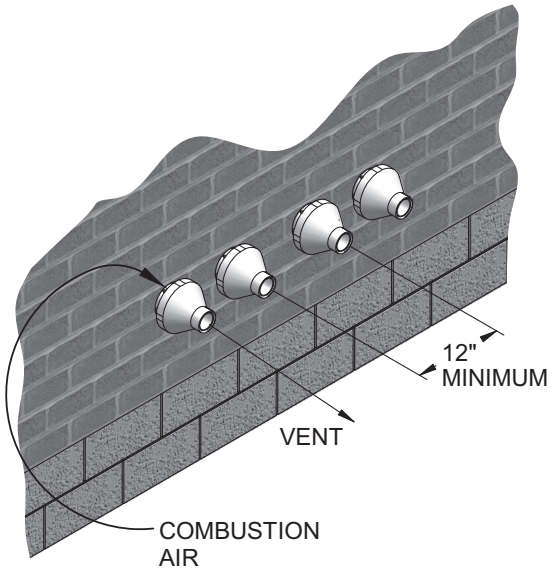


Figure 4-14 *Concentric Vent and Combustion Air Termination*

5 Vertical direct venting

Vent/air termination – vertical

⚠WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 17 of this manual.

2. Prepare the vent termination and the air termination elbow (FIG. 5-1A) by inserting bird screens. Bird screens should be obtained locally.

3. The vent must terminate at least 3 feet above the highest place in which the vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.

4. The air piping must terminate in a down-turned 180° return pipe no further than 2 feet from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.

5. The vent piping must terminate in an up-turned coupling as shown in FIG. 5-1A. The top of the coupling must be at least 1 foot above the air intake. When the vent termination uses a rain cap as illustrated in FIG. 5-1B maintain at least 36" (914 mm) above the air inlet. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet (.6 m) apart and with the vent termination at least 1 foot for PVC and 3 feet for stainless steel, above the air intake.

6. Maintain the required dimensions of the finished termination piping as shown in FIG. 5-1A.

7. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

⚠WARNING Rooftop vent and air inlet terminations must terminate in the same pressure zone, unless vertical vent sidewall air is set up as shown in the General Venting - Vertical Vent, Sidewall Air Section.

Figure 5-1A *PVC/CPVC Vertical Termination of Air and Vent*

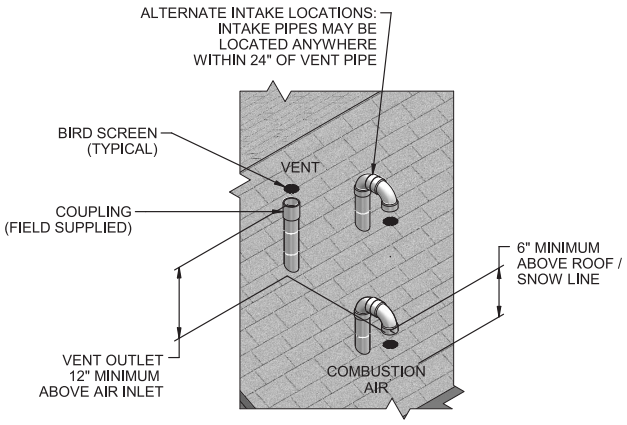
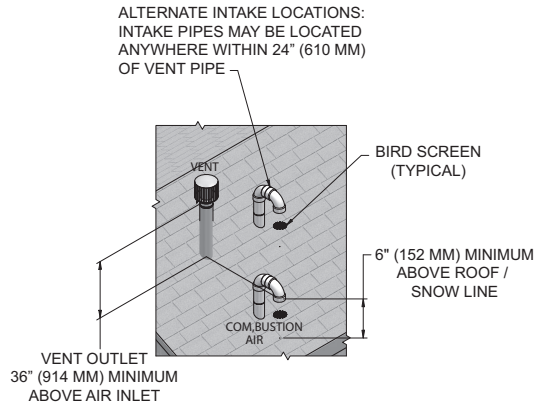


Figure 5-1B *Stainless Steel Vertical Termination of Air and Vent*



8. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

5 Vertical direct venting *(continued)*

Vent/air termination – vertical

Prepare roof penetrations

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.

2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      • 4½ inch hole for 3 inch vent pipe
      • 5½ inch hole for 4 inch vent pipe
      • 7½ inch hole for 6 inch vent pipe
   b. Insert a galvanized metal thimble in the vent pipe hole.

3. Space the air and vent holes to provide the minimum spacing shown in FIG. 5-1A, page 34.

4. Follow all local codes for isolation of vent pipe when passing through floors, ceilings, and roofs.

5. Provide flashing and sealing boots sized for the vent pipe and air pipe.

Multiple vent/air terminations

1. When terminating multiple Armor water heaters, terminate each vent/air connection as described in this manual (FIG. 5-2).

⚠ WARNING Terminate all vent pipes at the same height and all air pipes at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place roof penetrations to obtain minimum clearance of 12 inches between edge of air intake elbow and adjacent vent pipe of another water heater for U.S. installations (see FIG. 5-2). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.

3. The air inlet of an Armor water heater is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent water heater vents.

Figure 5-2 *Vertical Terminations with Multiple Water Heaters*

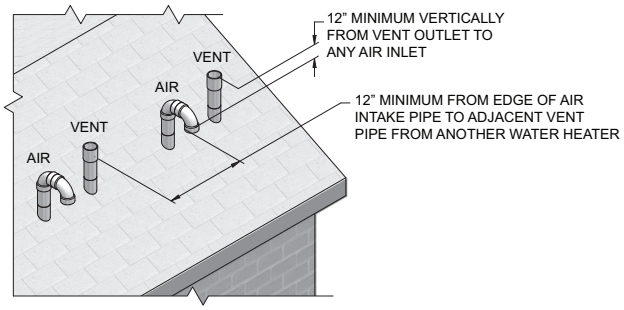
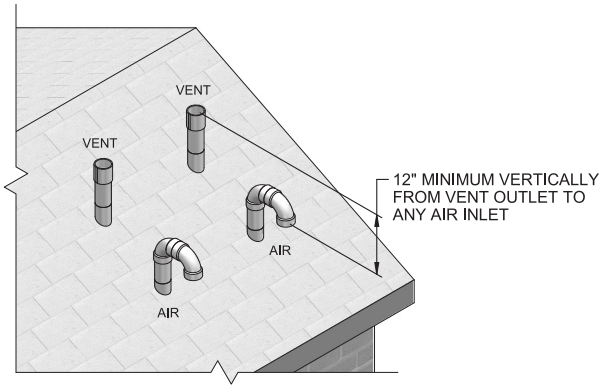


Figure 5-3 *Alternate Vertical Terminations with Multiple Water Heaters*



5 Vertical direct venting

Vertical termination – optional concentric vent: Models 151 - 601

Description and usage

Lochinvar offers an optional concentric combustion air and vent pipe termination kit. Both combustion air and vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown in FIG. 5-4.

Field supplied pipe and fittings are required to complete the installation.

The required combustion vent pipe and fittings are listed in Table 3D, on page 21 of this manual.

Vertical termination installation

1. See Section 5, Vertical Direct Venting - Determine Location (where applicable).

Figure 5-4 *Concentric Vertical Termination*

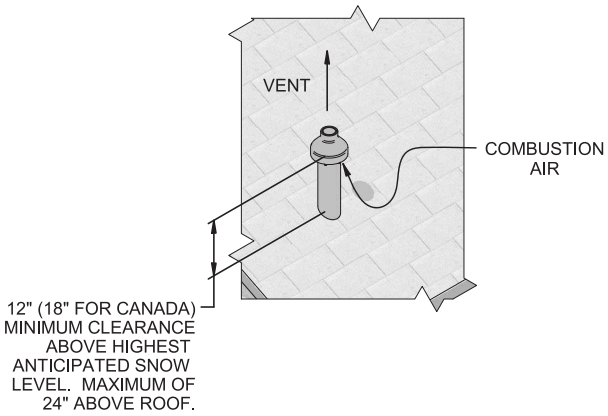


Figure 5-5 *Do Not Install U-Bend to Rain Cap*

2. Cut one (1) hole (5 inch diameter for #100140480 installations or 7 inch diameter for #100140484 installations) into the structure to install the termination kit.

3. Partially assemble the concentric vent termination kit. Clean and cement following the cleaning procedures in these instructions.

   a. Cement the Y concentric fitting to the larger diameter kit pipe (see FIG.'s 4-8 and 4-9, page 31).

   b. Cement rain cap to the smaller diameter kit pipe (see FIG.'s 4-8 and 4-9, page 31).

   c. Do not attach a U-Bend to the rain cap. Doing so could cause recirculation (see FIG. 5-5).

NOTICE Instead of cementing the smaller pipe to the rain cap, a field supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 4-12, page 32).

⚠WARNING When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

5 Vertical direct venting *(continued)*

Vertical termination – optional concentric vent: Models 151 - 601

⚠WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

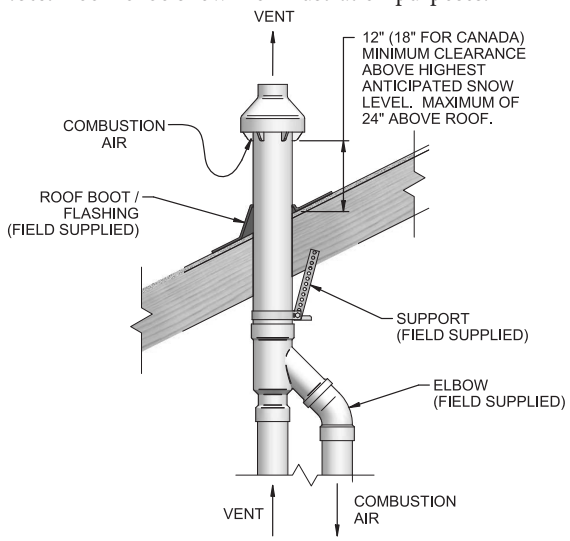
4. Install the Y concentric fitting pipe assembly up through the structure's hole and field supplied roof boot/flashing.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

5. Secure the assembly to the roof structure as shown below in FIG. 5-6 using field supplied metal strapping or equivalent support material.

Figure 5-6 *Concentric Vent Roof Installation*

Note: 100140480 shown for illustration purposes.



NOTICE Ensure termination height is above the roof surface or anticipated snow level (12 inches in U.S.A. or 18 inches in Canada) as shown in FIG. 5-4, page 36.

NOTICE If assembly is too short to meet height requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field supplied SDR-26 PVC (D2241) pipe for 100140480 and standard schedule 40 PVC for 100140484. Do not extend dimension D* more than 60 inches (see FIG.'s 4-10 and 4-11, page 32).

CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur.

6. Install the rain cap and the small diameter pipe assembly into the roof penetration assembly. Ensure the small diameter pipe is cemented and bottomed in the Y concentric fitting for #100140480 installations and fastened tightly into the rubber adapter for #100140484 installations.

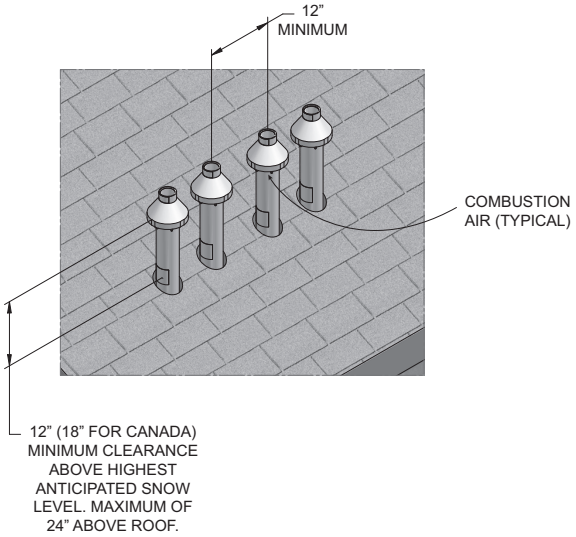
7. Cement the appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 5-6 for proper pipe attachment.

8. Operate the appliance through one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing vertical terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 5-7). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 5-7. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

Figure 5-7 *Concentric Vent and Combustion Air Vertical Termination*



5 Vertical direct venting

Alternate vertical concentric venting

This appliance may be installed with a concentric vent arrangement where the vent pipe is routed through an existing unused venting system; or by using the existing unused venting system as a chase for vent and combustion air routing.

Concentric Venting Arrangement

The venting is to be vertical through the roof. The annular space between the O.D. of the vent pipe and the I.D. of the existing unused venting system is utilized for the combustion air source.

The minimum size of the existing vent system required to achieve enough annular space for combustion air can be found in Table 5A below.

The upper and lower termination as well as any other unsealed joints in the existing vent system **must be** sealed to ensure that all combustion air is drawn from under the vent cap as shown in FIG.'s 5-8 and 5-9.

Approved venting materials must be used as specified in Table 3D on page 21.

Follow all vent / air termination and clearance requirements per this section to the appropriate example. Installation must comply with local requirements and with the National Fuel Gas Code.

The maximum allowable equivalent vent and air intake lengths for this venting arrangement are to be determined from the General Venting Section.

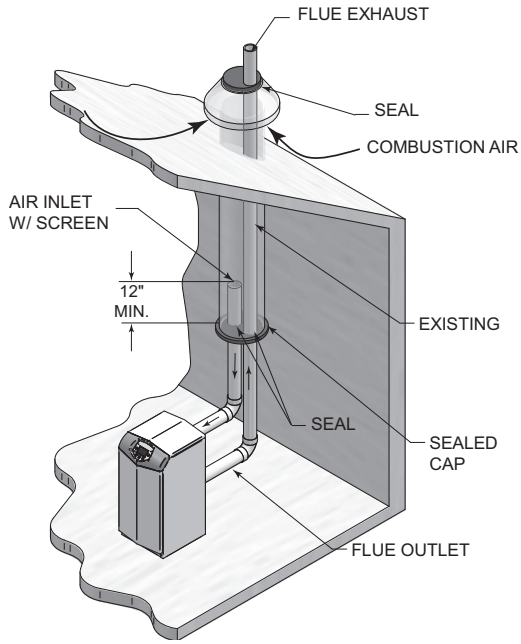
If an existing unused venting system is converted for use with this method of concentric venting, the installer must ensure that the existing venting system is clean and free from debris contamination that will harm this appliance and cause increased nuisance calls or maintenance. See Table 1A on page 11 for a list of corrosive contaminants and sources.

Two example scenarios of a concentric venting arrangement are shown for illustrative purposes in FIG.'s 5-8 and 5-9.

Table 5A *Alternate Vertical Concentric Vent / Chase Sizes*

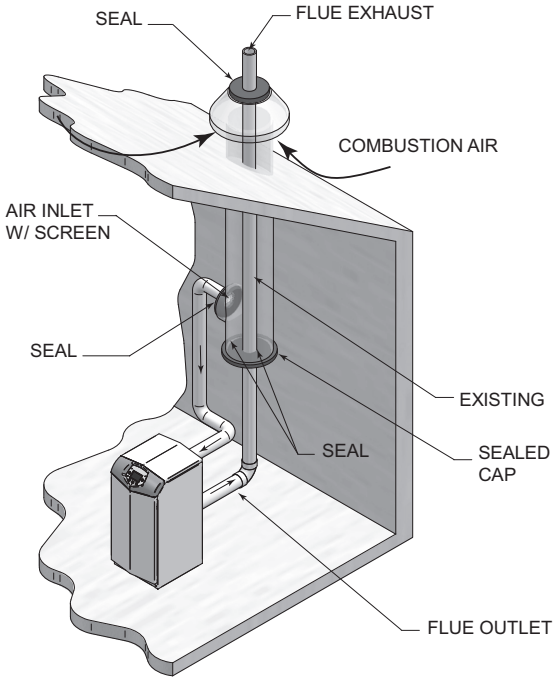
Model	Vent / Air Inlet Size	Minimum Existing Vent / Chase Size
151 - 200	3"	5"
286 - 601	4"	7"
701 - 801	6"	10"

Figure 5-8 *Concentric Vent Example 1*



*For concept illustration only. Individual installations may vary due to job site specific equipment.

Figure 5-9 *Concentric Vent Example 2*

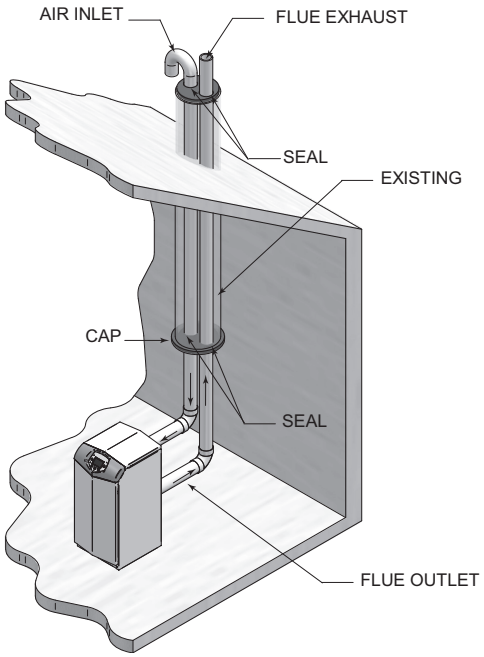


5 Vertical direct venting *(continued)*

Existing vent as a chase

Follow all existing termination and clearance requirements and allowable pipe lengths. Use only approved venting materials listed in the General Venting Section of this manual.

Figure 5-10 *Existing Vent as a Chase*



*For concept illustration only. Individual installations may vary due to job site specific equipment.

6 System piping

System water piping methods

Observe a minimum of 1/4 inch clearance around all un-insulated hot water pipes when openings around the pipes are not protected by non-combustible materials.

General piping information

Basic steps are listed below along with illustrations on the following pages (FIG.'s 6-4 thru 6-8), which will guide you through the installation of the Armor water heater.

1. Connect the cold water supply to the inlet side of the water heater.
2. Connect the hot water supply to the outlet side of the water heater.
3. Install a backflow preventer on the cold feed makeup water line.
4. Install the factory supplied pump as shown in FIG.'s 6-4 thru 6-8.
5. Install an expansion tank on the system supply. Consult the tank manufacturer's instruction for specific information relating to tank installation. Size the expansion tank for the required system volume and capacity.
6. Install a drain valve at the lowest point of the system.
7. This appliance is supplied with a relief valve sized in accordance with ASME Boiler and Pressure Vessel Code, Section IV ("Heating Boilers"). Pipe the discharge of the safety relief valve to a suitable drain to prevent injury in the event of pressure relief. Pipe the discharge to a drain. Provide piping that is the same size as the safety relief valve outlet. Never block the outlet of the safety relief valve.

⚠WARNING The relief valve, tee and other necessary fittings are shipped in the install kit with the water heater and are to be field installed.

See the *piping illustrations included in this section, FIG.'s 6-4 thru 6-8 for suggested guidelines in piping the Armor water heater.

NOTICE *Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

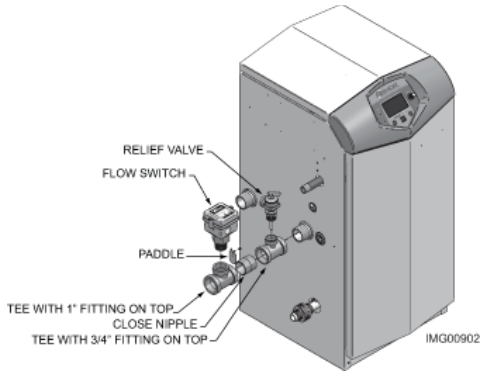
Flow switch and relief valve installation

Basic steps are listed below to guide you through the installation of the flow switch and relief valve provided with the unit.

1. Install the tee with the 3/4 inch fitting positioned vertically and on the top as shown in FIG. 6-1.
2. Install the relief valve into the 3/4 inch fitting of the tee installed in Step 1 (FIG. 6-1).
3. Install the close nipple on the downstream side of the temperature and pressure relief valve tee (FIG. 6-1).
4. Install the tee with the 1 inch fitting positioned vertically and on the top (FIG. 6-1).
5. Attach the paddle to the flow switch per the manufacturer's instructions. Reference Table 6A to select the correct paddle for the pipe size used (consult the manufacturer's instructions for a detailed explanation).
   For Example: If using a 1 1/4 inch pipe size (Models AWN151 - AWN200) select paddle #1.
6. Install the assembled flow switch into the 1 inch fitting of the tee installed in Step 4 (see FIG. 6-1).

NOTICE Be sure to install flow switch so that the arrow on the flow switch is pointing in the direction of the flow (see FIG. 6-2).

Figure 6-1 *Flow Switch and Relief Valve Installation*



Flow switch adjustment

Refer to Table 6A for the proper setting of the sensitivity screw. For reference, the position of the screw prior to setting should be turned clockwise with a Phillips driver until it stops (FIG. 6-2). Proceed to turn the screw counterclockwise the amount of turns listed in Table 6A based on the model.

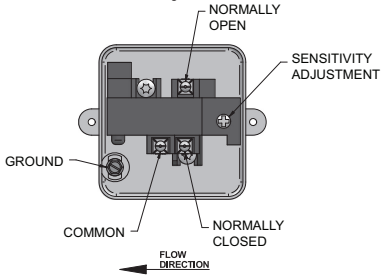
Consult the manufacturer's instructions for wiring the flow switch to your system.

Table 6A *Paddle Size / Sensitivity Screw Adjustment*

MODEL	PADDLE SIZE	SENSITIVITY SCREW ADJUSTMENT
Note: Paddles are included with the flow switch.		
151	#1	9 turns
200	#1	6 turns
286	#3	8¾ turns
400	#1	8 turns
501	#1	7½ turns
601	#1	7 turns
701	#1	6½ turns
801	#1	5½ turns

NOTICE Turn the sensitivity screw clockwise to increase the flow rate required to activate the switch. Turn the sensitivity screw counterclockwise to decrease the flow rate required to activate the switch.

Figure 6-2 *Flow Switch Adjustment*

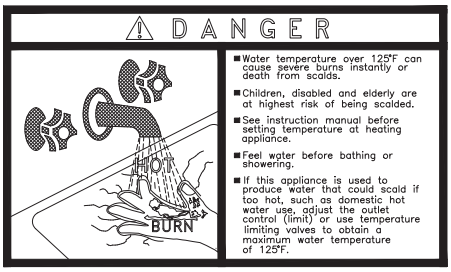


6 System piping *(continued)*

Scalding

This water heater can deliver scalding temperature water at any faucet in the system. Be careful whenever using hot water to avoid scalding injury. Certain appliances such as dishwashers and automatic clothes washers may require increased temperature water. By setting the thermostat on this water heater to obtain the increased temperature water required by these appliances, you may create the potential for scald injury. To protect against injury, you should install a mixing valve in the water system. This valve will reduce point of discharge temperature by mixing cold and hot water in branch supply lines. Such valves are available from the local plumbing supplier.

Figure 6-3 *Scald Warning Label Located on the Appliance*



The following chart (Table 6B) details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

Table 6B *Approximate Time / Temperature Scald Chart*

APPROXIMATE TIME / TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 1/2 seconds
155°F	About 1 second

Water chemistry

NOTICE The temperature rises and circulating pumps shown in Table 6C are selected based on the heating of potable water with a specified water chemistry. See Table 10A in Start-Up Section for recommendations.

Heating of high hardness and/or high total dissolved solids water may require a larger circulating pump, and a revised temperature rise specification based on the water chemistry of the water to be heated. See Table 10A in Start-Up Section for recommendations.

Water with a hardness of less than 5 grains per gallon will usually have a pH which can be aggressive and corrosive causing non-warrantable damage to the pump, and associated piping. Corrosion due to water chemistry generally shows up first in the hot water system because heated water increases the rate of corrosive chemical reactions.

Piping components

Water heater system piping:

Water heater system piping MUST be sized per the pipe requirements listed in Table 6C. Reducing the pipe size can restrict the flow rate through the water heater, causing inadvertent high limit shutdowns and poor system performance.

Check valves:

Field supplied. Check valves are recommended for installation as shown in FIG.'s 6-4 thru 6-8.

Water heater isolation valves:

Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the water heater.

Anti-scald mixing valve:

Field supplied. An anti-scald mixing valve is recommended when storing domestic hot water above 115°F.

Unions:

Field supplied. Recommended for unit serviceability.

Temperature and pressure relief valve:

Factory supplied on water heaters. The temperature and pressure relief valve is sized to ASME specifications. Storage tanks may require additional valves depending on local codes.

Tank sensor:

Lochinvar supplies a tank sensor. The tank sensor must be installed in the tapping provided in the lower 25% of the storage tank to achieve proper operation. As shipped from the factory, the tank sensor is in the literature package shipped with the unit. Placing the sensor in the tapping provided on the storage tank will improve temperature response and prevent short cycles of operation.

Strainer:

Field supplied. Required to help eliminate debris from causing damage to the heat exchanger. When installing in a pre-existing system, it is recommended to install a filter in the recirculation line capable of removing debris left in the system.

Building Recirculation Filter:

Field supplied as required (see Table 10A). When required, helps to eliminate debris from causing damage to the heat exchanger.

⚠ CAUTION Check recirculation pump size to verify it is sized for filter addition and upsize if necessary.

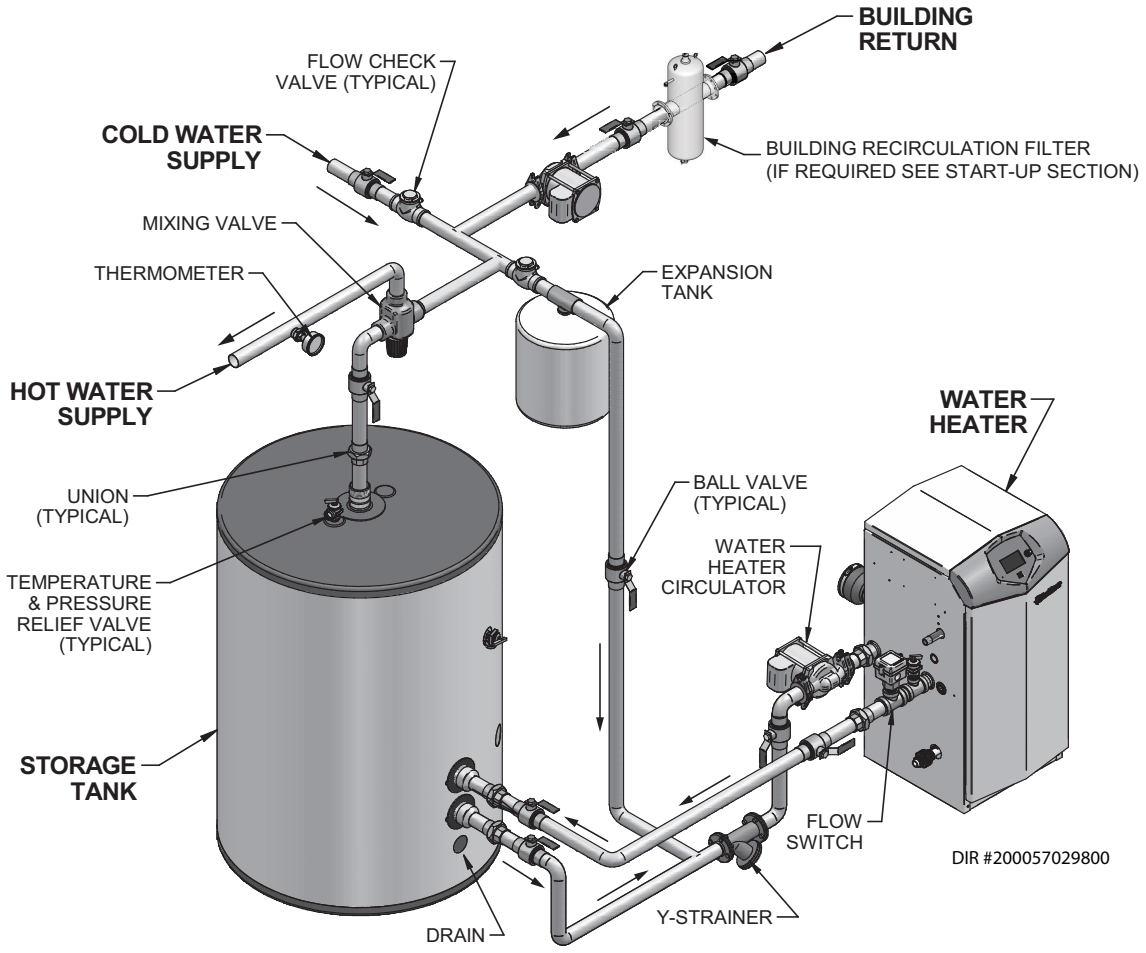
6 System piping

Table 6C Water Heater Pump Applications / Typical Temperature Rise

Water Heater Pump Applications							Water Heater Pump Applications						
Model	Pipe Size	Water Hardness	*Grundfos	Flow Rate (GPM)	Loss (FT/HD)	Temp. Rise	Model	Pipe Size	Water Hardness	*Grundfos	Flow Rate (GPM)	Loss (FT/HD)	Temp. Rise
151	1-1/4"	5 to 12 gpg	*UP 43-100 SF	16	20	18°F	501	2"	5 to 12 gpg	*UP 43-110 SF	53	26	18°F
		12 to 15 gpg	TP 40-160	24	41	12°F			12 to 15 gpg	TP 40-240	66	43	14°F
200	1-1/4"	5 to 12 gpg	*UP 43-100 SF	21	22	18°F	601	2"	5 to 12 gpg	*UP 43-110 SF	53	26	22°F
		12 to 15 gpg	TP 40-160	28	38	13°F			12 to 15 gpg	TP 40-240	66	43	17°F
286	2"	5 to 12 gpg	*UP 43-100 SF	30	23	18°F	701	2"	5 to 12 gpg	*TP 40-160	63	32	22°F
		12 to 15 gpg	TP 40-160	38	36	14°F			12 to 15 gpg	TP 50-160/2B	75	46	17°F
400	2"	5 to 12 gpg	*UP 43-110 SF	42	31	18°F	801	2"	5 to 12 gpg	*TP 40-160	67	31	24°F
		12 to 15 gpg	TP 40-240	56	48	13°F		2-1/2"	12 to 15 gpg	TP 50-160/2B	85	43	18°F
*Denotes standard pump supplied with unit.							*Denotes standard pump supplied with unit.						

NOTICE Pump selections and flow shown above are based on 45 feet of piping, 4 - 90° elbows, and 2 - fully ported ball valves.

Figure 6-4 Single Heater - Single Tank

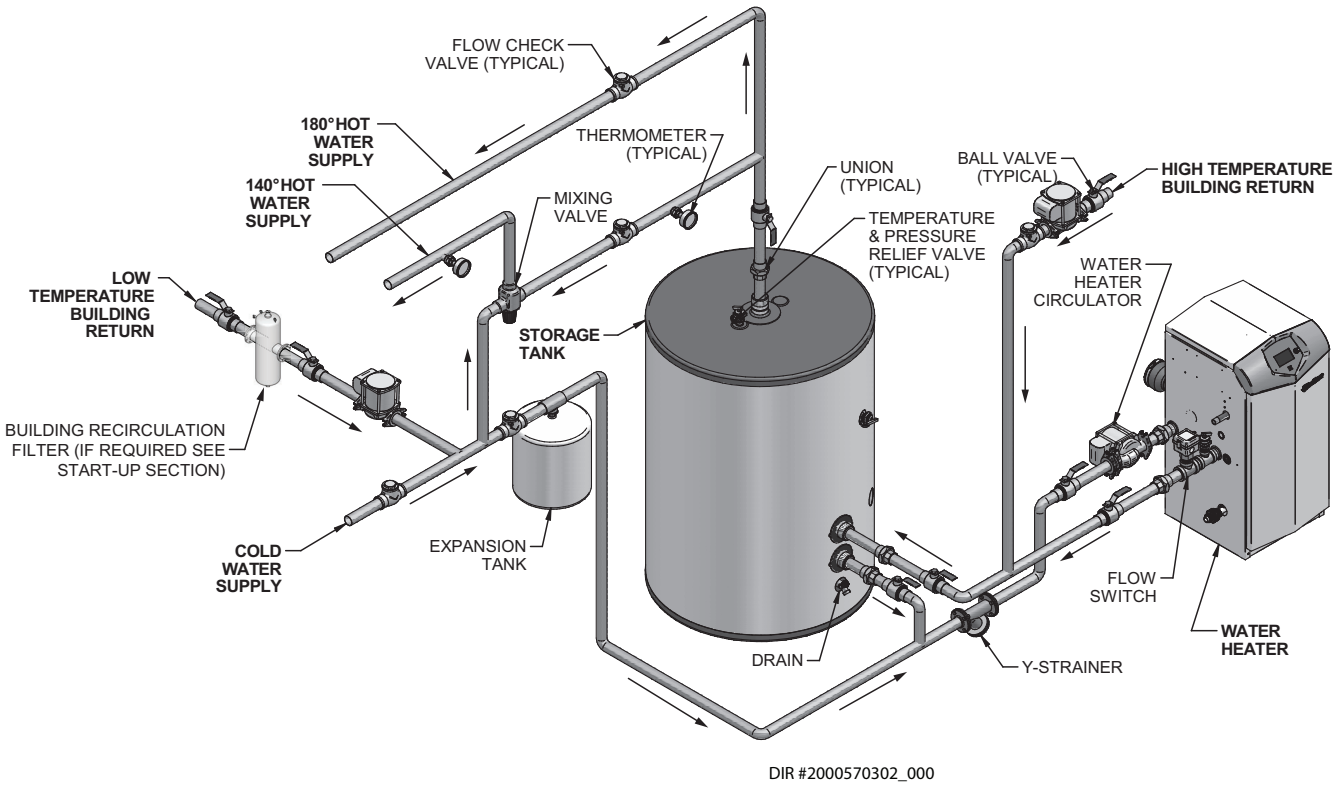


⚠ CAUTION The piping will not support the weight of the water heater circulator pump. Do not attempt to support the weight of the water heater circulator pump with the piping or its accessories. Refer to the pump manufacturer's installation instructions. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment. The installer must follow all manufacturer's instructions for each system component. The installer is responsible for compliance with local codes.

6 System piping *(continued)*

Figure 6-5 *Single Heater - Single Tank (2 Temperature)*

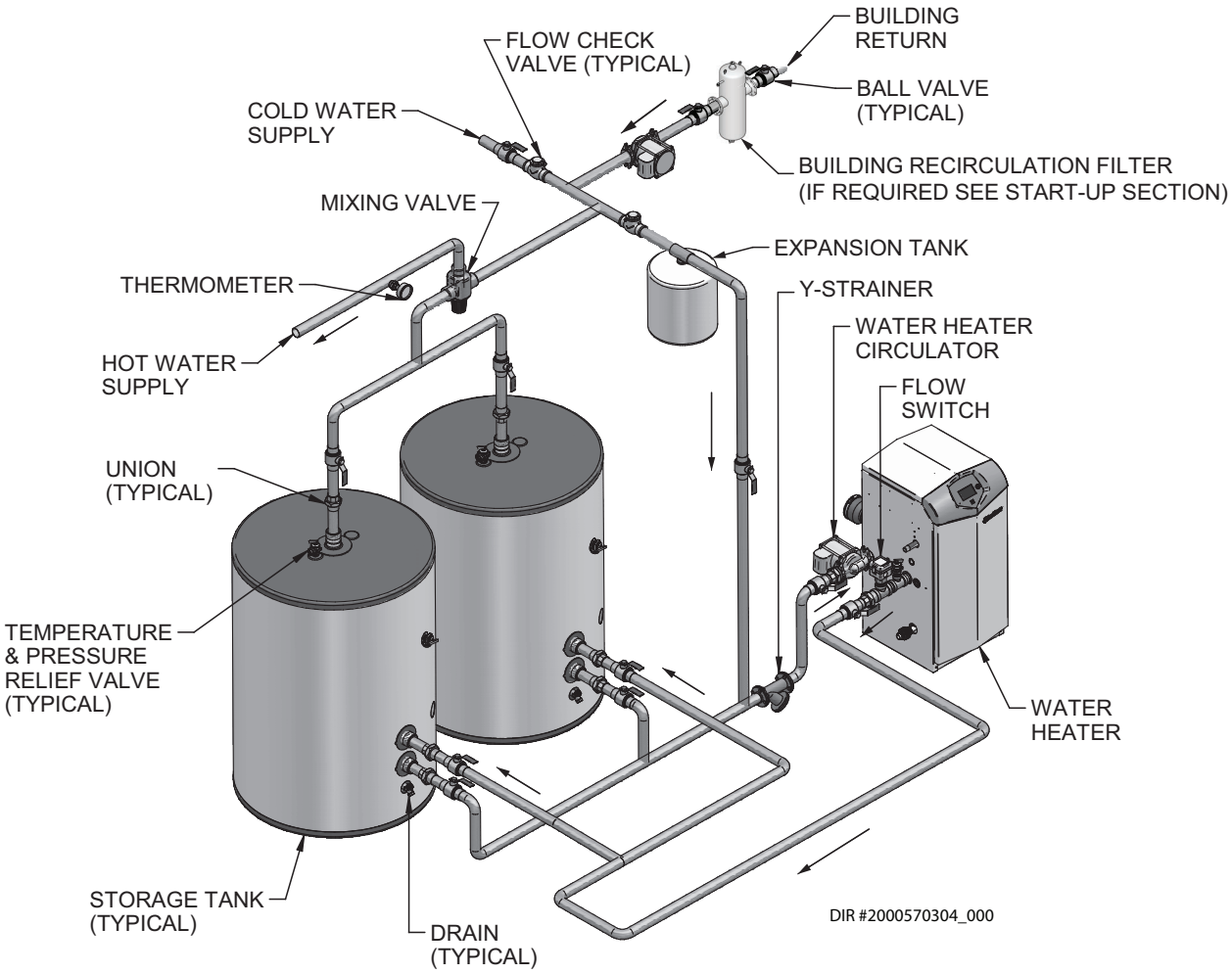


⚠ CAUTION The piping will not support the weight of the water heater circulator pump. Do not attempt to support the weight of the water heater circulator pump with the piping or its accessories. Refer to the pump manufacturer's installation instructions. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment. The installer must follow all manufacturer's instructions for each system component. The installer is responsible for compliance with local codes.

6 System piping

Figure 6-6 *Single Heater - Double Tank*



⚠ CAUTION The piping will not support the weight of the water heater circulator pump. Do not attempt to support the weight of the water heater circulator pump with the piping or its accessories. Refer to the pump manufacturer's installation instructions. Failure to comply could result in severe personal injury, death, or substantial property damage.

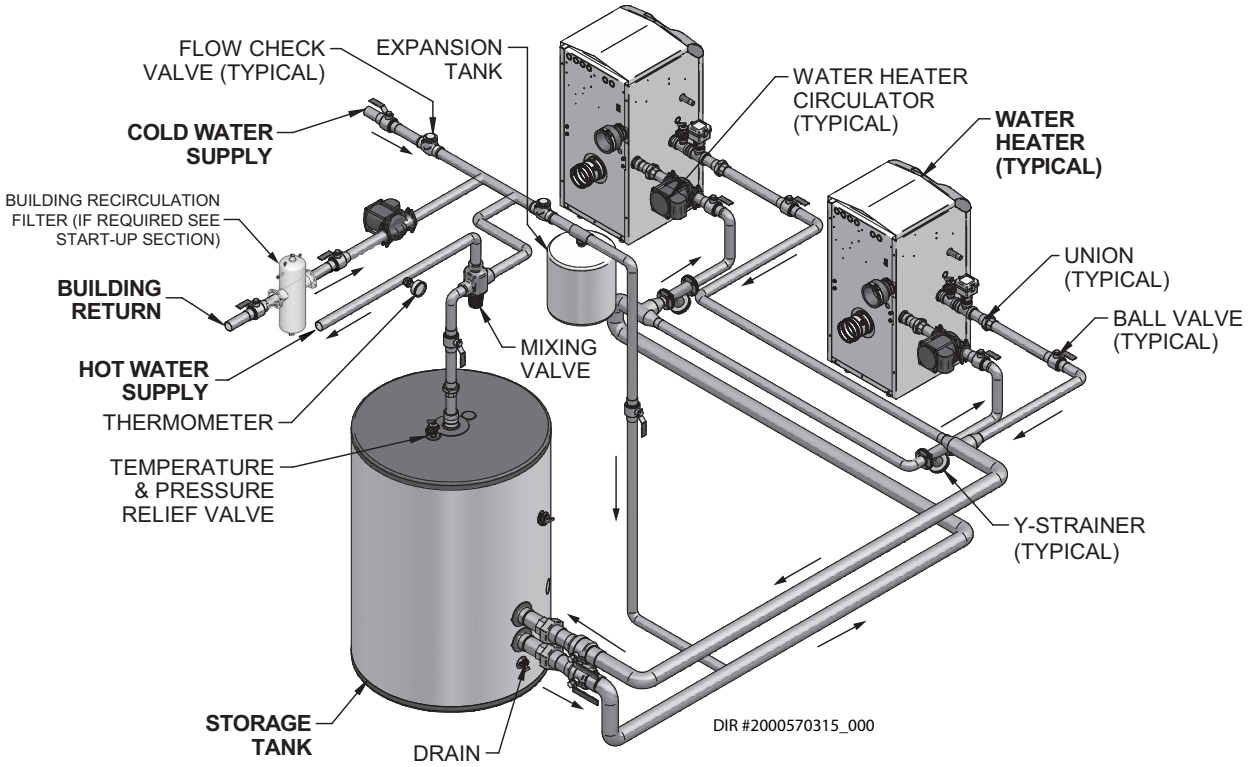
NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment. The installer must follow all manufacturer's instructions for each system component. The installer is responsible for compliance with local codes.

6 System piping *(continued)*

Figure 6-7 *Double Heater - Single Tank*

Model	Number of Units						
	2	3	4	5	6	7	8
	Required Pipe Sizes in NPT with Standard Pump						
151	1 1/2"	2"	2"	2 1/2"	2 1/2"	3"	3"
200	2"	2"	2 1/2"	2 1/2"	3"	3"	4"
286	2"	2 1/2"	3"	3"	4"	4"	4"
400	2 1/2"	3"	3 1/2"	4"	4"	5"	5"
501	3"	3 1/2"	4"	5"	5"	5"	6"
601	3"	3 1/2"	4"	5"	5"	5"	6"
701	3"	4"	5"	5"	6"	6"	6"
801	3"	4"	5"	6"	6"	6"	6"

Model	Number of Units						
	2	3	4	5	6	7	8
	Required Pipe Sizes in NPT with Upsized Pump						
151	2"	2 1/2"	2 1/2"	3"	3"	4"	4"
200	2"	2 1/2"	3"	3"	4"	4"	4"
286	2 1/2"	3"	3"	4"	4"	4"	5"
400	3"	3 1/2"	4"	5"	5"	5"	6"
501	3"	3 1/2"	4"	5"	5"	6"	6"
601	3"	3 1/2"	4"	5"	5"	5"	6"
701	3"	4"	5"	5"	6"	6"	6"
801	4"	4"	5"	6"	6"	6"	6"



⚠ CAUTION The piping will not support the weight of the water heater circulator pump. Do not attempt to support the weight of the water heater circulator pump with the piping or its accessories. Refer to the pump manufacturer's installation instructions. Failure to comply could result in severe personal injury, death, or substantial property damage.

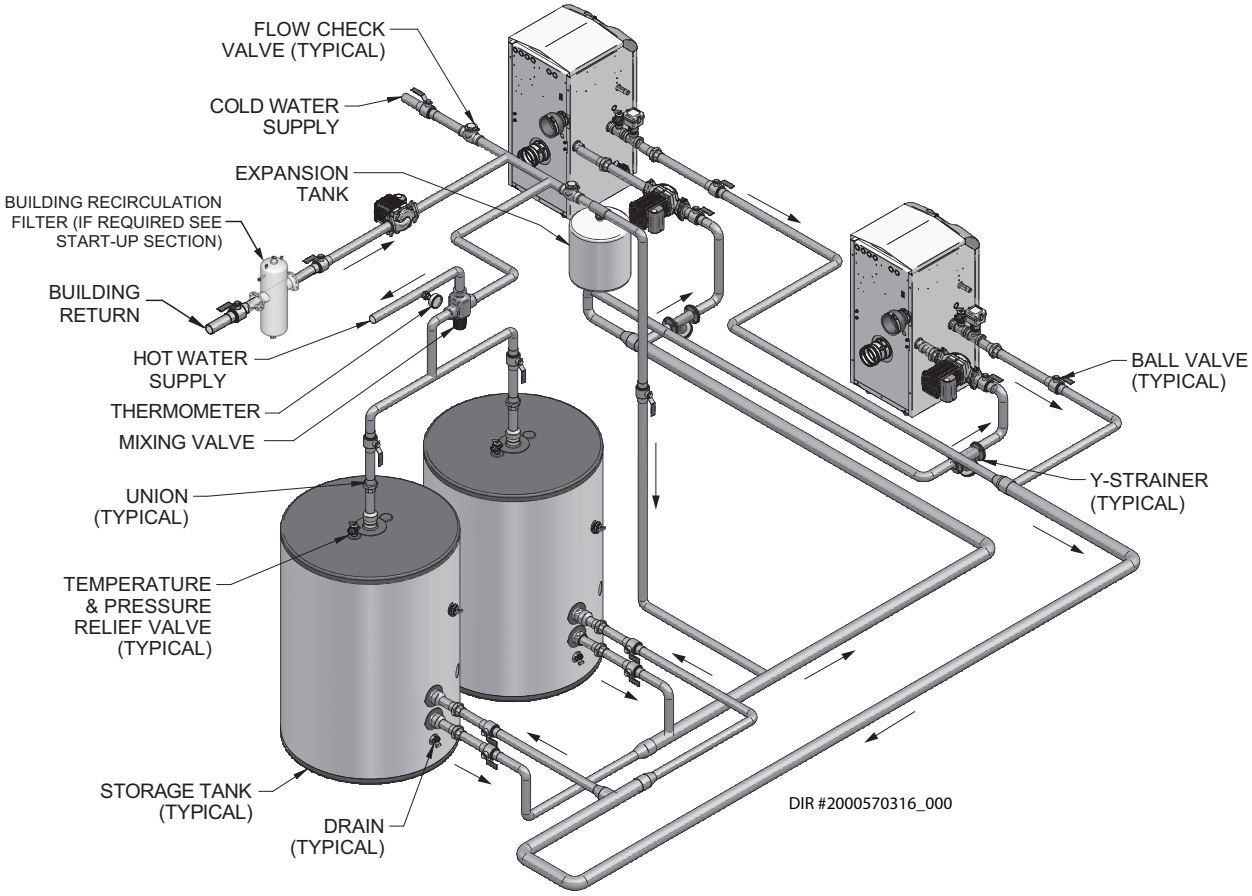
NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment. The installer must follow all manufacturer's instructions for each system component. The installer is responsible for compliance with local codes.

6 System piping

Figure 6-8 *Double Heater - Double Tank*

Model	Number of Units						
	2	3	4	5	6	7	8
	Required Pipe Sizes in NPT with Standard Pump						
151	1 1/2"	2"	2"	2 1/2"	2 1/2"	3"	3"
200	2"	2"	2 1/2"	2 1/2"	3"	3"	4"
286	2"	2 1/2"	3"	3"	4"	4"	4"
400	2 1/2"	3"	3 1/2"	4"	4"	5"	5"
501	3"	3 1/2"	4"	5"	5"	5"	6"
601	3"	3 1/2"	4"	5"	5"	5"	6"
701	3"	4"	5"	5"	6"	6"	6"
801	3"	4"	5"	6"	6"	6"	6"

Model	Number of Units						
	2	3	4	5	6	7	8
	Required Pipe Sizes in NPT with Upsized Pump						
151	2"	2 1/2"	2 1/2"	3"	3"	4"	4"
200	2"	2 1/2"	3"	3"	4"	4"	4"
286	2 1/2"	3"	3"	4"	4"	4"	5"
400	3"	3 1/2"	4"	5"	5"	5"	6"
501	3"	3 1/2"	4"	5"	5"	6"	6"
601	3"	3 1/2"	4"	5"	5"	5"	6"
701	3"	4"	5"	5"	6"	6"	6"
801	4"	4"	5"	6"	6"	6"	6"



⚠ CAUTION The piping will not support the weight of the water heater circulator pump. Do not attempt to support the weight of the water heater circulator pump with the piping or its accessories. Refer to the pump manufacturer's installation instructions. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment. The installer must follow all manufacturer's instructions for each system component. The installer is responsible for compliance with local codes.

7 Gas connections

Connecting gas supply piping

1. Remove the top access panel and refer to FIG.'s 7-1 thru 7-4 to pipe gas to the water heater.
   a. Install ground joint union for servicing, when required.
   b. On Models 151 - 400 install a manual shutoff valve in the gas supply piping outside water heater jacket when required by local codes or utility requirements.
   c. In Canada – When using manual main shutoff valves, it must be identified by the installer.
2. Install sediment trap / drip leg.

Figure 7-1 *Gas Supply Piping - Models 151 - 200*

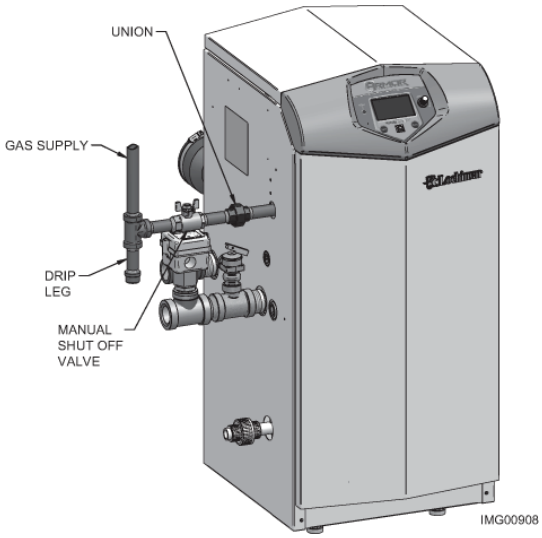


Figure 7-2 *Gas Supply Piping - Models 286 - 400*

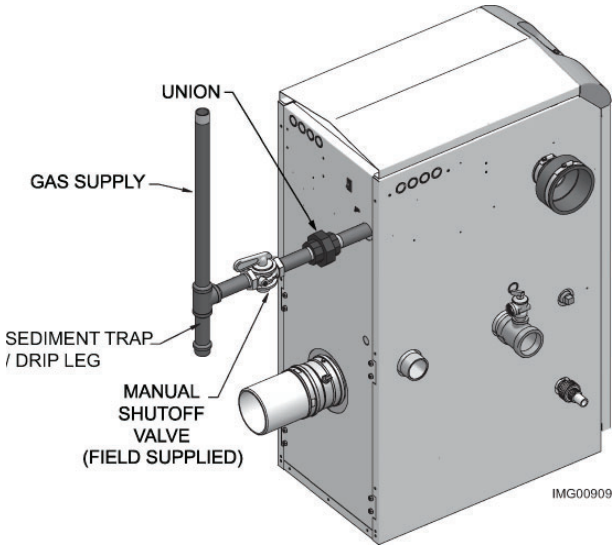


Figure 7-3 *Gas Supply Piping - Model 501*

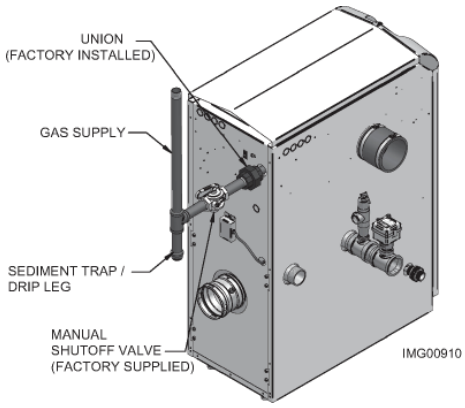
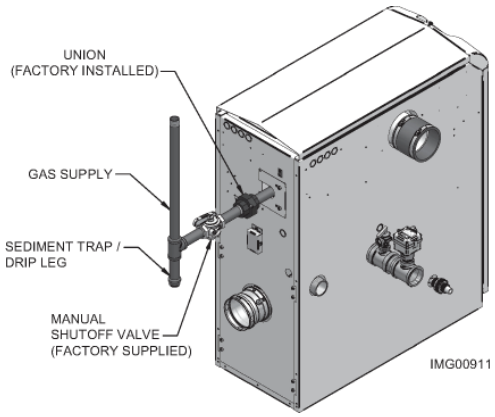


Figure 7-4 *Gas Supply Piping - Models 601 - 801*



3. Support piping with hangers, not by the water heater or its accessories.

⚠WARNING The gas valve and blower will not support the weight of the piping. Do not attempt to support the weight of the piping with the water heater or its accessories. Failure to comply could result in severe personal injury, death, or substantial property damage.

4. Purge all air from the gas supply piping.
5. Before placing the water heater in operation, check the water heater and its gas connection for leaks.
   a. The appliance must be disconnected from the gas supply piping system during any pressure testing of that system at a test pressure in excess of 1/2 PSIG (3.5 kPa).
   b. The appliance must be isolated from the gas supply piping system by closing a manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG (3.5 kPa).
   c. The appliance and its gas connection must be leak tested before placing it in operation.

7 Gas connections

⚠WARNING Do not check for gas leaks with an open flame – use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

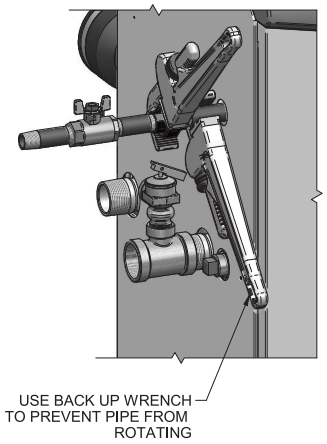
6. Use pipe sealing compound compatible with propane gases. Apply sparingly only to male threads of the pipe joints so that pipe dope does not block gas flow.

⚠WARNING Failure to apply pipe sealing compound as detailed in this manual can result in severe personal injury, death, or substantial property damage.

⚠WARNING Armor water heaters are typically shipped ready to fire on natural gas. Check the water heater rating plate to determine which fuel the water heater is set for. If set to natural gas, it may be converted to LP by installing an orifice or by making a gas valve adjustment (see pages 13 thru 15). In order to operate on LP gas, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠WARNING Use two wrenches when tightening gas piping at water heater (FIG. 7-5), using one wrench to prevent the water heater gas line connection from turning. Failure to support the water heater gas connection pipe to prevent it from turning could damage gas line components.

Figure 7-5 *Inlet Pipe with Backup Wrench*



NOTICE Maximum inlet gas pressure must not exceed the value specified. Minimum value listed is for the purposes of input adjustment.

Natural gas:

Pipe sizing for natural gas

1. Refer to Table 7A for pipe length and diameter. Based on rated water heater input (divide by 1,000 to obtain cubic feet per hour).
   a. Table 7A is only for natural gas with specific gravity 0.60 inches, with a pressure drop through the gas piping of 0.30 inches w.c.
   b. For additional gas pipe sizing information, refer to ANSI Z223.1 (or B149.1 for Canadian installations).

Natural gas supply pressure requirements

1. Pressure required at the gas valve inlet pressure port:
   - Maximum 14 inches w.c. with no flow (lockup) or with water heater on.
   - Minimum 4 inches w.c. with gas flowing (verify during water heater startup).

2. Install 100% lockup gas pressure regulator in supply line if inlet pressure can exceed 14 inches w.c. at any time. Adjust lockup regulator for 14 inches w.c. maximum.

Propane gas:

⚠WARNING Armor water heaters are typically shipped ready to fire on natural gas. Check water heater rating plate to determine which fuel the water heater is set for. If set to natural gas, it may be converted to LP by installing an orifice or by making a gas valve adjustment (see pages 13 thru 15). In order to operate on LP gas, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Pipe sizing for propane gas

1. Contact gas supplier to size pipes, tanks, and 100% lockup gas pressure regulator.

Propane supply pressure requirements

1. Adjust propane supply regulator provided by the gas supplier for 14 inches w.c. maximum pressure.

2. Pressure required at gas valve inlet pressure port:
   - Maximum 14 inches w.c. with no flow (lockup) or with water heater on.
   - Minimum 8 inches w.c. with gas flowing (verify during water heater startup).

⚠WARNING Ensure that the high gas pressure regulator is at least 6 - 10 feet upstream of the appliance.

7 Gas connections *(continued)*

***Table 7A** Natural Gas Pipe Size Chart*

Capacity of Schedule 40 Metallic Pipe in Cubic Feet of Natural Gas Per Hour (based on .60 specific gravity, 0.30" w.c. pressure drop)														
Pipe Size (Inches)	Length of Pipe in Straight Feet													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/2	131	90	72	62	55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3/4	273	188	151	129	114	104	95	89	83	79	70	63	58	N/A
1	514	353	284	243	215	195	179	167	157	148	131	119	109	102
1 1/4	1,060	726	583	499	442	400	368	343	322	304	269	244	224	209
1 1/2	1,580	1,090	873	747	662	600	552	514	482	455	403	366	336	313
2	3,050	2,090	1,680	1,440	1,280	1,160	1,060	989	928	877	777	704	648	602
2 1/2	4,860	3,340	2,680	2,290	2,030	1,840	1,690	1,580	1,480	1,400	1,240	1,120	1,030	960
3	8,580	5,900	4,740	4,050	3,590	3,260	3,000	2,790	2,610	2,470	2,190	1,980	1,820	1,700
4	17,500	12,000	9,660	8,270	7,330	6,640	6,110	5,680	5,330	5,040	4,460	4,050	3,720	3,460

⚠WARNING Armor water heaters are typically shipped ready to fire on natural gas. Check the water heater rating plate to determine which fuel the water heater is set for. If set to natural gas, it may be converted to LP by installing an orifice or by making a gas valve adjustment (see pages 13 thru 15). In order to operate on LP gas, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check inlet gas supply

NOTICE CSA or UL listed flexible gas connections are acceptable, but you must exercise caution to ensure that the line has adequate capacity to allow your water heater to fire at full rate. Consult with local codes for proper installation or service procedures.

⚠WARNING DO NOT adjust or attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter or measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

The gas piping must be sized for the proper flow and length of pipe, to avoid excessive pressure drop. Both the gas meter and the gas regulator must be properly sized for the total gas load.

If you experience a pressure drop greater than 1 inch w.c., the meter, regulator, or gas line is undersized or in need of service. Perform the steps below when checking inlet gas supply:

1. Turn the main power switch to the "OFF" position.
2. Shut off gas supply at the manual gas valve in the gas piping to the appliance.
3. On Models 151 - 501 loosen the set screw one (1) full turn from inside the pressure tap on top of the gas valve. On Models 601 - 801 remove the 1/8" (3 mm) pipe plug on the inlet flange to the valve and install a suitable 1/8" (3 mm) fitting (field supplied) for the manometer tubing. Place the tubing of the manometer over the tap once the set screw is loosened or the 1/8" (3 mm) fitting is installed (depending on model) as shown in FIG.'s 7-6 thru 7-9 on page 50.
4. Slowly turn on the gas supply at the field installed manual gas valve.
5. Turn the power switch to the "ON" position.
6. Adjust the temperature set point on the control panel of the SMART SYSTEM control module to call for heat.
7. Observe the gas supply pressure as the burner fires at 100% of rated input. Percent of burner input will be displayed on the control panel.
8. Ensure inlet pressure is within specified range. Minimum and maximum gas supply pressures are specified in this section of the manual.
9. If gas supply pressure is within normal range and no adjustments are needed, proceed on to Step 11.
10. If the gas pressure is out of range, contact the gas utility, gas supplier, qualified installer or service agency to determine the necessary steps to provide proper gas pressure to the control.
11. Turn the power switch to the "OFF" position.
12. Shut off the gas supply at the manual gas valve in the gas piping to the appliance.
13. Remove the manometer from the pressure tap on top of the gas valve. On Models 151 - 501 re-tighten the set screw inside the pressure tap. On Models 601 - 801 remove the 1/8" (3 mm) field supplied fitting and reinstall the pipe plug removed in Step 3.

⚠WARNING When re-tightening the set screw, be sure to tighten securely to prevent gas leaks.

Do not check for gas leaks with an open flame -- use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

14. Turn on the gas supply at the manual gas valve.
15. Turn the power switch to the "ON" position.
16. Adjust the temperature set point on the control panel of the SMART SYSTEM control module to the desired water temperature so the appliance will call for heat.

7 Gas connections

17. Check burner performance by cycling the system while you observe burner response. The burner should ignite promptly. Flame pattern should be stable. Turn system off and allow burner to cool, then cycle burner again to ensure proper ignition and flame characteristics.

Figure 7-6 *Inlet Gas Supply Check - Models 151 - 286*

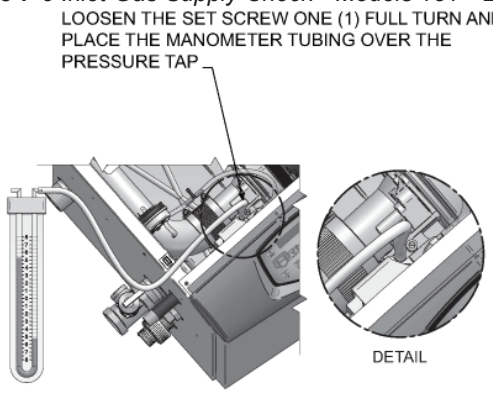


Figure 7-7 *Inlet Gas Supply Check - Model 400*

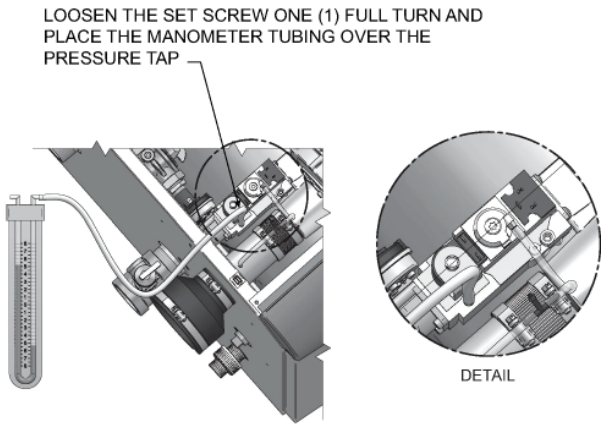


Figure 7-8 *Inlet Gas Supply Check - Model 501*

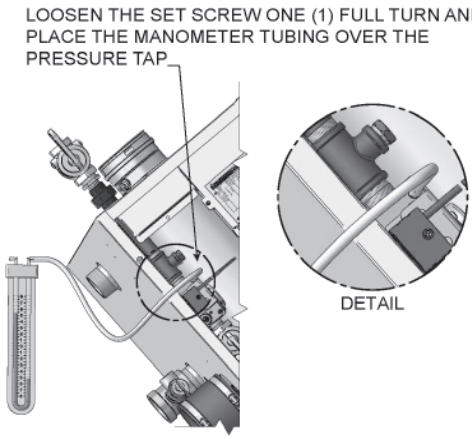
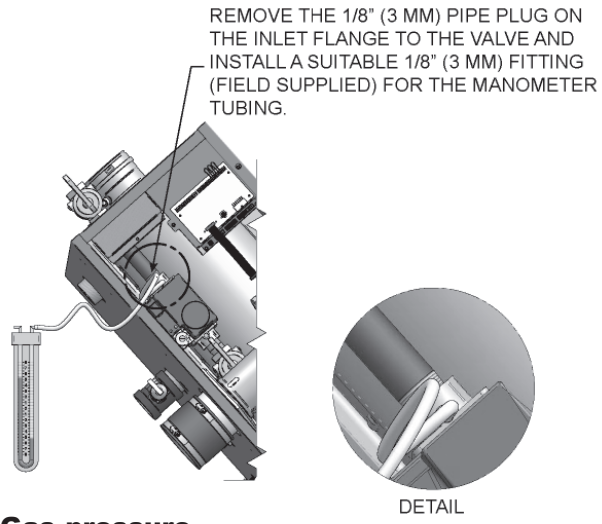


Figure 7-9 *Inlet Gas Supply Check - Models 601 - 801*



Gas pressure

The gas pressure must remain between 4 inches w.c. (natural), 8 inches w.c. (LP) minimum and 14 inches w.c. (natural and LP) maximum during stand-by (static) mode and while in operating (dynamic) mode. If an in-line regulator is used, it must be a minimum of 10 feet from the Armor water heater. It is very important that the gas line is properly purged by the gas supplier or utility company. Failure to properly purge the lines or improper line sizing, will result in ignition failure.

The problem is especially noticeable in NEW LP installations and also in empty tank situations. This can also occur when a utility company shuts off service to an area to provide maintenance to their lines.

Gas valve replacement

The gas valve MUST NOT be replaced with a conventional gas valve under any circumstances. As an additional safety feature, this gas valve has a flanged connection to the venturi and blower.

⚠WARNING Failure to follow all precautions could result in fire, explosion, or death!

⚠WARNING DO NOT adjust gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

8 Field wiring

⚠ WARNING ELECTRICAL SHOCK HAZARD – For your safety, turn off electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

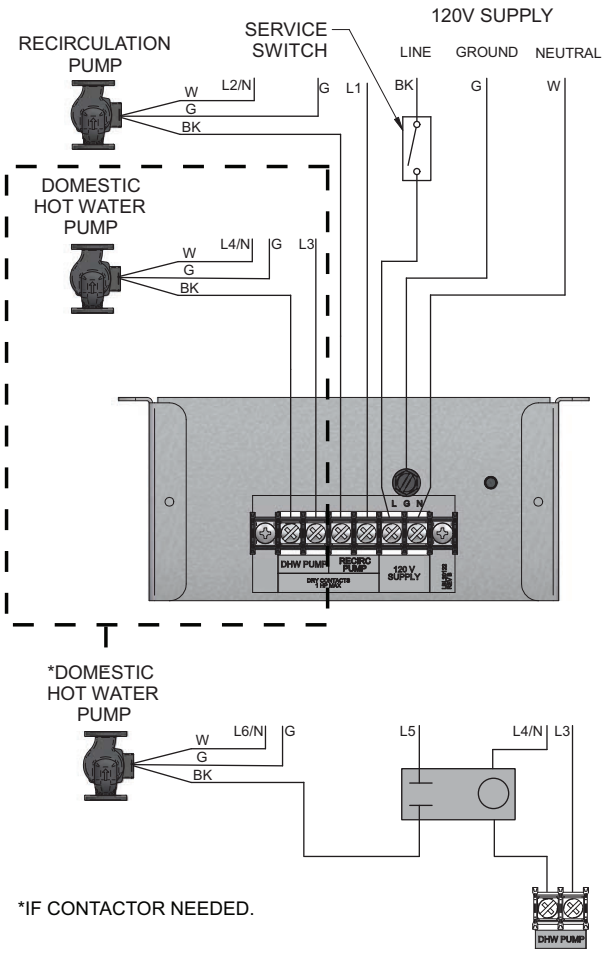
NOTICE Wiring must be N.E.C. Class 1.

If original wiring as supplied with the water heater must be replaced, use only type 105°C wire or equivalent.

The water heater must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – latest edition.

⚠ CAUTION Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Figure 8-1 *Line Voltage Field Wiring Connections - With and Without Contactor*



Installation must comply with:

1. National Electrical Code and any other national, state, provincial, or local codes, or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

Line voltage connections

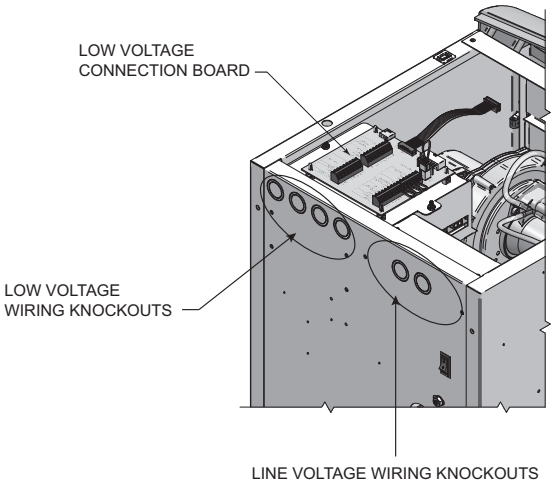
1. Connect 120 VAC power wiring to the line voltage terminal strip in the junction box, as shown in FIG. 8-1.
2. Provide and install a fused disconnect or service switch (15 amp recommended) as required by the code (see FIG. 8-1).
3. The DHW (water heater) pump is shipped loose on all Armor models. Wire the water heater pump as shown in FIG. 8-1.
4. The Armor water heater is capable of controlling a building recirculation pump (field supplied). Wire the building recirculation pump as shown in FIG. 8-1.
5. Dry contacts are sized for 1 hp/120V or 2 hp/240V.

⚠ CAUTION If using a pump greater than these ratings, a field supplied contactor must be installed. If not installed, electrical failures and unexpected operation may occur. See FIG. 8-1 for wiring information.

Low voltage connections

1. Route all low voltage wires through the knockouts in the rear of the water heater, as shown in FIG. 8-2.
2. Connect low voltage wiring to low voltage connection board as shown in FIG. 8-3 on page 54 of this manual and the water heater wiring diagram.

Figure 8-2 *Routing Field Wiring (Models 151 - 286)*



8 Field wiring

Tank thermostat

1. Connect the tank thermostats (isolated contact only) to the tank thermostat contacts as shown in FIG. 8-3.

Tank sensor

1. By installing a tank sensor, the SMART SYSTEM control can perform the tank thermostat function. The SMART SYSTEM control automatically detects the presence of this sensor and generates a DHW call for heat when the tank temperature drops below the programmed differential and finishes the call for heat when the tank temperature reaches above the programmed offset.
2. The tank sensor is the only sensor suitable for use with the SMART SYSTEM control. Connect the sensor leads to the Tank Sensor terminals on the Low Voltage Connection Board (FIG. 8-3).

Louver relay

If louvers need to operate when the water heater fires, they can be controlled by this output. Connect these terminals to a 24 VAC relay coil, which is wired to operate the louvers (FIG. 8-3).

Louver proving switch

When the operation of the louvers needs to be verified before the water heater fires, remove the jumper wire from these terminals and connect them to the normally open contacts on its proving switch (FIG. 8-3).

High gas pressure switch

If a switch is provided to detect excessive gas pressure, remove the jumper wire from the terminals on the connection board, and then connect them to its normally closed contacts (FIG. 8-3).

Low gas pressure switch

1. If a switch is provided to detect low gas pressure, remove the jumper wire from the terminals on the connection board and connect them to its normally open contacts (FIG. 8-3).
2. If both a high and low gas pressure switch are used, connect their respective contacts in series, and connect them to the terminals on the connection board (FIG. 8-3).

NOTICE See *Section 7 - Gas Connections* for a detailed explanation regarding high and low gas pressure switch operation.

Flow switch

1. A flow switch is used to guarantee flow through the water heater before allowing it to fire. The flow switch must be installed at the water heater outlet.
2. Connect these terminals to the normally open contacts on the flow switch (FIG. 8-3).

Rate output

This output provides a 0 - 10V signal that is proportional to the firing rate of the water heater. This may be used by a BMS system to monitor the actual rate of the water heater.

ModBus

When the optional ModBus interface module is installed, the RS-485 ModBus cable is connected to these terminals. Use shielded, 2-wire twisted pair cable. If desired, the shield can be connected to ground by installing a jumper wire between terminals 1 and 3 on connector X5 on the optional ModBus interface module.

Water heater Building Management System (BMS)

1. An external control may be connected to control either the firing rate or the set point of the water heater. If the external control uses a set of contacts to enable the water heater, connect the contacts to the Tank Thermostat terminals. Otherwise, the SMART SYSTEM control will be enabled by the 0-10V signal.
2. Make sure the (-) terminal is connected to the (-) or common output terminal of the external control, and the (+) terminal is connected to the (+) or 0 - 10 VDC terminal of the external control. Make sure the (-) voltage is not below ground.

8 Field wiring *(continued)*

Runtime contacts

The SMART SYSTEM control closes a set of dry contacts whenever the burner is running. This is typically used by Building Management Systems to verify that the water heater is responding to a call for heat.

Alarm contacts

The SMART SYSTEM control closes another set of contacts whenever the water heater is locked out or the power is turned off. This can be used to turn on an alarm, or signal a Building Management System that the water heater is down.

Wiring of the cascade

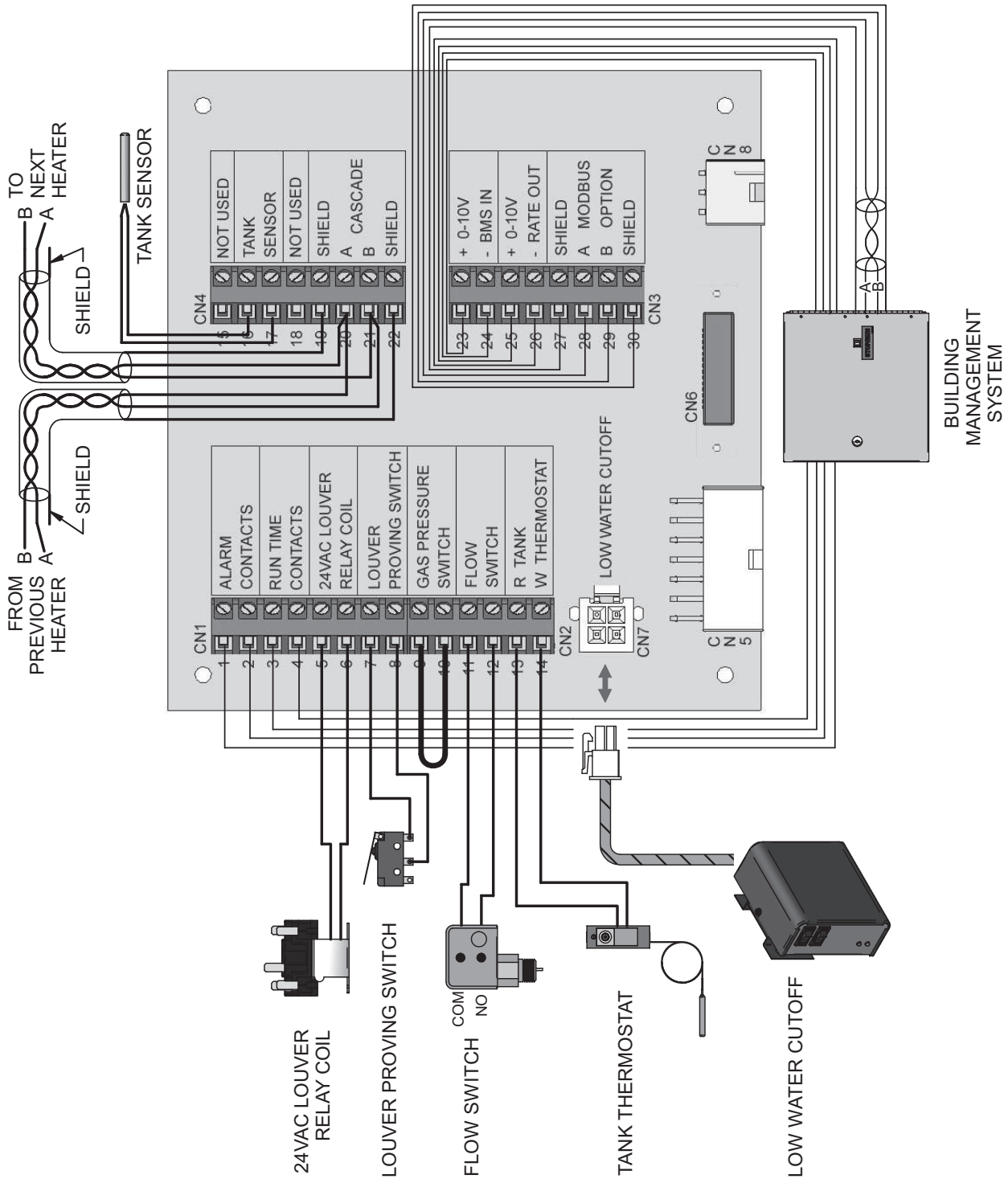
When wiring the water heaters for Cascade operation, select one water heater as the Leader water heater. The remaining water heaters will be designated as Members. See page 61 “Configuration of the Cascade” for a detailed explanation of this procedure.

Connect the tank sensor to the Leader water heater. For the Cascade system to work properly the tank sensor must be installed. The tank sensor should be wired to the low voltage connection board at the terminals marked for the tank sensor (see FIG. 8-3). The Leader control will use the water temperature at the tank sensor to control the operation of the Cascade.

Communication between the Leader water heater and the Member water heaters is accomplished by using shielded, 2-wire twisted pair communication cable. Connect one of the twisted pair wires to Cascade terminal A on each of the Low Voltage Connection boards, and the other wire of the twisted pair to Cascade terminal B on each of the Low Voltage Connection Boards. Connect the shield wires to one of the shield terminals on the Low Voltage Connection Boards (FIG. 8-3). If more than two water heaters are on the Cascade, daisy chain the wiring from the Cascade terminals on the second water heater to the Cascade terminals on the third water heater, then from the third to the forth, and so on. The connections between heaters can be made in any order, regardless of the addresses of the water heaters. Try to keep each cable as short as possible.

8 Field wiring

Figure 8-3 *Low Voltage Field Wiring Connections*



9 Condensate disposal

Condensate drain

1. This water heater is a high efficiency appliance that produces condensate.
2. The side of the water heater has a 1/2 inch PVC union for connection of a 1/2 inch PVC pipe (FIG. 9-1).
3. Slope condensate tubing down and away from the water heater into a drain or condensate neutralizing filter. Condensate from the Armor water heater will be slightly acidic (typically with a pH from 3 to 5). Install a neutralizing filter if required by local codes.

   A Neutralizer Kit (FIG. 9-1) is available from the factory.
4. Install the 1/2 inch PVC elbow (field supplied) as shown in FIG. 9-1.
5. Do not expose condensate line to freezing temperatures.
6. Use only plastic tubing or piping as a condensate drain line (FIG. 9-1).

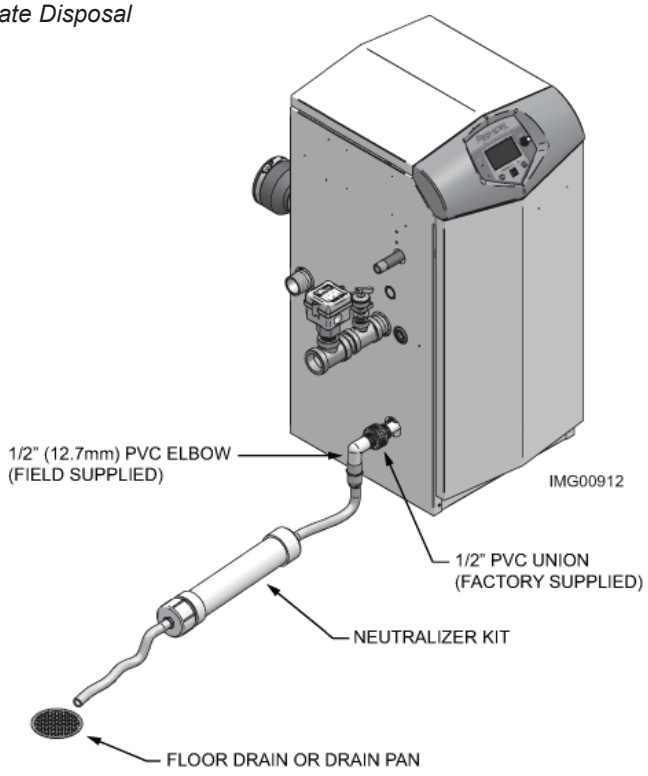
NOTICE Use materials approved by the authority having jurisdiction. In the absence of other authority, PVC and CPVC pipe must comply with ASTM D1785 or D2845. Cement and primer must comply with ASME D2564 or F493. For Canada use CSA or ULC certified PVC or CPVC pipe, fittings, and cement.

NOTICE To allow for proper drainage on large horizontal runs, a second line vent may be required and tubing size may need to increase to 1 inch.

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate is allowed to freeze in the line or if the line is obstructed in any other manner, condensate can exit from the water heater tee, resulting in potential water damage to property.

7. A condensate removal pump is required if the water heater is below the drain. When installing a condensate pump, select one approved for use with condensing water heaters and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. The switch should be wired in series with the blocked drain switch inside the water heater (see FIG. 10-1 on page 56).

Figure 9-1 *Condensate Disposal*



NOTE: Neutralizer shown for illustrative purposes only. Actual neutralizer may vary.

10 Start-up

Check/control water chemistry

NOTICE Conduct water quality testing prior to installing the appliance. Various solutions are available to adjust water quality.

See the following table for properly operating the water heater with the appropriate water chemistry. Good water quality will help extend the life of the appliance by reducing the effects of scale buildup and corrosion.

***Table 10A** Water Chemistry*

WATER CHEMISTRY		
Specification	**Range**	**Requirement**
Hardness	< 5 gpg	Follow recommendations detailed below (See Notice 3)
	5 to 12 gpg	Use Table 6C for pump recommendation
	12 to 15 gpg	Use Table 6C for pump recommendation
	> 15 gpg	Water softening system required (See Notice 4)
Dissolved Solids	< 350 ppm	Hardness level must be met
pH Level	6.5 to 8.5	Acceptable range
Chloride	< 150 ppm	Acceptable range

NOTICE

1. Do not use the water heater to directly heat swimming pool or spa water.

2. At initial fill and during water heater start-up and testing, check system thoroughly for any leaks. Repair all leaks before proceeding further.

3. When water hardness levels are less than 5 gpg or 85.5 mg/l, the following is recommended:

   a. Flush and clean existing water heating system prior to installation.

   b. Inspect and, if necessary, replace the anodes in any existing tanks.

   c. Install a Y-strainer on the inlet of each water heater as detailed in Section 6.

   d. Limit the run time of the hot water recirculation loop.

   e. Filter the hot water recirculation loop to a level of 10 microns. CAUTION: Check recirculation pump size to verify it is sized for filter addition and upsize if necessary.

4. When water softener is required, a Template Assisted Crystallization system is recommended.

Check for gas leaks

⚠WARNING Before starting the water heater, and during initial operation, smell near the floor and around the water heater for gas odorant or any unusual odor. Remove the top access panel and smell the interior of the water heater enclosure. Do not proceed with startup if there is any indication of a gas leak. Use an approved leak detection solution. Repair any leaks at once.

⚠WARNING DO NOT adjust gas valve outlet pressure. The gas valve is factory set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

⚠WARNING Propane water heaters only – Your propane supplier mixes an odorant with the propane to make its presence detectable. In some instances, the odorant can fade, and the gas may no longer have an odor. Before startup (and periodically thereafter), have the propane supplier verify the correct odorant level in the gas.

Inspect/fill condensate system

Inspect/check condensate lines and fittings

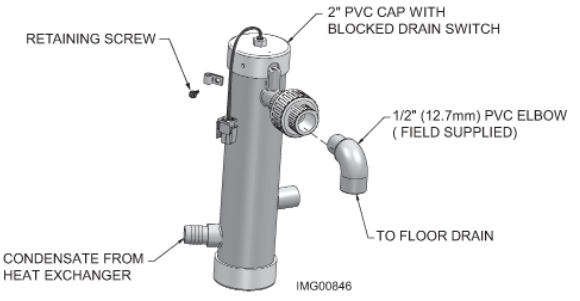
1. Inspect the condensate drain line, condensate PVC fittings and condensate trap.

Fill condensate trap with water

1. Remove the PVC cap retaining screw from the PVC cap (FIG. 10-1).
2. Remove the 2 inch PVC cap with the switch located at the top of the trap (FIG. 10-1).
3. Fill with fresh water until the water begins to pour out of the drain.
4. Replace the cap. Press the cap onto the trap until the cap makes contact with the drain.
5. Replace the retaining screw.

⚠WARNING The condensate trap (FIG. 10-1) must be filled with water during all times of water heater operation to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe personal injury or death.

***Figure 10-1** Condensate Trap*



10 Start-up *(continued)*

Final checks before starting the water heater

- ❑ Read the Armor Water Heater Service Manual to familiarize yourself with SMART SYSTEM control module operation. Read this manual, pages 58 and 59 for proper steps to start the water heater.
- ❑ Verify the water heater and system are full of water and all system components are correctly set for operation.
- ❑ Verify the preparation procedures of Section 10, pages 56 and 57 have been completed.
- ❑ Fill the vent condensate trap with water (removing the retaining screw in order to remove the 2 inch PVC cap with the switch located at the top of the trap). Replace the cap. Press the cap onto the trap until the cap makes contact with the drain. Replace the retaining screw.
- ❑ Verify electrical connections are correct and securely attached.
- ❑ Inspect vent piping and air piping for signs of deterioration from corrosion, physical damage or sagging. Verify air piping and vent piping are intact and correctly installed per this manual.

Start the water heater

1. Read and follow the Operating instructions in FIG.'s 10-2 and 10-3, pages 58 and 59.

If water heater does not start correctly

1. Check for loose connections, blown fuse or service switch off?
2. Is water heater water temperature above 200°F?
3. Is tank thermostat or tank set point set below room temperature?
4. Is gas turned on at meter or water heater?
5. Is incoming gas pressure less than 4 inches w.c.?

If none of the above corrects the problem, refer to the Troubleshooting Section of the Armor Water Heater Service Manual.

Check system and water heater

❑ Check water piping

1. Check system piping for leaks. If found, shut down the water heater and repair immediately. (See WARNINGS on pages 56 and 57 (startup) regarding failure to repair leaks.)
2. Check Delta T. Reference Section 6 - *System Piping* on page 41 for more information regarding Delta T.
3. Vent any remaining air from the system using manual vents. Air in the system will interfere with circulation and cause heat distribution problems and noise.

❑ Check vent piping and air piping

1. Check for gastight seal at every connection, seam of air piping, and vent piping.

⚠WARNING Venting system must be sealed gastight to prevent flue gas spillage and carbon monoxide emissions, which will result in severe personal injury or death.

❑ Check gas piping

1. Check around the water heater for gas odor following the procedure on page 47 of this manual *(Connecting Gas Supply Piping)*.

⚠WARNING If you discover evidence of any gas leak, shut down the water heater at once. Find the leak source with a bubble test and repair immediately. Do not start the water heater again until corrected. Failure to comply could result in severe personal injury, death, or substantial property damage.

❑ Propane water heaters – verify conversion

1. Verify propane conversion has been completed per the Propane Conversion instructions.

⚠WARNING DO NOT adjust gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

⚠WARNING Armor water heaters are typically shipped ready to fire on natural gas. Check water heater rating plate to determine which fuel the water heater is set for. If set to natural gas, it may be converted to LP by installing an orifice or by making a gas valve adjustment (see pages 13 thru 15). In order to operate on LP gas, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check flame and combustion

1. Turn the main power off to the water heater by placing the "On/Off" switch in the OFF position.
2. Remove the flue temperature sensor from the flue pipe connection. **Note:** Combustion measurements will be made at this point.
3. Turn the main power on to the water heater by placing the "On/Off" switch in the ON position.

10 Start-up

Figure 10-2 *Operating Instructions - Models 151 - 286*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

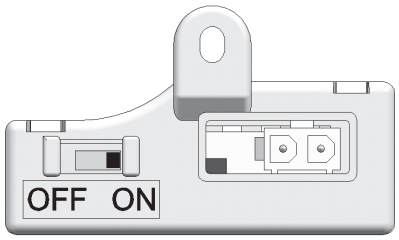
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to move the gas control switch. Never use tools. If the switch will not move by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove front door.
6. Move switch to the "OFF" position.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Move the switch to the "ON" position.
9. Install front door.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove front door.
4. Move the switch to the "OFF" position.
5. Install front door.

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10 Start-up *(continued)*

Figure 10-3 *Operating Instructions - Models 400 - 801*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

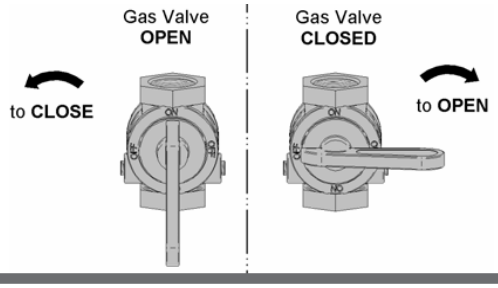
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control knob. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove top cover.
6. Turn gas shutoff valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Turn gas shutoff valve clockwise to "ON". Handle will be parallel to pipe.
9. Install top cover.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove top cover.
4. Turn gas shut off valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force
5. Install top cover.

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10 Start-up

Check flame and combustion *(continued)*

4. Place the water heater into the active position by pressing the RIGHT SELECT [ON] key (FIG. 11-1, page 66).

5. Locate the pinhole button below the RESET button on the display board (FIG. 11-1). Insert a thin wire (such as a paper clip) into the hole and press the button once and hold for 5 seconds to place the water heater into Service Mode. In Service Mode the water heater will fire at ignition speed and will then modulate up to full fire.

6. Insert the probe from a combustion analyzer into the hole left by the removal of the flue temperature sensor.

7. Once the water heater has modulated up to full fire, measure the combustion. The values should be in the range listed in Table 10B below. The CO levels should be less than 150 ppm for a properly installed unit.

   If the combustion is not within the specified range, reference the Troubleshooting Section of the Armor Water Heater Service Manual for possible causes and corrective actions.

***Table 10B** Flue Products Chart*

Natural Gas		Propane	
CO_2	O_2	CO_2	O_2
8.0% - 10%	3.0% - 6.5%	9.0% - 11%	4.1% - 6.9%

8. Once the combustion analysis is complete, test the safety shutoff device by turning the manual shutoff valve to the OFF position and ensuring that the water heater shuts down and registers an alarm. Open the manual shutoff valve and reset the control.

9. Turn the main power off to the water heater and replace the flue temperature sensor into the flue pipe connection.

10. Place the water heater back into normal operation.

⚠WARNING You must replace the flue gas temperature sensor to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

Set water heater operation

Set tank set point temperature

NOTICE Please note that the brackets ([]) denote screen status.

The NAVIGATION dial may be used during normal operation to adjust the tank set point temperature.

1. From the Status Screen press the NAVIGATION dial.

2. Press the NAVIGATION dial then rotate the NAVIGATION dial to adjust the temperature.

3. Once the desired temperature is displayed, press the RIGHT SELECT [SAVE] key.

4. Press the RIGHT SELECT [HOME] key to upload the changes.

5. If the RIGHT SELECT [SAVE] key is not pressed, the new settings will be discarded.

Verify WHR circulator mode

When the tank thermostat or tank sensor calls for heat, the SMART SYSTEM control will turn on the water heater pump. When the DHW call for heat ends, the water heater pump will continue to run for a period of time. This pump delay is set at the factory to 60 seconds. If a shorter or longer delay is desired, the appropriate parameter in the control must be changed. See the Armor Water Heater Service Manual for a detailed explanation of this procedure.

10 Start-up *(continued)*

Set clock

NOTICE Please note that the brackets ([]) denote screen status.

The SMART SYSTEM control has a built-in clock that it uses for its night setback feature and for logging events. This clock must be set when the water heater is installed, and anytime the water heater has been powered off for more than 4 hours. Use the following procedure to set the clock:

1. Press and hold the LEFT SELECT [MENU] key for at least 5 seconds.
2. The display changes to read [PASSWORD], with four (4) zeros below it.
3. Press the RIGHT SELECT [SAVE] key.
4. The display will then show a menu with the time and date and temperature unit.
5. Press the NAVIGATION dial twice.
6. Turn the NAVIGATION dial to adjust the hours. Press the NAVIGATION dial.
7. Turn the NAVIGATION dial to adjust the minutes. Press the NAVIGATION dial.
8. Turn the NAVIGATION dial to adjust the month. Press the NAVIGATION dial.
9. Turn the NAVIGATION dial to adjust the date. Press the NAVIGATION dial.
10. Turn the NAVIGATION dial to adjust the year. Press the RIGHT SELECT [SAVE] key.
11. Press the RIGHT SELECT [HOME] key.

NOTICE The internal clock does not adjust for Daylight Savings Time and therefore, will require a manual adjustment.

The clock is automatically updated whenever a PC is connected and the Win Pro-Installer program is started.

Configuration of the cascade

NOTICE Please note that the brackets ([]) denote screen status.

When installed in a Cascade system, the individual controls must be programmed for cascade operation. This is accomplished by accessing the control parameters.

Press the [MENU] key for at least five (5) seconds. Input the Installer code as described in the Armor Service Manual. Once the control parameters have been accessed, use the NAVIGATION dial to select the Control Mode parameters. Press the NAVIGATION dial to access these parameters.

Rotate the NAVIGATION dial to select the parameter “Cascade Address”. Press the NAVIGATION dial to access this parameter. Each appliance in the Cascade system must be programmed with its own address. The water heater designated as the Leader will have an address of 0. The remaining water heaters in the Cascade will be Members and have addresses from 1 - 7. Rotate the NAVIGATION dial to select the appropriate address. Press the RIGHT SELECT [SAVE] key.

Press the RIGHT SELECT [HOME] key to upload the address into the control. Repeat this procedure for all water heaters in the Cascade, designating the Leader control and the Member controls.

Note: A tank sensor must be installed when operating Armor water heaters in Cascade.

11 Operating information

General

How the water heater operates

The Armor water heater uses an advanced stainless steel heat exchanger and electronic control module that allows fully condensing operation. The blower pulls in air and pushes flue products out of the water heater through the heat exchanger and flue piping. The control module regulates blower speed to control the water heater firing rate. The gas valve senses the amount of air flowing into the water heater and allows only the right amount of gas to flow.

Control inputs and outputs

Tank thermostat / tank sensor

Either of these inputs will tell the water heater to provide heat to the water tank. If a tank sensor is connected, the SMART SYSTEM control will ignore the tank thermostat.

0 - 10VDC input (set point or power)

The Armor water heater can be controlled by a Building Management System (BMS) using a 0 - 10 VDC signal. The control can be configured by the installer to use this signal to either control set point or firing rate. This signal can be sent to the heater through ModBus as well.

Temperature control

Modulation

The Armor water heater is capable of modulating its firing rate from a minimum of 20% to a maximum of 100%. The firing rate is dictated by the hot water draw and various other temperature limitations.

Night setback

The controller may be programmed to reduce the DHW set point during certain times each week. Seven different start and stop times may be programmed for the DHW setback.

Flame current support

To prevent nuisance shutdowns when the water heater is firing at minimum rates, the control will increase fan speed when the flame signal drops too low.

Protection features

Outlet temperature, flue temperature, and temperature rise limiting

The outlet temperature is monitored by the water heater outlet temperature sensor. When the outlet temperature exceeds 185°F, the unit will reduce the fan speed. If the outlet water temperature exceeds 195°F the control will shut the unit down until it cools off.

The control module monitors the flue temperature by a sensor located in the flue exhaust. If the flue temperature exceeds 215°F the control will reduce the maximum fan speed. If the flue temperature exceeds 225°F (107°C) the control will shut the unit down. The unit will restart automatically once the flue temperature drops 10°F (6°C) and the minimum off time has expired.

The control monitors the temperature difference between the inlet and the outlet sensor. If the control determines the temperature rise is too high, it will either reduce the firing rate or shut down the unit as appropriate.

The unit will restart automatically once the temperature difference has dropped below the allowable rise and the minimum off time has expired.

Freeze protection

DO NOT install the water heater in a room likely to freeze.

The following integral feature of the SMART SYSTEM control module provides some protection for the water heater.

- The SMART SYSTEM control module provides freeze-up protection as follows when the water heater water temperature drops below 45°F:
- Below 45°F, the water heater pump operates constantly.
- Below 37°F, the water heater turns on.
- The water heater and pump will turn off if water heater water temperature rises above 45°F.

⚠ CAUTION This feature of the SMART SYSTEM control module does not eliminate the possibility of freezing. The installation must still use recognized design, installation and maintenance practice to prevent freeze potential for the water heater.

11 Operating information *(continued)*

Monitor external limits

Connections are provided on the connection board for external limits such as flow switch, gas pressure switches, and a louver proving switch. The SMART SYSTEM will shut off the burner and inhibit relighting whenever any of these external limits open.

Runtime and alarm outputs

The water heater provides dry contacts for indicating when the water heater is running, and when it is unable to operate.

Runtime and cycle counting

The control uses a timer to monitor the total hours of burner operation. The timer monitors the time the water heater is firing.

The control uses two (2) ignition counters to monitor the amount of water heater cycles. The first counter counts all ignitions of the control. The second counter counts only ignition attempts that have failed.

Service reminder

The control can be programmed for service reminder notification. This notification will become active when either a set amount of time has expired, or a set amount of running hours or cycles has expired (all adjustable by the installer). The display will show a Maintenance Required screen. The installer's name and phone number can be programmed into the control. This information will appear on the Maintenance Required screen. The service reminder notification can be reset or disabled by the installer.

The time dependent feature has been disabled by the manufacturer. To enable this feature change the parameter to the desired time interval, reference the Armor Service Manual for details regarding parameters.

Error logging

The control will hold in memory the last 10 lockouts as well as the last 10 blockings. The date and time of the occurrence will be recorded as well. Only the 10 most current occurrences of each will be held in memory.

Water heater temperature regulation

Operating temperature (target)

The SMART SYSTEM control module senses water temperature and regulates water heater firing and firing rate to achieve a target temperature. The target temperature can be set between 60°F and 190°F.

High limit operations

The Armor water heater is equipped with a fixed automatic reset hight limit and an adjustable manual reset high limit. The automatic reset high limit has a set point of 200°F and the manual reset high limit has a maximum set point of 210°F.

When the outlet temperature exceeds 200°F, the automatic high limit action occurs. The water heater shuts down until the outlet water temperature cools below 190°F, and a 60 second timer has expired. If the outlet temperature continues to increase, the manual reset high limit action will occur at 210°F.

High limit test procedure

NOTICE Please note that the brackets ([]) denote screen status.

1. Turn ON the main power to the boiler by placing the ON/OFF switch in the ON position.
2. From the Status Screen, press the NAVIGATION dial to access the Set Points Screen.
3. Press the LEFT SELECT (LIMITS) key.
4. Select the manual reset high limit (MRHL) by rotating the NAVIGATION dial counterclockwise, then press the NAVIGATION dial.
5. Decrease the set point of the MRHL to below the current outlet temperature (or to its minimum setting, whichever is higher) by turning the NAVIGATION dial counterclockwise.
6. Press the RIGHT SELECT [SAVE] key.
7. Press the RIGHT SELECT [HOME] key. The new parameter will upload to the control.
8. If the current outlet temperature is above the new MRHL set point, the MRHL will function causing boiler lockout. If this occurs, skip to Step 11.
9. If the current outlet temperature is below the new MRHL set point, locate the pinhole (SERVICE button) below the RESET button on the display board. Insert a thin probe (such as a paper clip) into the hole and press the button continuously for five (5) seconds to place the boiler into Service Mode. In Service Mode, the boiler will fire at ignition speed and will then modulate up to full fire.
10. Once the outlet temperature rises up to the MRHL set point, the MRHL will function, causing the boiler to shut down and lock out.
11. Repeat Steps 2, 3 and 4.
12. Set the MRHL to the appropriate set point by turning the NAVIGATION dial clockwise.
13. Repeat Steps 6 and 7.
14. Press the RESET button to clear the lockout.
15. If needed, press the RIGHT SELECT [STOP] key to exit Service Mode.

Low water cutoff protection

1. The SMART SYSTEM control module uses temperature sensing of both supply and return areas of the heat exchanger. If the flow rate is too low or the outlet temperature too high, the control module modulates and shuts the water heater down. This ensures water heater shutdown in the event of low water or low flow conditions.
2. Some codes and jurisdiction may accept these integral features of the control in lieu of requiring an additional limit control or low water cutoff. Consult local jurisdiction to determine. A low water cutoff is available from the factory (100208652).

11 Operating information

Cascade

When multiple water heaters are installed, they can be wired together in a cascade sequence. A maximum of eight water heaters can be controlled from a single control. In this application one water heater would be designated as the Leader control and all others would be designated as Member controls. The Leader control can be programmed to use Lead/Lag or Efficiency Optimization control methods.

Once the Leader water heater receives a call for heat from a tank sensor, BMS or Modbus, the control will determine what the set point will be. A fixed temperature set point can be programmed into the control. See page 60 of this manual to program the set point.

If the water temperature at the tank is less than the set point - differential, then the control will initiate a call for heat on the Cascade (see the Armor Water Heater Service Manual for an explanation of the differential). The Leader will energize the lead water heater on the Cascade. For a new startup this will be the Leader water heater.

Sequence of the cascade

To equalize the runtime of all water heaters on the Cascade, the firing sequence will automatically be changed at set intervals.

For the first 24 hours after initializing the Cascade, the sequence will be changed every hour. After that the sequence will be changed once every 24 hours. The switching on/off sequence will be as follows:

TIME	SWITCHING ON SEQUENCE
Start	L-M1-M2-M3-M4-M5-M6-M7
+ 1 hour	M1-M2-M3-M4-M5-M6-M7-L
+ 2 hours	M2-M3-M4-M5-M6-M7-L-M1

If a water heater locks out, it will automatically be given the lowest priority for the rest of that 24 hour period.

Night Setback operation with cascade

Night Setback operation of the water heaters within the Cascade is available. Programming of the Night Setback will be done through the Leader water heater. Refer to the Armor Water Heater Service manual for information regarding Night Setback.

Access modes

User

The user can adjust tank target temperatures by pressing the NAVIGATION dial when "↓SETPOINTS" is flashing at the bottom of the display. The date, time, and the temperature units can also be changed (see page 61).

Installer

Most parameters are available only to the installer, accessible by entering the installer password, see the Armor Water Heater Service Manual.

Saving parameters *(reference the Parameter Table in the Armor Water Heater Service Manual)*

NOTICE Please note that the brackets ([]) denote screen status.

To save parameters and exit programming:

Press the RIGHT SELECT [SAVE] key and then press the RIGHT SELECT [HOME] key.

To enter a parameter and continue programming:

Press the RIGHT SELECT [SAVE] key 1 time to return to the parameter listings; press again to return to the menu listings. Remember to press the RIGHT SELECT [HOME] key when finished programming in order to save the changes made.

See the Armor Water Heater Service Manual for a detailed description of parameters and access modes.

11 Operating information *(continued)*

Sequence of operation

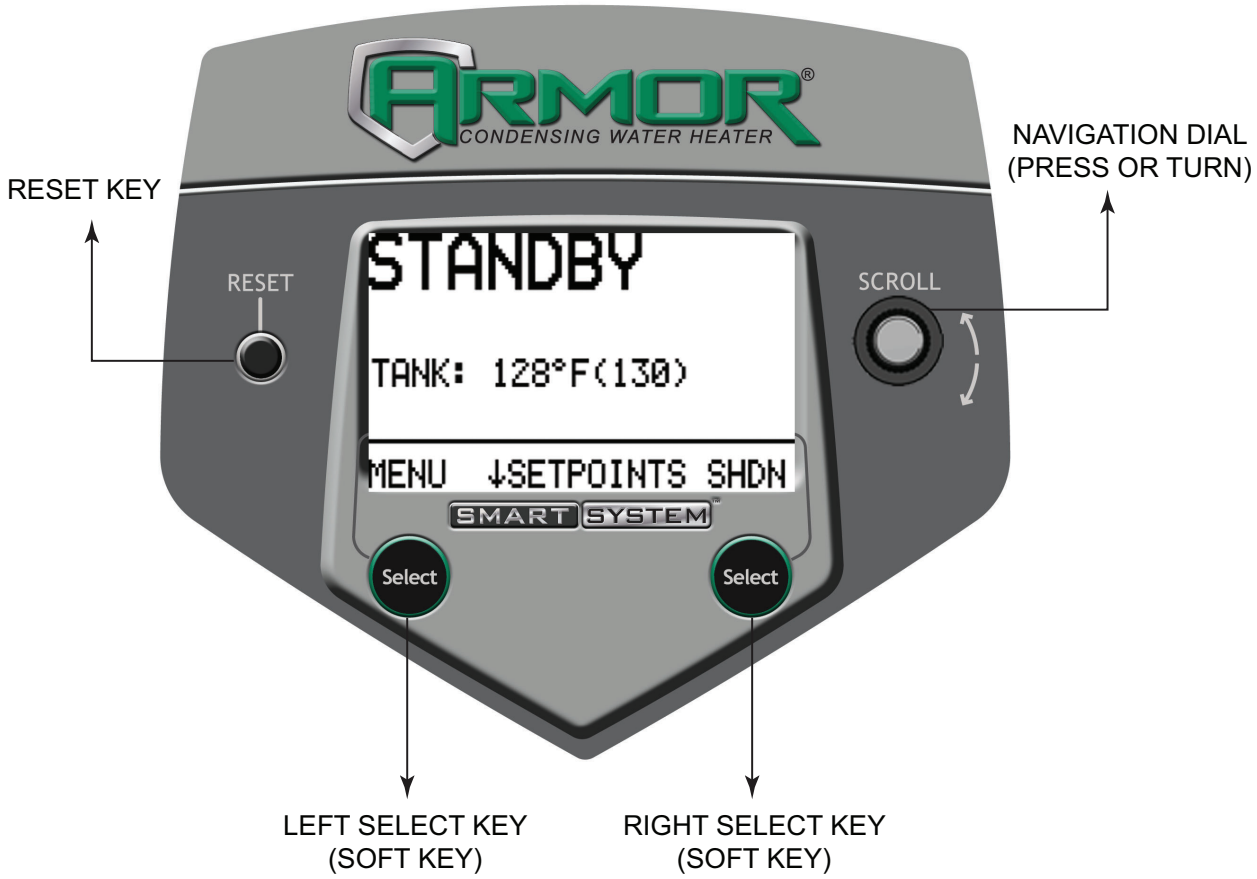
OPERATION	DISPLAY
1. The control will turn on the water heater pump (always ON except in Night Setback). The flow switch and/or LWCO must close.	START TANK: 119°F(125) MENU ⇩⇗SCREEN SHDN
2. The control turns on power to the louver relay. The louver proving switch, air pressure switch, and blocked drain switch must close.	START TANK: 119°F(125) MENU ⇩⇗SCREEN SHDN
3. The control starts the prepurge cycle.	PRE-PURGE TANK: 119°F(125) MENU ⇩⇗SCREEN SHDN
4. The control starts the trial for ignition by firing the spark electrode and opening the gas valve.	IGNITION TANK: 119°F(125) MENU ⇩⇗SCREEN SHDN
5. If flame is not detected after the sparking ends, the control will perform a postpurge, then start another prepurge cycle and try to light the burner again. On the 501 and larger models, the control will lock out if this second attempt also fails. On the 400 and smaller models, the control will perform a total of 4 attempts before locking out.	POST-PURGE TANK: 119°F(125) MENU ⇩⇗SCREEN SHDN
6. If flame is detected, it holds the firing rate steady for a few seconds to let the flame stabilize, then it begins to modulate the firing rate based on a set point or some other command (such as a 0-10V BMS signal).	42% TANK: 119°F(125) MENU ⇩⇗SCREEN SHDN
7. Once the call for heat is satisfied, the control will turn off the burner. The blower will continue to run during the postpurge.	POST-PURGE TANK: 128°F(125) MENU ⇩⇗SCREEN SHDN
8. The water heater pump will continue to run for its respective pump delay time before turning off. A 60 second anti-cycle period will start, which will delay any new call for heat until it times out.	BLOCKED ANTI-CYCLING TANK: 128°F(125) MENU ⇩⇗SCREEN SHDN
9. In Standby, ready to start a new cycle.	STANDBY TANK: 128°F(125) MENU ↓SETPOINT SHDN

11 Operating information

Armor water heater control module

Use the control panel (FIG. 11-1) to set temperatures, operating conditions, and monitor water heater operation.

Figure 11-1 *Control Panel*

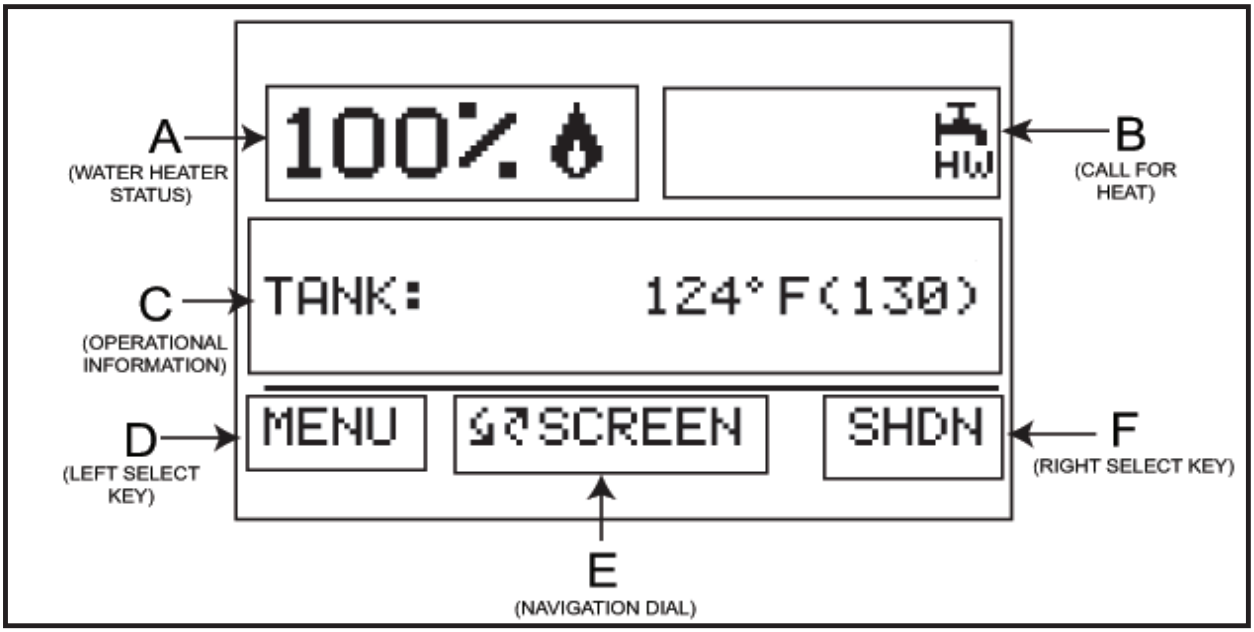


The information on the bottom of the display shows the functions of the two SELECT keys (on either corner), and the NAVIGATION dial (in the center):

MENU = Left SELECT Key
SETPOINTS = NAVIGATION Dial - Pressing Down
SHDN = Right SELECT Key

11 Operating information *(continued)*

Figure 11-2 *Status Display Screen*



Status Display Screens		
Section	**Display**	**Description**
A (Water heater Status Bar)	**STANDBY**	The unit has not received a call for heat from a remote thermostat nor has it received a call for heat from a DHW thermostat.
	START	The unit has begun a burn cycle and is checking all safety circuits.
	PREPURGE	The unit has initiated a prepurge period on a call for heat.
	IGNITION	The unit has begun a spark period to ignite the main burner.
	%	The unit has fired and is running at the displayed percentage.
	POSTPURGE	The call for heat has been satisfied and the unit runs the fan for an additional postpurge period to clear the combustion chamber and vent system of residual flue products.
	SHUTDOWN	The unit has been placed in the OFF position.
	SETPOINT MET	The controlled temperature has exceeded its set point and its offset.
	BLOCKED	The unit has detected a condition that has temporarily interrupted the current call for heat.
B (Call for Heat Indicators)	HW	The tank thermostat or sensor has a call for heat.
	V	The unit is being controlled by a 0 - 10V BMS signal.
	C	The member unit is supplying heat while in Cascade Mode.

11 Operating information

Status Display Screens *(cont'd)*		
Section	**Display**	**Description**
C (Operational Information)	**TANK:**	The temperature read by the tank sensor (if connected).
	INLET TEMP:	The temperature read at the inlet to the heat exchanger.
	OUTLET TEMP:	The temperature read at the outlet of the heat exchanger.
	DELTA T:	The temperature difference between the inlet and the outlet of the heat exchanger.
	FLUE TEMP:	The temperature read by the flue sensor.
	FLAME CURRENT:	The current measured by the flame sense circuit.
	FAN SPEED:	The speed of the combustion blower.
	SYSTEM PUMP:	The status of the recirculation pump output.
	DHW PUMP:	The status of the DHW pump output.
	BMS VOLTAGE:	The voltage received from a BMS system.
	BLR PUMP OUTPUT:	The speed signal sent to a variable speed water heater pump in percent.
	RATE OUTPUT:	A 0 - 10V signal indicating the firing rate of the water heater.
	DHW RUN HOURS:	The total hours of operation in the DHW Mode.
	DHW CYCLES:	The total burner cycles in the DHW Mode.
	LAST 10 FAULTS NO:	The last 10 lockouts.
D (LEFT SELECT key function)	**MENU**	Press and hold the LEFT SELECT key for 5 seconds to enter the Menu Screen.
	EXIT	Press the LEFT SELECT key to exit the current screen or setting.
	YES	Press the LEFT SELECT key to confirm that the water heater needs to shutdown.
	LIMITS	Press the LEFT SELECT key to enter the screen that allows you to adjust the limit settings.
	HOME	Press the LEFT SELECT key to return to the Status Screen and upload parameter changes.

11 Operating information *(continued)*

Status Display Screens *(cont'd)*		
Section	**Display**	**Description**
E (NAVIGATION Dial Function)	↻?SCREEN	Turning the NAVIGATION dial will select the next or previous Status Screen.
	↓NEXT	Pressing the NAVIGATION dial will show the next fault, NSB (Night Setback) trigger, or ramp delay setting.
	↓SELECT	Pressing the NAVIGATION dial will select the setting indicated by the cursor.
	↓SETPOINTS	Pressing the NAVIGATION dial will display the Set Points Screen.
	↻? SCROLL	Turning the NAVIGATION dial will move the cursor up or down.
	↻? ADJUST	Turning the NAVIGATION dial will increase or decrease the current setting.
F (RIGHT SELECT key function)	**SHDN**	Press the RIGHT SELECT key to turn the water heater OFF.
	ON	Press the RIGHT SELECT key to turn the water heater ON.
	NO	Press the RIGHT SELECT key to cancel the shutdown operation.
	SAVE	Press the RIGHT SELECT key to save the current change.
	HOME	Press the RIGHT SELECT key to return to the Status Screen and upload parameter changes.

12 Maintenance

Maintenance and annual startup

Table 12A *Service and Maintenance Schedules*

Service technician (see the following pages for instructions)	
ANNUAL START-UP	**General:** • Address reported problems • Inspect interior; clean and vacuum if necessary; • Clean condensate trap and fill with fresh water • Check for leaks (water, gas, flue, condensate) • Verify flue and air lines in good condition and sealed tight • Check system water pressure/system piping/expansion tank • Check control settings • Check ignition and flame sense electrodes (sand off any deposits; clean and reposition) • Check wiring and connections • Perform start-up checkout and performance verification per Section 10 of this manual. • Flame inspection (stable, uniform) • Flame signal (at least 10 microamps at high fire) • Clean the heat exchanger if flue temperature is more than 54°F above return water temperature. • Check Delta T (Temperature Rise) **If combustion or performance indicate need:** • Clean heat exchanger • Remove and clean burner using compressed air only • Clean the blower wheel

Owner maintenance	
Daily	• Check water heater area
Monthly	• Check vent piping • Check air piping • Check air and vent termination screens • Check relief valve • Check condensate drain system • Check automatic air vents • Check Delta T (Temperature Rise) • Remove debris from Y-strainer per manufacturer's instructions • Check building recirculation filter (if filter required)
Every 6 months	• Check water heater piping (gas and water) for leaks • Operate relief valve • Check water chemistry

12 Maintenance *(continued)*

⚠WARNING Follow the service and maintenance procedures given throughout this manual and in component literature shipped with the water heater. Failure to perform the service and maintenance could result in damage to the water heater or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.

⚠WARNING The water heater should be inspected annually only by a qualified service technician. In addition, the maintenance and care of the water heater designated in Table 12A and explained on the following pages must be performed to assure maximum water heater efficiency and reliability. Failure to service and maintain the water heater and system could result in equipment failure.

⚠WARNING Electrical shock hazard – Turn off power to the water heater before any service operation on the water heater except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

Address reported problems

1. Inspect any problems reported by the owner and correct before proceeding.

Inspect water heater area

1. Verify that water heater area is free of any combustible materials, gasoline and other flammable vapors and liquids.
2. Verify that air intake area is free of any of the contaminants listed in Section 1 - Determine Water Heater Location. If any of these are present in the water heater intake air vicinity, they must be removed. If they cannot be removed, reinstall the air and vent lines per this manual and the Armor Water Heater Service Manual.

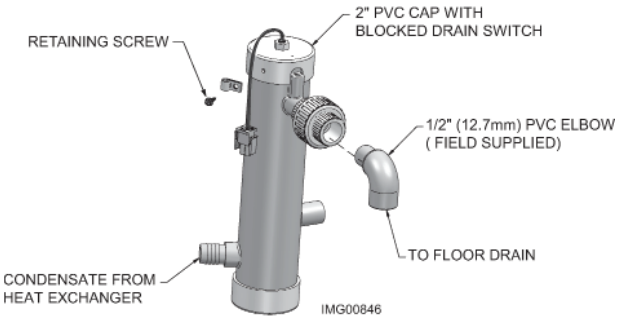
Inspect water heater interior

1. Remove the front access cover and inspect the interior of the water heater.
2. Vacuum any sediment from inside the water heater and components. Remove any obstructions.

Clean condensate trap

1. Inspect the condensate drain line, condensate PVC fittings, and condensate trap.
2. Remove the PVC cap retaining screw from the PVC cap (FIG. 12-1).
3. Remove the 2 inch PVC cap with the switch located at the top of the trap (FIG. 12-1).
4. Remove any sediment in the trap.
5. Fill with fresh water until the water begins to pour out of the drain.
6. Replace the cap. Press the cap onto the trap until the cap makes contact with the drain.
7. Replace the retaining screw.

Figure 12-1 *Condensate Trap*



⚠WARNING The condensate trap must be filled with water during all times of water heater operation to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe personal injury or death.

Check all piping for leaks

⚠WARNING Eliminate all system or water heater leaks. Leaking water may cause severe property damage.

1. Inspect all water and gas piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check gas line using the procedure found in Section 7 - Gas Connections.

Flue vent system and air piping

1. Visually inspect the entire flue gas venting system and air piping for blockage, deterioration or leakage. Repair any joints that show signs of leakage. Verify that air inlet pipe is connected and properly sealed.
2. Verify that water heater vent discharge and air intake are clean and free of obstructions.

12 Maintenance

⚠WARNING Failure to inspect for the above conditions and have them repaired can result in severe personal injury or death.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 PSI).
3. Watch the system pressure as the water heater heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

Check expansion tank

1. Expansion tanks provide space for water to move in and out as the heating system water expands due to temperature increase or contracts as the water cools. Tanks may be open, closed or diaphragm or bladder type. See Section 6 - System Piping for suggested best location of expansion tanks and air eliminators.

Check water heater relief valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read Section 6 - System Piping before proceeding further.

⚠WARNING Safety relief valves should be re-inspected AT LEAST ONCE EVERY THREE YEARS, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the water heater relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

⚠WARNING Following installation, the valve lever must be operated AT LEAST ONCE A YEAR to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down the water heater until a new relief valve has been installed.

2. After following the above warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

Inspect ignition and flame sense electrodes

1. Remove the ignition and flame sense electrodes from the water heater heat exchanger access cover.
2. Remove any deposits accumulated on the ignition/flame sense electrode using sandpaper. If the electrodes cannot be cleaned satisfactorily, replace with new ones.
3. Replace ignition/flame sense electrode, making sure gasket is in good condition and correctly positioned.

Check ignition ground wiring

1. Inspect water heater ground wire from the heat exchanger access cover to ground terminal strip.
2. Verify all wiring is in good condition and securely attached.
3. Check ground continuity of wiring using continuity meter.
4. Replace ground wires if ground continuity is not satisfactory.

Check all water heater wiring

1. Inspect all water heater wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Set the SMART SYSTEM control module display to Parameter Mode and check all settings. See Section 1 of the Armor Service Manual. Adjust settings if necessary. See Section 1 of the Armor Service Manual for adjustment procedures.
2. Check settings of external limit controls (if any) and adjust if necessary.

12 Maintenance *(continued)*

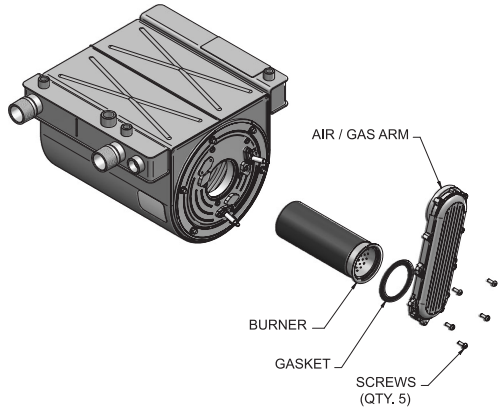
Perform start-up and checks

1. Start water heater and perform checks and tests specified in Section 10 - Start-up.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.

Check burner flame

1. Inspect flame through observation window.
2. If the flame is unsatisfactory at either high fire or low fire, turn off water heater and allow water heater to cool down. Remove the burner and clean it thoroughly using a vacuum cleaner or compressed air. Do not use compressed air to clean burner if performed inside a building.
3. Remove the burner, reference FIG. 12-2 below.
4. When replacing the burner, ensure gasket is in good condition and positioned correctly (FIG. 12-2).

***Figure 12-2** Burner Assembly*



Check flame signal

1. At high fire the flame signal shown on the display should be at least 10 microamps.
2. A lower flame signal may indicate a fouled or damaged flame sense electrode. If cleaning the flame sense electrode does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the flame sense electrode.
3. See Section 3 - Troubleshooting in the Armor Service Manual for other procedures to deal with low flame signal.

Review with owner

1. Emphasize the need to perform the maintenance schedule specified in this manual.
2. Remind the owner of the need to call a licensed contractor should the water heater or system exhibit any unusual behavior.
3. Remind the owner to follow the proper shutdown procedure and to schedule an annual start-up.

Cleaning heat exchanger

For recommended materials; including brush, appropriate extension(s), refractory cover, and detailed instructions see Table 12B - Heat Exchanger Cleaning Kits.

1. Shut down water heater:
   - Follow the "To Turn Off Gas to Appliance" instructions for the water heater in Section 10 - Startup.
   - Do not drain the water heater unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain.
2. Allow time for the water heater to cool to room temperature if it has been firing.
3. Remove the nuts securing the heat exchanger access cover to the heat exchanger and set aside.
4. Remove the heat exchanger access cover, burner, and gas/air arm assembly.

⚠WARNING The water heater contains ceramic fiber materials. Use care when handling these materials per instructions in the Service Manual. Failure to comply could result in severe personal injury.

5. Remove the condensate hose from the heat exchanger end. Connect a field supplied 3/4" diameter hose to a drain pan. Using field supplied means, cover the refractory in the back of the combustion chamber of the heat exchanger.
6. Use a vacuum cleaner to remove any accumulation on the water heater heating surfaces. Do not use any solvent.
7. Brush the heat exchanger while dry using a nylon bristle brush. **Caution:** DO NOT use a metal brush. Re-vacuum the heat exchanger.
8. Finish cleaning using a clean cloth dampened with warm water. Rinse out debris with a low pressure water supply.
9. Allow the heat exchanger to thoroughly dry.
10. Remove the field supplied rear refractory cover from the back of the combustion chamber of the heat exchanger and reassemble.
11. Close isolation valves on piping to isolate water heater from system. Attach a hose to the water heater drain and flush water heater thoroughly with clean water by using purging valves to allow water to flow through the water makeup line to the water heater.
12. Perform start-up and check-out procedures in the Check Flame and Combustion - Section 10 - Startup on pages 57 and 60 of this manual.
13. Replace the access cover and restore water heater to operation.

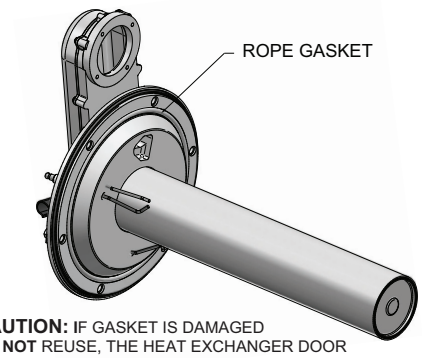
12 Maintenance

Table 12B Heat Exchanger Cleaning Kits

Model	Kit Number	Part Number	Component Description
151 - 400	100157627	100208804	Rear Refractory Cover
		100208309*	Nylon 4" Wheel Brush*
		100162566	3mm Allen Wrench
		100208311	1/4" x 24" Drill Extension
501 - 801	100157628	100208804	Rear Refractory Cover
		100208309*	Nylon 4" Wheel Brush*
		100208310	1/4" x 12" Drill Extension
		100208311	1/4" x 24" Drill Extension

⚠ CAUTION * Do NOT use a metal brush. Only use the kit provided brush or an equivalent replacement nylon brush.

Figure 12-3 Rope Gasket - Heat Exchanger Door



CAUTION: IF GASKET IS DAMAGED **DO NOT** REUSE, THE HEAT EXCHANGER DOOR MUST BE REPLACED.

NOTICE Rope gasket is intended for sealing combustion (see FIG. 12-3). If gasket is damaged DO NOT reuse, the heat exchanger door must be replaced. Consult factory for replacement heat exchanger door (kit 100173794 and 100173799).

Check Delta T

1. Check Delta T. Reference Section 6 - *System Piping* on page 41 for more information regarding Delta T.

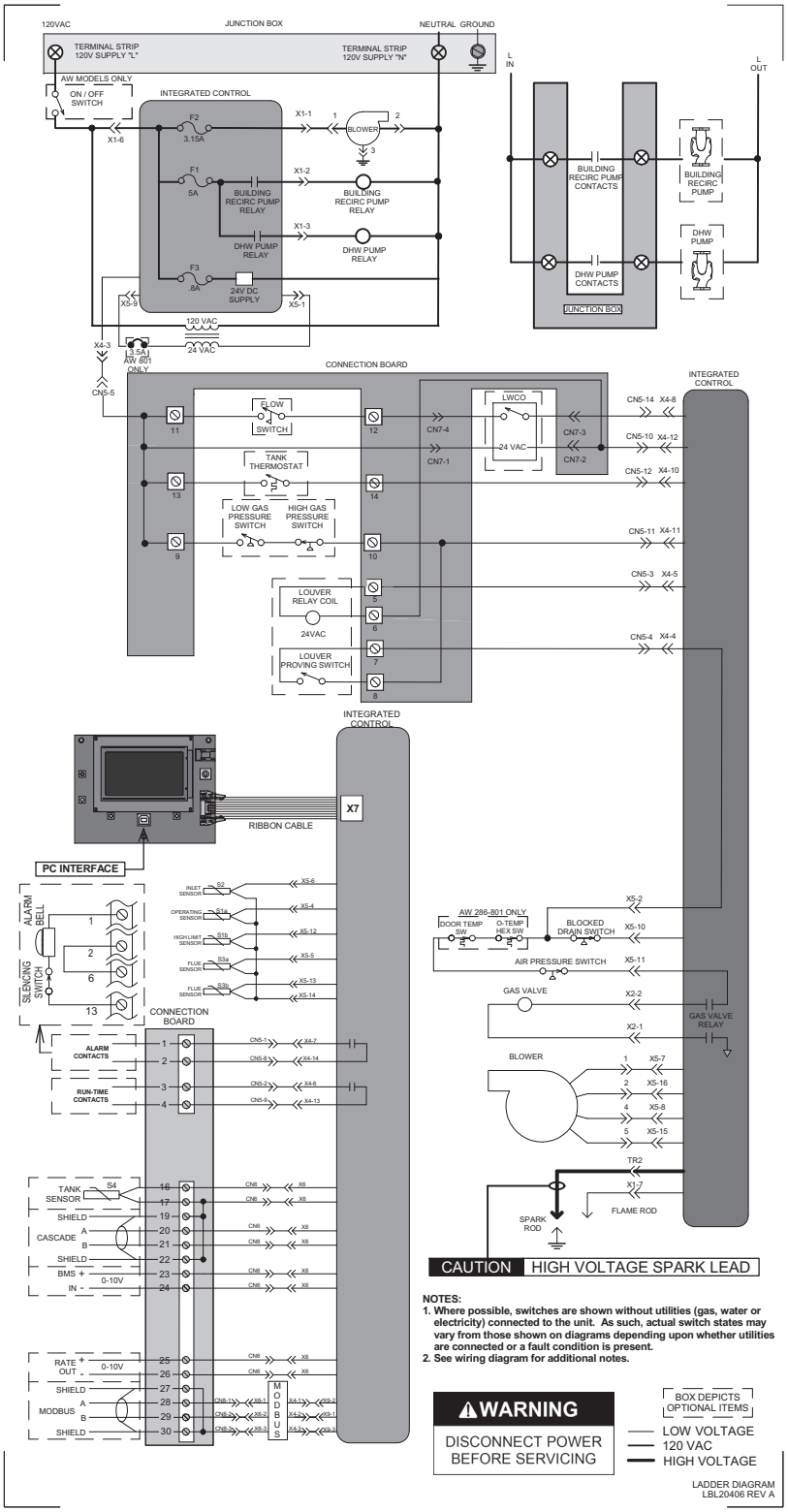
Oiled bearing circulators

1. The circulator shipped with the Armor water heater is water-lubricated. No oiling is required.

2. Check other circulators in the system. Oil any circulators requiring oil, following circulator manufacturer's instructions. Over-oiling will damage the circulator.

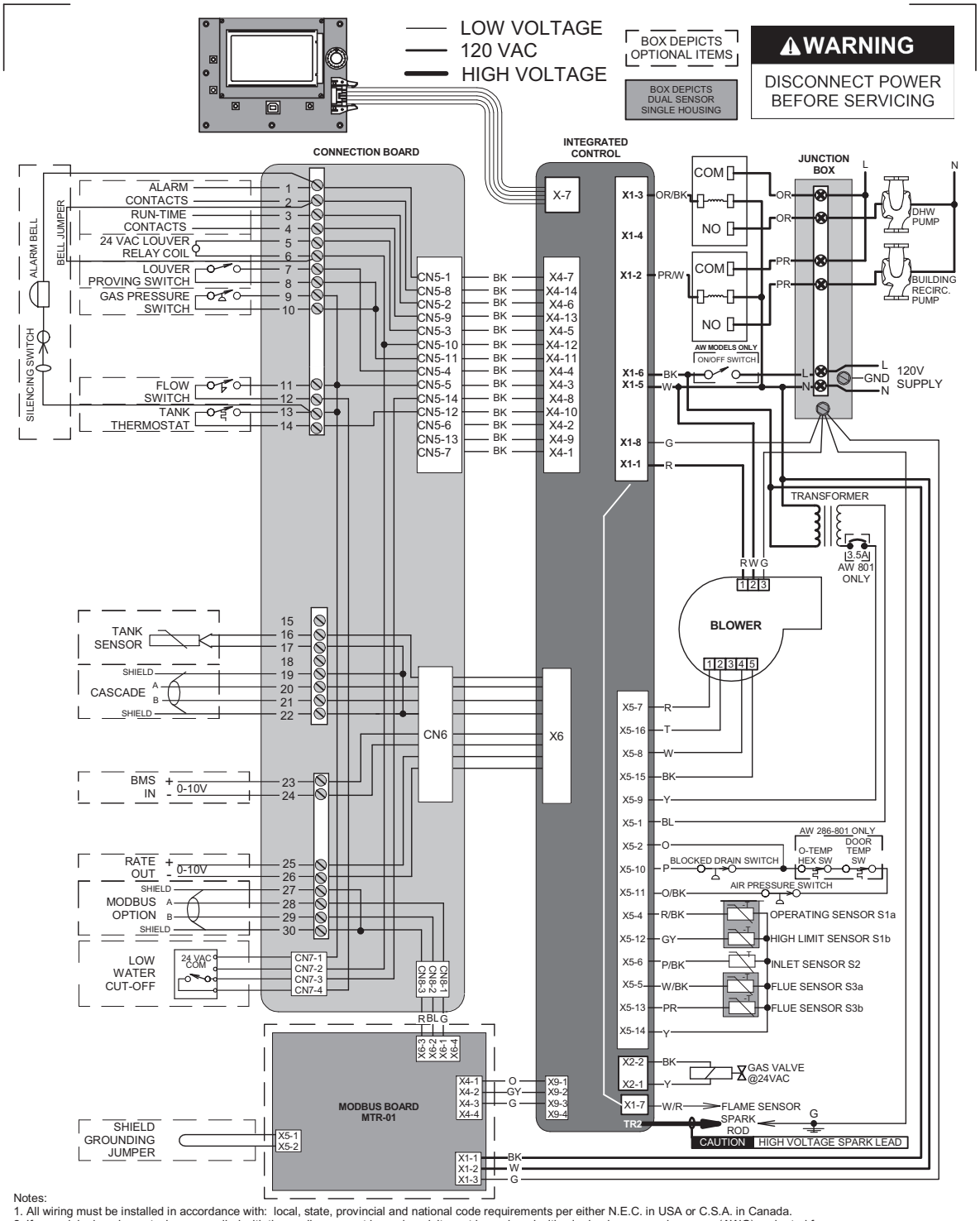
13 Diagrams

Figure 13-1 *Ladder Diagram*



13 Diagrams

Figure 13-2 *Wiring Diagram*



Notes:
1. All wiring must be installed in accordance with: local, state, provincial and national code requirements per either N.E.C. in USA or C.S.A. in Canada.
2. If any original equipment wire as supplied with the appliance must be replaced, it must be replaced with wire having same wire gauge (AWG) and rated for a minimum of 105℃. Exceptions: Replacement high voltage spark lead and ribbon cables must be purchased from the factory. Use of a non-approved spark lead or ribbon cables can lead to operational problems which could result in non-repairable damage to the integrated controller or other components.
3. Actual connector block locations may vary from those shown on diagrams. Refer to actual components for proper connector block locations when using diagrams to troubleshoot unit.

WIRING DIAGRAM
LBL20407 REV A

Notes

Notes

Notes

Revision Notes:

Revision A (ECO #C06238) initial release.

Revision B (ECO #C07442) new layout in InDesign, piping diagram on page 43 (ECR #R03671), and edits made to the Ratings Page (page 7).

Revision C (ECO #C07575) changes made (mixing valves) to the piping diagrams on pages 39 - 43, changes made to the gas supply piping images on page 44 (ECR R03740), the addition of the rope gasket notice on page 71 (ECR R03940), change water pipe clearances from 1" to 1/4" (ECR R04077), and changes made to Table 3A on page 19.

Revision D (ECO #C08817) reflects the addition of the O-temp switch, additional information added to the humidity warning on page 8, and changes made to FIG. 8-1 on page 48.

Revision E (ECO #C09197) reflects updates made to the SMART SYSTEM control (ECR #R04523).

Revision F (ECO #C09803) reflects the addition of the new Polypropylene Vent material section, rearranging the venting section, and the addition of the AHRI and ASME logos (R05009).

Revision G (ECO #C10143) reflects updates made to the ignition timing information.

Revision H (ECO #C12382) reflects the addition of the CSA Low Lead Content logo.

Revision I (ECO #C12692) reflects changes made to the wiring and ladder diagrams to match the diagrams used on the Armor Wall Mount (pages 72 and 73).

Revision J (ECO #C11814) reflects the addition of Metal Fab and Security Chimney as approved suppliers along with updates made to the polypropylene de-rate amounts.

Revision K (ECO #C14411) reflects the removal of the page number reference on page 16, the addition of the corrosive contaminant warning on pages 3 and 8 (R06313), changes made to Table 7A - Gas Piping Chart on page 46 (R6621), condensate trap changes (R06594), updates made to the flex piping information (R06464) on page 22 and a note that the 286 model can be vented using 3" diameter pipe up to a maximum of 60 equivalent feet, pages 7 and 18.

Revision L (ECO #C14713) reflects high altitude updates.

Revision M (ECO #C15251) reflects the addition of the burner door temperature switch updates (R6322).

Revision N (ECO C16461) reflects the update of piping diagrams (check valve and pump location) on pages 39 through 43.

Revision O (ECO #C16894) reflects the removal of temperature and pressure gauge information from the page 67 (ECR R07715), the update of water content in the Ratings table on page 7 (ECR R07744) , the regulation of pressure drop information on pages 45 and 46 and the addition of Grundfos pumps to Table 6C on page 38.

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Revision R (Change #500000695) reflects the addition of ICC venting options on page 23 (R06799), modify / correct Table 3D on page 21 (R07819) and the addition of the California contaminant warning on page 3 (R07228).

Revision T (Change #500000927) reflects the update of FIG. 6-8 on page 43 to increase pipe size depiction.

Revision U (PCP# 3000002352 / CN# 500002601) reflects an update to the venting materials in Table 31 on page 23.

Revision V (PCP# 3000003998 / CN# 500004062) reflects a change to the Duravent Polypro Adapter number in Table 3F on page 22. SAP numbers have been updated.

Revision W (PCP# 3000004287 / CN# 500004864) reflects a change to the numbers of the Polypropylene Adapters for models 151-200 and 400-601 in Table 3F on page 22. Figure 3-11 has also been updated.

Revision X (PCP# 3000005143 / CN# 500006666) reflects the addition of new venting category information on pages 26 through 28.

Revision Y (PCP# 3000004438 / CN# 500005574) reflects an update to the flue temperatures on page 62.

Revision AA (PCP# 3000006133 / CN# 500007549) reflects the change from PVC-DMV to PVC-DWV vent fitting in Table 3D on page 21.

Revision AB (PCP# 3000008814 / CN# 500008824) reflects changes in the water chemistry information on pages 41-46, 56, and 70.

Revision AC (PCP #3000010561 / CN #500010149) reflects an update to the vent increase notice on page 18.

Revision AD (PCP #3000010783 / CN #500010520) reflects an update to the low water flow requirement information on pages 41 and 62.

Revision AE (PCP #3000010953 / CN #500010523) reflects an update to the pump information in Table 6C on page 41.

Revision AF (PCP #3000027357 / CN #500017568) reflects an update to table 6C on page 41.

Revision AG (PCP #3000028700 / CN #500018325) reflects the addition of the optional field supplied contactor on page 51.

Revision AH (PCP #3000030779 / CN #500020179) reflects an update to the piping diagrams, Table 10A, Table 12A, and the addition of the building recirculation filter on page 41.

Revision AJ (PCP #3000031681 / CN #500020790) reflects an update to the ratings table on page 7.

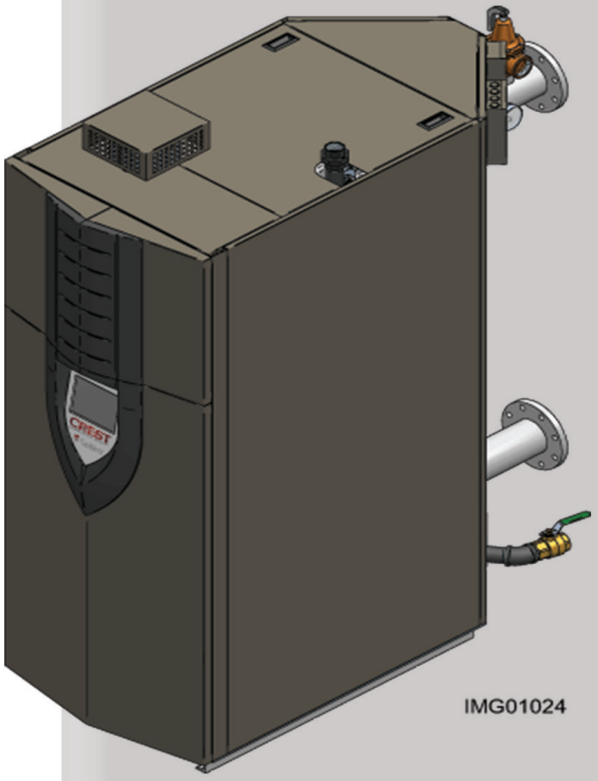
Revision AK (PCP #3000038559 / CN #500026649) reflects an update to the water heater sensor material number.

AWII-I-O_MM #100160827_DIR #2000000330_Rev AK
03/20

100208043_2000004587_Rev AE

CREST®
CONDENSING BOILER

Installation & Operation Manual
Models: 751 - 6001
Series: 100 - 101 & 110 - 111



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⚠WARNING This manual must only be used by a qualified heating installer / service technician. Read all instructions, including this manual and the Crest Service Manual, before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

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HIGH EFFICIENCY BOILERS & WATER HEATERS

Contents

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

DANGER DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

Please read before proceeding

⚠ WARNING **Installer** – Read all instructions, including this manual and the Crest Service Manual, before installing. Perform steps in the order given.

User – This manual is for use only by a qualified heating installer/ service technician. Refer to the User's Information Manual for your reference.

Have this boiler serviced/inspected by a qualified service technician, at least annually.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE When calling or writing about the boiler – Please have the boiler model and serial number from the boiler rating plate.

Consider piping and installation when determining boiler location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.

⚠ WARNING Failure to adhere to the guidelines on this page can result in severe personal injury, death, or substantial property damage.

⚠ WARNING If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

This appliance MUST NOT be installed in any location where gasoline or flammable vapors are likely to be present.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

⚠ WARNING DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 9). Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING The California Safe Drinking Water and Toxic Enforcement Act requires the Governor of California to publish a list of substances known to the State of California to cause cancer, birth defects, or other reproductive harm, and requires businesses to warn of potential exposure to such substances.

This product contains a chemical known to the State of California to cause cancer, birth defects, or other reproductive harm. This boiler can cause low level exposure to some of the substances listed in the Act.

When servicing boiler –

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow boiler to cool before performing maintenance.

Boiler operation –

- Do not block flow of combustion or ventilation air to the boiler.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this boiler if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

Boiler water –

- Thoroughly flush the system to remove debris. Use an approved pre-commissioning cleaner (see Start-Up Section), without the boiler connected, to clean the system and remove sediment. The high-efficiency heat exchanger can be damaged by build-up or corrosion due to sediment.

  NOTE: Cleaners are designed for either new systems or pre-existing systems. Choose accordingly.

Freeze protection fluids –

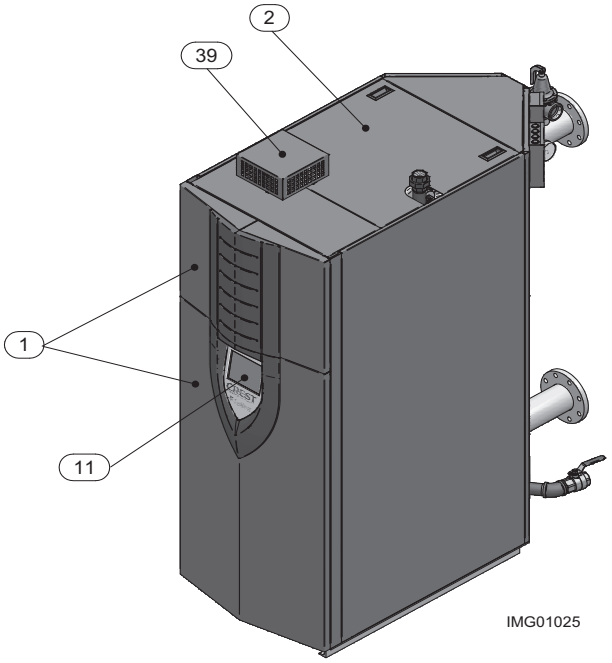
- NEVER use automotive antifreeze. Use only inhibited propylene glycol solutions, which are specifically formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems.

The Crest - How it works...

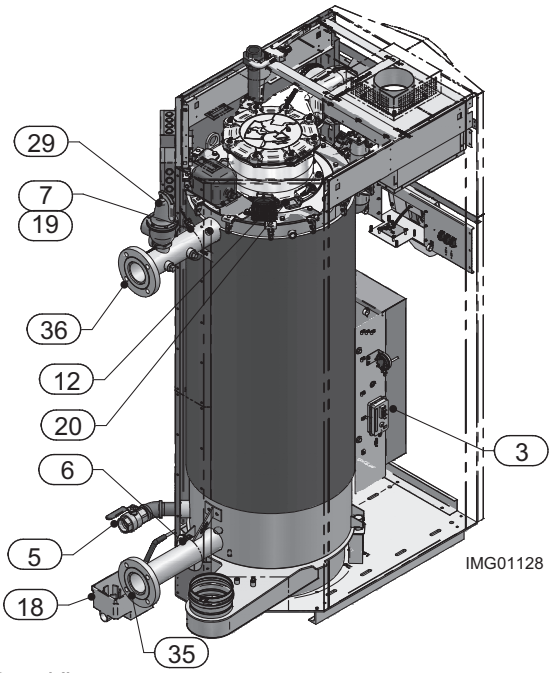
1. **Front access panels**
   Provides access to the controls compartment.
2. **Top access panel**
   Provides access to the burner compartment.
3. **Air pressure switch**
   The air pressure switch detects blocked flue/vent conditions.
4. **Blower**
   The blower pulls in air and gas through the venturi (item 34). Air and gas mix inside the blower and is pushed into the burner, where they burn inside the combustion chamber.
5. **Boiler drain connection**
   Location from which the heat exchanger can be drained.
6. **Boiler inlet temperature sensor**
   The boiler inlet temperature sensor monitors system return water temperature. If selected as the controlling sensor, the control module will adjust the boiler firing rate so the inlet temperature matches the set point.
7. **Boiler outlet temperature sensor**
   The boiler outlet temperature sensor monitors boiler outlet water temperature. If selected as the controlling sensor, the control module will adjust the boiler firing rate so the outlet temperature matches the set point.
8. **Burner (not shown)**
   Single chamber design with a stress free metal fiber outer mesh and durable stainless steel structure. Provides firing rates up to 15:1 turndown (Model 751), 20:1 turndown (Models 1001 - 1251 and 2501 - 3501), 25:1 turndown (Models 1501 - 2001), 12:1 turndown (Model 4001) and 10:1 turndown (Models 5001 - 6001).
9. **Condensate drain connection**
   The condensate drain connection provides a connection point to install a condensate drain line using flexible hose provided.
10. **Control module (on control panel assembly)**
    The control module responds to internal and external signals and controls the blower, gas valves, and pump(s), depending on the application, to meet the heating demand.
11. **Electronic display**
    Digital controls with SMART TOUCH screen technology, full color display, and an 8" user interface screen.
12. **Flame inspection window**
    Two large high temperature quartz observation windows provide views of the burner surface during firing.
13. **Dual flame sensors (not shown)**
    Two flame sensors are provided to monitor the main burner and transition flame.
14. **Flue temperature sensor**
    The flue sensor monitors flue gas temperature. The control module will modulate or shut the boiler down if the flue gas temperature gets too high.
15. **Gas connection pipe**
    The gas connection pipe is a threaded black iron pipe connection (see Gas Connections Section for specific model pipe size requirements). This pipe should be connected to the incoming gas supply to deliver gas to the boiler.
16. **Gas shutoff valve (inside unit)**
    The manual gas shutoff valve is used to isolate the boiler gas train from the gas supply.
17. **Gas valves**
    The gas valves sense the negative pressure created by the blower, allowing gas to flow only if the gas valves are powered and combustion air is flowing.
18. **Condensate trap**
    The condensate trap is sized for a 1" PVC outlet connection pipe.
19. **High limit devices (primary and backup)**
    The high limit devices are used to monitor the outlet water temperature - if either device senses the water temperature exceeding the predetermined setting, the boiler will shut down.
20. **Ignition electrode**
    An electrical spark across the electrodes will ignite the burner.
21. **Line voltage junction box**
    The line voltage junction box contains the connection points for the line voltage power to the boiler (and pumps if used).
22. **Line voltage wiring connections (knockouts)**
    Conduit connection points for the high voltage junction box.
23. **Low gas pressure switch**
    Monitors gas supply pressure to the boiler and shuts the boiler down in the event a low gas pressure condition occurs.
24. **High gas pressure switch**
    Monitors gas supply pressure to the boiler and shuts the boiler down in the event a high gas pressure condition occurs.
25. **Low voltage connection board(s)**
    Connection boards used to connect external low voltage devices.
26. **Low voltage wiring connections (knockouts)**
    Conduit connection points for the low voltage connection boards.
27. **Low water cutoff probe (LWCO) (not shown)**
    Ensures adequate water is supplied to the boiler. In the event of inadequate water levels, the boiler will shut down.
28. **Power switch**
    The On/Off power switch provides the ability to turn line voltage power to the boiler on and off.
29. **Relief valve**
    The safety relief valve protects the heat exchanger from an over pressure condition. The boiler comes with a 50 PSI relief valve as standard equipment. Optional settings are available.
30. **Reset switch**
    Reset switch for the low water cutoff. Hold the switch for 10 seconds to reset.
31. **Test switch**
    The test switch permits manual triggering of the LWCO safety circuit to test the contacts and evaluate the integrity of the circuit. Hold the switch for 10 seconds to test.
32. **Firetube heat exchanger**
    High grade stainless steel WAVE^{TM} firetube design that extracts heat from flue gases and transfers it directly into boiler water.
33. **Temperature and pressure gauge**
    Monitors the outlet temperature of the boiler as well as the system water pressure.
34. **Venturi**
    The venturi controls air and gas flow into the burner.
35. **Water inlet**
    An ANSI flange connects the return water from the system to the heat exchanger.
36. **Water outlet**
    An ANSI flange connects the hot water supply from the boiler to the system.
37. **Ignition transformer**
    The transformer provides voltage to the ignition electrode (item 20).
38. **Air arm temperature sensor (not shown)**
    Monitors fuel-air delivery temperature to the burner.
39. **Air inlet cover (shipped loose)**
    Used with room air for combustion and to prevent debris from entering the boiler.
40. **Fuses**
    A low resistance resistor that acts as a sacrificial device to provide over current protection, of either the load or source circuit.
41. **Air metering valve**
    The air metering valve is used to control the amount of air used when firing.
42. **Air metering valve air pressure switch**
    The air metering valve air pressure switch is used to ensure the air metering valve is open when firing gas valve 2.
43. **Proof of closure valve (not shown)**
    An additional safety shutoff valve with proof of closure contacts is used on the Crest 6.0 model **only**.
44. **Combustion measurement port**
    Access point for combustion analyzer probe.

The Crest - How it works... *(continued)*

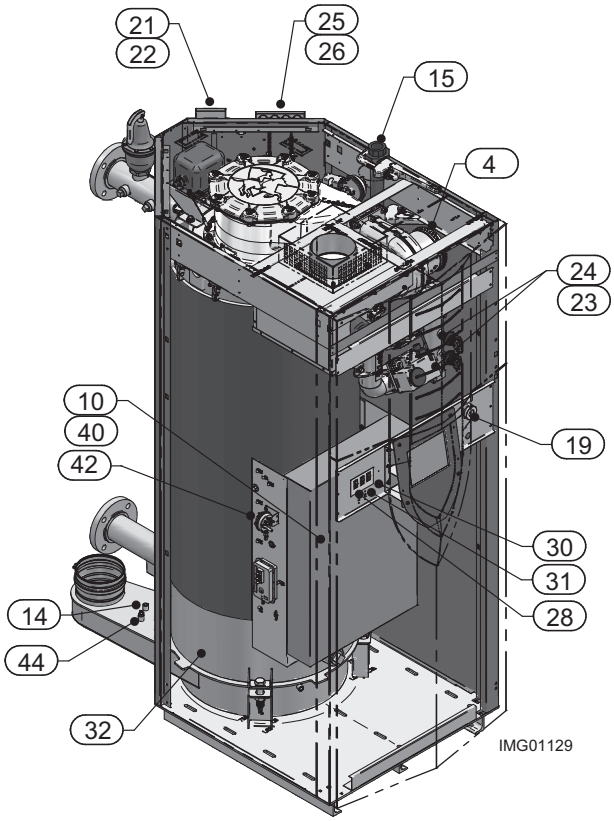
NOTICE FBN1000 Series 100 model shown for illustration purposes only.



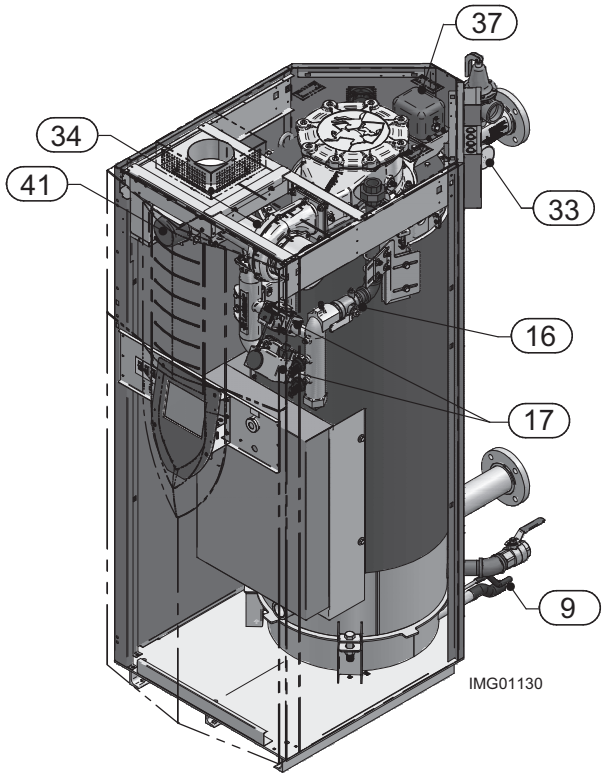
Front View



Rear View



Left Side (inside unit)



Right Side (inside unit)

Ratings

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Crest AHRI Rating

Model Number Note: Change "N" to "L" for L.P. gas models.	Input MBH (Notes 4 - 6)		Gross Output MBH (Note 1)	Net AHRI Ratings Water, MBH (Note 2)
	Min	Max		
FB(N,L)0751	50	750	722	626
FB(N,L)1001	50	999	961	834
FB(N,L)1251	62.5	1250	1203	1043
FB(N,L)1501	60	1500	1443	1252
FB(N,L)1751	70	1750	1684	1461
FB(N,L)2001	80	1999	1923	1699
FB(N,L)2501	125	2500	2400	2087
FB(N,L)3001	150	3000	2883	2507
FB(N,L)3501	175	3500	3364	2925
FB(N,L)4001	333.3	3999	3843	3342
FB(N,L)5001	499.9	4999	4804	4177
FB(N,L)6001	600	6000	5766	5014

Other Specifications

Appliance Water Content Gallons	Pipe Size Outlet	Pipe Size Inlet	Gas Inlet Size	Air Size	Vent Size (Note 3)	Weight w/Water (lbs.)
73	3"	3"	1 1/4"	6"	6"	1768
77	3"	3"	1 1/4"	6"	6"	1838
87	3"	3"	1 1/2"	6"	8"	1975
94	4"	4"	1 1/2"	8"	8"	2307
106	4"	4"	1 1/2"	8"	8"	2458
111	4"	4"	1 1/2"	8"	8"	2570
157	4"	4"	2"	8"	9"	3600
156	4"	4"	2"	10"	10"	3900
202	4"	4"	2"	10"	10"	4600
201	4"	4"	2 1/2"	12"	12"	5200
254	6"	6"	2 1/2"	14"	14"	5900
304	6"	6"	3"	14"	14"	6900

NOTICE Maximum allowed working pressure is located on the rating plate.

Notes:

1. The ratings are based on standard test procedures prescribed by the United States Department of Energy.
2. Net AHRI ratings are based on net installed radiation of sufficient quantity for the requirements of the building and nothing need be added for normal piping and pickup. Ratings are based on a piping and pickup allowance of 1.15.
3. Crest boilers require special gas venting. Use only the vent materials and methods specified in the Crest Installation and Operation Manual.
4. Standard Crest boilers are equipped to operate from sea level to 4,500 feet **only**. The boiler will de-rate by 1.4% for each 1,000 feet above sea level up to 4,500 feet.
5. High altitude Crest Models are equipped to operate from 3,000 to 12,000 feet **only**. The boiler will not de-rate up to 5,500 feet and will de-rate by 1.6% for each 1,000 feet above 5,500 feet. The operation given in this manual remains the same as the standard boilers. A high altitude label (as shown in FIG A.) is also affixed to the unit.

   De-rate values are based on proper combustion calibration and CO_2's adjusted to the recommended levels.
6. High altitude Crest Models 4.0 and 5.0 will not de-rate up to 5,500 feet.
7. The high altitude Crest 6.0 model will de-rate by 2.0% for each 1000 feet above sea level up to 5,500 feet.
8. For Crest Models 4.0, 5.0 and 6.0, installations above 5,500 feet contact the factory.
9. Ratings have been confirmed by the Hydronics Section of AHRI.

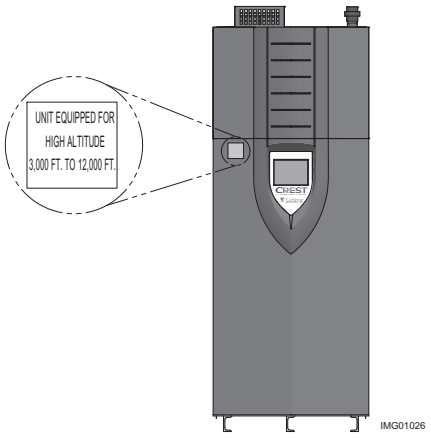


***Figure A** High Altitude Label Location*

1 Determine boiler location

Installation must comply with:

- Local, state, provincial, and national codes, laws, regulations, and ordinances.
- National Fuel Gas Code, NFPA 54 / ANSI Z223.1 – latest edition.
- Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1 - latest edition, when required.
- National Electrical Code, NFPA 70 - latest edition.
- For Canada only: CSA B149.1 Installation Code, CSA C22.1 Canadian Electrical Code Part 1 and any local codes.

NOTICE The Crest gas manifold and controls met safe lighting and other performance criteria when the boiler underwent tests specified in ANSI Z21.13/CSA 4.9 – latest edition.

Before locating the boiler, check:

1. Check for nearby connection to:
   - System water piping
   - Venting connections
   - Gas supply piping
   - Electrical power
2. Locate the appliance so that if water connections should leak, water damage will not occur. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. The pan must not restrict combustion air flow. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this appliance, or any of its components.
3. Check area around the boiler. Remove any combustible materials, gasoline and other flammable liquids.

⚠WARNING Failure to keep boiler area clear and free of combustible materials, gasoline, and other flammable liquids and vapors can result in severe personal injury, death, or substantial property damage.

4. The Crest must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.
5. If a new boiler will replace an existing boiler, check for and correct system problems, such as:
   - System leaks causing oxygen corrosion or heat exchanger cracks from hard water deposits.
   - Incorrectly-sized expansion tank.
   - Lack of freeze protection in boiler water causing system and boiler to freeze and leak.
   - Debris left from existing piping, if not flushed and cleaned with an appropriate cleaner.
6. The appliance must be installed on a level floor, both front to back and side to side, for proper condensate drainage.
7. If the optional neutralizing kit is to be used, elevate the boiler at least 3" above the floor.
8. Check around the boiler for any potential air contaminants that could risk corrosion to the boiler or the boiler combustion air supply (see Table 1A on page 9). Prevent combustion air contamination. Remove any of these contaminants from the boiler area.

⚠WARNING DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 9). Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠WARNING This appliance is certified as an indoor appliance. Do not install the appliance outdoors or locate where the appliance will be exposed to freezing temperatures or to temperatures that exceed 100°F (37.8°C).

Do not install the appliance where the relative humidity may exceed 93%. Do not install the appliance where condensation may form on the inside or outside of the appliance, or where condensation may fall onto the appliance.

Failure to install the appliance indoors could result in severe personal injury, death, or substantial property damage.

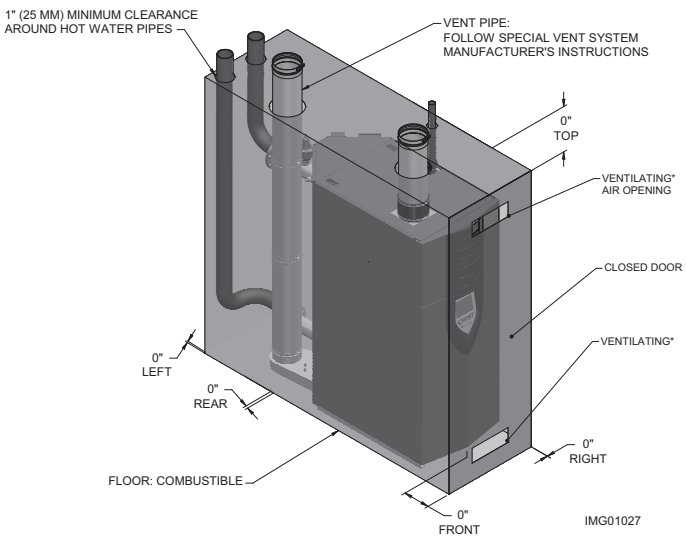
⚠WARNING This appliance requires a special venting system. Use only the vent materials specified in this manual. Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

Provide clearances:

Clearances from combustible materials

- Hot water pipes ..... 1/4"
- Sides ..... 0"
- Rear ..... 0"
- Front ..... 0"
- Top ..... 0"
- Floor ..... Combustible
- Vent pipe - Follow special vent system manufacturer's instructions

Figure 1-1 *Clearances*



1 Determine boiler location

NOTICE If you do not provide the recommended service clearances shown, it may not be possible to service the boiler without removing it from the space.

Recommended clearances for service access

- Sides ..... 24"
- Rear ..... 24"
- Front ..... 30"
- Top ..... 24"

Maintain minimum specified clearances for adequate operation. All installations must allow sufficient space for servicing the vent connections, water pipe connections, piping and other auxiliary equipment, as well as the appliance. The clearance labels on each appliance note the same service and combustible clearance requirements as shown in this manual.

Multiple boilers may be installed side by side with no clearance between adjacent boilers because this boiler is approved for zero clearance from combustible surfaces; however, service access will be limited from the sides.

Consult the *Venting* section of this manual for specific installation instructions for the appropriate type of venting system that you will be using.

Provide air openings to room:

The Crest alone in boiler room

1. No air ventilation openings into the boiler room are needed when clearances around the Crest are at least equal to the SERVICE clearances shown in FIG. 1-1. For spaces that do NOT supply this clearance, provide two openings as shown in FIG. 1-1. Each opening must provide one square inch free area per 1,000 Btu/hr of boiler input.
2. Combustion air openings are required when using the Room Air Option on page 28 of this manual.

The Crest in same space with other gas or oil-fired appliances

1. Follow the National Fuel Gas Code (U.S.) or CSA B149.1 (Canada) to size/verify size of the combustion/ventilation air openings into the space.

⚠WARNING The space must be provided with combustion/ventilation air openings correctly sized for all other appliances located in the same space as the Crest.

Failure to comply with the above warnings could result in severe personal injury, death, or substantial property damage.

2. Size openings only on the basis of the other appliances in the space. No additional air opening free area is needed for the Crest when it takes its combustion air from outside (direct vent installation).

Flooring and foundation

Flooring

The Crest is approved for installation on combustible flooring, but must never be installed on carpeting.

⚠WARNING Do not install the boiler on carpeting even if foundation is used. Fire can result, causing severe personal injury, death, or substantial property damage.

If flooding is possible, elevate the boiler sufficiently to prevent water from reaching the boiler.

⚠WARNING Assure that the floor and structure is sufficient to support the installed weight of the boiler, including the water content in the heat exchanger. If not, structural building failure will result, causing severe personal injury, death, or substantial property damage.

Vent and air piping

The Crest requires a special gas vent system, designed for pressurized venting.

The boiler is to be used for either direct vent installation or for installation using indoor combustion air. When room air is considered, see page 28 of this manual. Note prevention of combustion air contamination below when considering vent/air termination.

Vent and air must terminate near one another and may be vented vertically through the roof or out a side wall, unless otherwise specified. You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Crest using any other means.

Be sure to locate the boiler such that the vent and air piping can be routed through the building and properly terminated. The vent/air piping lengths, routing and termination method must all comply with the methods and limits given in this manual.

Prevent combustion air contamination

Install air inlet piping for the Crest as described in this manual. Do not terminate vent/air in locations that can allow contamination of combustion air. Refer to Table 1A, page 9 for products and areas which may cause contaminated combustion air.

⚠WARNING Ensure that the combustion air will not contain any of the contaminants in Table 1A, page 9. Contaminated combustion air will damage the boiler, resulting in possible severe personal injury, death or substantial property damage. Do not pipe combustion air near a swimming pool, for example. Also, avoid areas subject to exhaust fumes from laundry facilities. These areas will always contain contaminants.

1 Determine boiler location *(continued)*

When using an existing vent system to install a new boiler:

⚠WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

Check the following venting components before installing:

- **Material** - For materials listed for use with this appliance, see Section 2 - General Venting, Table 2A-1. For stainless steel venting, an adapter of the same manufacturer (Table 2B) may be used at the flue collar connection.
- **Size** - To ensure proper pipe size is in place, see Table 2C. Check to see that this size is used throughout the vent system.
- **Manufacturer** - Only use the listed manufacturers and their type product listed in Table 2A-1 for CAT IV positive pressure venting with flue producing condensate.
- **Supports** - Non-combustible supports must be in place allowing a minimum 1/4" rise per foot. The supports should adequately prevent sagging and vertical slippage, by distributing the vent system weight. For additional information, consult the vent manufacturer's instructions for installation.
- **Terminations** - Carefully review Sections 2 through 4 to ensure requirements for the location of the vent and air terminations are met and orientation of these fit the appropriate image from the Sidewall or Vertical options listed in the General Venting Section.
- **Seal** - With prior requirements met, the system should be tested to the procedure listed in parts (c) through (f) of the Removal of an Existing Boiler Section on page 10.

With stainless steel vent, seal and connect all pipe and components as specified by the vent manufacturer used.

⚠WARNING If any of these conditions are not met, the existing system must be updated or replaced for that concern. Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

***Table 1A** Corrosive Contaminants and Sources*

Products to avoid:
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

1 Determine boiler location

When removing a boiler from existing common vent system:

DANGER Do not install the Crest into a common vent with any other appliance except as noted in Section 2 on page 20. This will cause flue gas spillage or appliance malfunction, resulting in possible severe personal injury, death, or substantial property damage.

⚠WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

a. Seal any unused openings in the common venting system.

b. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, or other deficiencies, which could cause an unsafe condition.

c. Test vent system – Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

d. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

e. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.

f. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined herein, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous conditions of use.

g. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code. When re-sizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code.

Remove boiler from wood pallet

1. After removing the outer shipping crate and plastic from the boiler, remove the parts package (packaged parts inside the controls compartment of the boiler inside the lower front access panel).

2. To remove the boiler from the pallet:

a. Remove the three (3) shipping bolts located inside the controls compartment securing the boiler to the front of the pallet (see FIG. 1-2).

b. Remove the three (3) shipping bolts that fasten the tie-down brackets securing the legs to the rear of the pallet (FIG. 1-2).

c. The boiler can now be removed from the pallet using a lift truck lifting from the front or rear of the boiler. If lifting from the front, the lift truck forks must extend at least half way under the boiler heat exchanger to assure proper lifting technique with no damage to the boiler.

⚠WARNING Failure to assure the truck forks are long enough to extend at least halfway under the boiler heat exchanger will result in the boiler tipping off the lift truck, and potentially falling. This will result in severe personal injury, death, or substantial property damage.

d. If lifting by crane is desired, remove the top access panels to gain access to the lifting lugs located on the boiler (see FIG. 1-3). It is also recommended that the upper and lower front panels along with both front side panels be removed (no tools required).

NOTICE Do not drop the boiler or bump the jacket on the floor or pallet. Damage to the boiler can result.

1 Determine boiler location *(continued)*

Figure 1-2 *Boiler Mounted on Shipping Pallet*

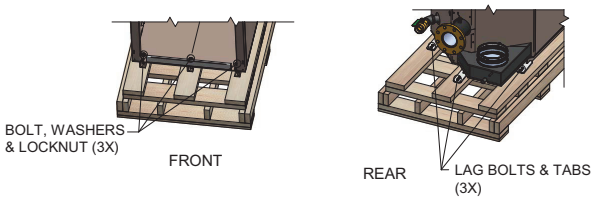
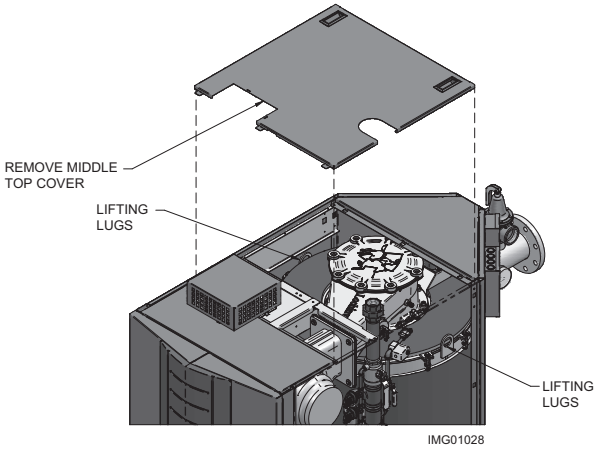


Figure 1-3 *Boiler Removed from Shipping Pallet*



Combustion and ventilation air requirements for appliances drawing air from the equipment room

Provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, NFPA 54 / ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

The equipment room MUST be provided with properly sized openings and/or be of sufficient volume to assure adequate combustion air and proper ventilation for all gas fired appliances in the equipment room to assure adequate combustion air and proper ventilation.

The requirements shown are for the **appliance only**; additional gas fired appliances in the equipment room will require an increase in the net free area and/or volume to supply adequate combustion air for all appliances.

No combustion air openings are needed when the appliance is installed in a space with a volume **NO LESS** than 50 cubic feet per 1,000 Btu/hr of all installed gas fired appliances and the building **MUST NOT be of "Tight Construction"**[3].

A combination of indoor and outdoor combustion air may be utilized by applying a ratio of available volume to required volume times the required outdoor air opening(s) size(s). This must be done in accordance with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1.

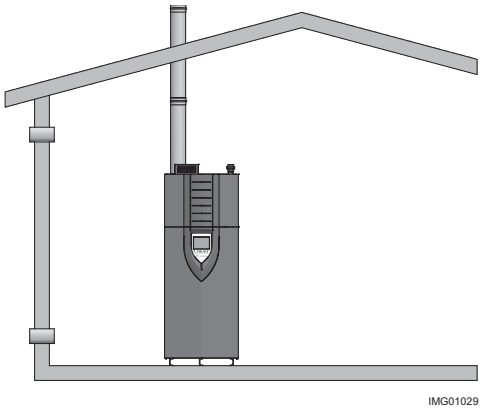


Figure 1-4_Combustion Air Direct from Outside

1. If air is taken directly from outside the building with no duct, provide two permanent openings to the equipment room each with a net free area of one square inch per 4000 Btu/hr input (5.5 cm^2 per kW) (see FIG. 1-4).

1 Determine boiler location

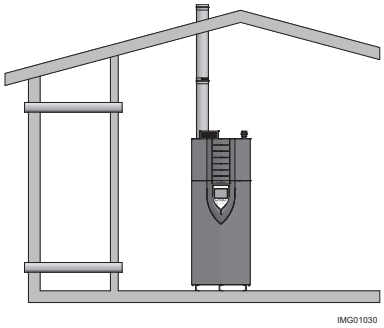


Figure 1-5_Combustion Air Through Ducts

2. If combustion and ventilation air is taken from the outdoors using a duct to deliver the air to the equipment room, each of the two openings should be sized based on a minimum free area of one square inch per 2000 Btu/hr (11 cm^2 per kW) of input (see FIG. 1-5).

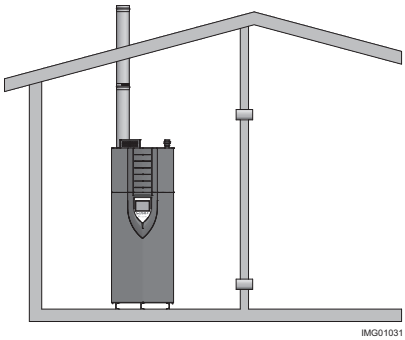


Figure 1-6_Combustion Air from Interior Space

3. If air is taken from another interior space combined with the equipment room:

(a) Two spaces on same story: Each of the two openings specified above should have a net free area of one square inch for each 1000 Btu/hr (22 cm^2 per kW) of input, but not less than 100 square inches (645 cm^2) (see FIG. 1-6).

(b) Two spaces on different stories: One or more openings should have a net free area of two square inches per 1000 Btu/hr (44 cm^2 per kW).

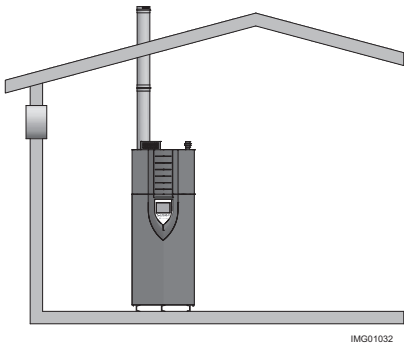


Figure 1-7_Combustion Air from Outside - Single Opening

4. If a single combustion air opening is provided to bring combustion air in directly from the outdoors, the opening must be sized based on a minimum free area of one square inch per 3000 Btu/hr (7 cm^2 per kW). This opening must be located within 12" (30 cm) of the top of the enclosure (see FIG. 1-7).

Combustion air requirements are based on the latest edition of the National Fuel Gas Code, NFPA 54 / ANSI Z223.1; in Canada refer to the latest edition of CGA Standard CAN/CSA B149.1. Check all local code requirements for combustion air.

All dimensions based on net free area in square inches. Metal louvers or screens reduce the free area of a combustion air opening a minimum of approximately 25%. Check with louver manufacturers for exact net free area of louvers.

Where two openings are provided, one must be within 12" (30 cm) of the ceiling and one must be within 12" (30 cm) of the floor of the equipment room. Each opening must have a net free area as specified in Table 1B. Single openings shall commence within 12" (30 cm) of the ceiling. The minimum dimension of air openings shall not be less than 3" (80 mm).

⚠CAUTION Under no circumstances should the equipment room ever be under negative pressure. Particular care should be taken where exhaust fans, attic fans, clothes dryers, compressors, air handling units, etc., may take away air from the unit.

The combustion air supply must be completely free of any flammable vapors that may ignite or chemical fumes which may be corrosive to the appliance. Common corrosive chemical fumes which must be avoided are fluorocarbons and other halogenated compounds, most commonly present as refrigerants or solvents, such as Freon, trichlorethylene, perchlorethylene, chlorine, etc. These chemicals, when burned, form acids which quickly attack the stainless steel heat exchanger, headers, flue collectors, and the vent system.

The result is improper combustion and a non-warrantable, premature appliance failure.

EXHAUST FANS: Any fan or equipment which exhausts air from the equipment room may deplete the combustion air supply and/or cause a downdraft in the venting system. Spillage of flue products from the venting system into an occupied living space can cause a very hazardous condition that must be corrected immediately.

1 Determine boiler location *(continued)*

TABLE - 1B
MINIMUM RECOMMENDED COMBUSTION AIR SUPPLY TO EQUIPMENT ROOM

Model Number	FIG. 1-4		FIG. 1-5		FIG. 1-6			FIG. 1-7
	*Outside Air from 2 Openings Directly from Outdoors[1]		*Outside Air from 2 Ducts Delivered from Outdoors[1]		Inside Air from 2 Ducts Delivered from Interior Space[2]			*Outside Air from 1 Opening Directly from Outdoors, in² (cm²)[1]
					Same Story		Different Stories	
	Top Opening, in² (cm²)	Bottom Opening, in² (cm²)	Top Opening, in² (cm²)	Bottom Opening, in² (cm²)	Top Opening, in² (cm²)	Bottom Opening, in² (cm²)	Total Openings, in² (cm²)	
FB 0751	188 (1213)	188 (1213)	375 (2420)	375 (2420)	750 (4839)	750 (4839)	1500 (9678)	250 (1613)
FB 1001	250 (1613)	250 (1613)	500 (3226)	500 (3226)	1000 (6452)	1000 (6452)	2000 (12904)	333 (2149)
FB 1251	313 (2020)	313 (2020)	625 (4033)	625 (4033)	1250 (8065)	1250 (8065)	2500 (16129)	417 (2691)
FB 1501	375 (2420)	375 (2420)	750 (4839)	750 (4839)	1500 (9678)	1500 (9678)	3000 (19355)	500 (3226)
FB 1751	438 (2826)	438 (2826)	875 (5646)	875 (5646)	1750 (11291)	1750 (11291)	3500 (22581)	583 (3762)
FB 2001	500 (3226)	500 (3226)	1000 (6452)	1000 (6452)	2000 (12904)	2000 (12904)	4000 (25807)	667 (4304)
FB 2501	625 (4033)	625 (4033)	1250 (8065)	1250 (8065)	2500 (16129)	2500 (16129)	5000 (32258)	833 (5381)
FB 3001	750 (4839)	750 (4839)	1500 (9678)	1500 (9678)	3000 (19355)	3000 (19355)	6000 (38710)	1000 (6452)
FB 3501	875 (5646)	875 (5646)	1750 (11291)	1750 (11291)	3500 (22581)	3500 (22581)	7000 (45162)	1167 (7530)
FB 4001	1000 (6450)	1000 (6450)	2000 (12900)	2000 (12900)	4000 (25800)	4000 (25800)	8000 (51600)	1333 (8600)
FB 5001	1250 (8062)	1250 (8062)	2500 (16129)	2500 (16129)	5000 (32250)	5000 (32250)	10000 (64500)	1667 (10750)
FB 6001	1500 (9677)	1500 (9677)	3000 (19355)	3000 (19355)	6000 (38710)	6000 (38710)	12000 (77419)	2000 (12903)

The above requirements are for the **appliance only**; additional gas fired appliances in the equipment room will require an increase in the net free area and/or volume to supply adequate combustion air for all appliances.
No combustion air openings are needed when the appliance is installed in a space with a volume NO LESS than 50 cubic feet per 1,000 Btu/hr of all installed gas fired appliances. **Buildings MUST NOT be of *"Tight Construction"[3].**
[1]Outside air openings shall directly communicate with the outdoors.
[2]Combined interior space must be 50 cubic feet per 1,000 Btu/hr input. **Buildings MUST NOT be of *"Tight Construction".**
[3]**"Tight Construction"** is defined as a building with less than 0.40 ACH (air changes per hour). For buildings of **"Tight Construction"**, provide air openings into the building from outside.

Combustion air filter

This unit has a standard air filter located at the combustion air inlet. This air filter is provided to help ensure clean air is used for the combustion process. Check this filter every month and replace when it becomes dirty. You can find these commercially available filters at any home center or HVAC supply store. Follow the steps below when replacing the combustion air filter:

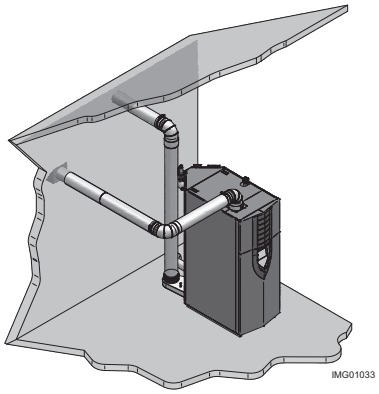
1. Locate the combustion air filter box.
2. Lift and remove the air filter box cover to gain access to the air filter.
3. Slide the air filter out the top of the air filter box.
4. Inspect the air filter for dirt and debris, replace if necessary.
5. Replace the air filter and the air filter box cover.

NOTICE During construction the air filter should be checked more frequently to ensure it does not become clogged with combustion dirt and debris.

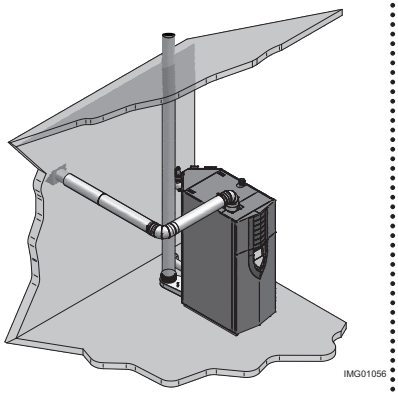
CAUTION Sustained operation of an appliance with a clogged burner may result in nuisance operational problems, bad combustion, and non-warrantable component failures.

2 General venting

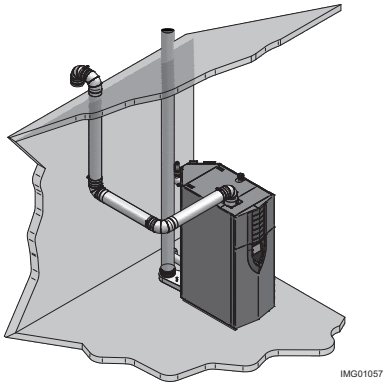
Direct venting



Sidewall

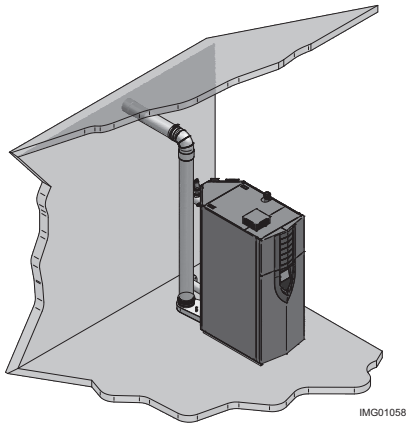


Vertical Vent, Sidewall Air

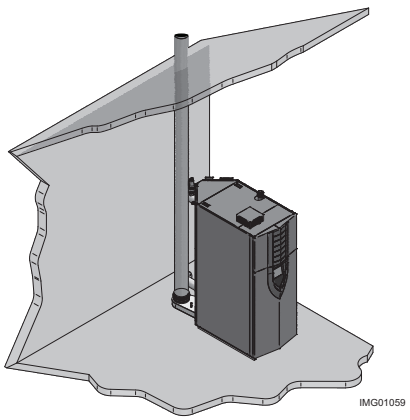


Vertical

Optional room air



Sidewall



Vertical

2 General venting *(continued)*

Install vent and combustion air piping

DANGER

The Crest must be vented and supplied with combustion and ventilation air as described in this section. Ensure the vent and air piping and the combustion air supply comply with these instructions regarding vent system, air system, and combustion air quality. See also Section 1 of this manual.

Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of applicable codes.

Failure to provide a properly installed vent and air system will cause severe personal injury or death.

Air inlet pipe materials:

The air inlet pipe(s) must be sealed. Choose acceptable combustion air inlet pipe materials from the following list:

ABS, PVC, or CPVC
Dryer Vent or Sealed Flexible Duct (not recommended for rooftop air inlet)
Galvanized steel vent pipe with joints and seams sealed as specified in this section.
Type "B" double-wall vent with joints and seams sealed as specified in this section.
AL29-4C, stainless steel material to be sealed to specification of its manufacturer.

*Plastic pipe may require an adapter (not provided) to transition between the air inlet connection on the appliance and the plastic air inlet pipe.

⚠WARNING

Using vent or air intake materials other than those specified, failure to properly seal all seams and joints or failure to follow vent pipe manufacturer's instructions can result in personal injury, death or property damage. Mixing of venting materials will void the warranty and certification of the appliance.

NOTICE

The use of double-wall vent or insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

Sealing of Type "B" double-wall vent material or galvanized vent pipe material used for air inlet piping on a sidewall or vertical rooftop Combustion Air Supply System:

a. Seal all joints and seams of the air inlet pipe using either Aluminum Foil Duct Tape meeting UL Standard 723 or 181A-P or a high quality UL Listed silicone sealant such as those manufactured by Dow Corning or General Electric.

b. Do not install seams of vent pipe on the bottom of horizontal runs.

c. Secure all joints with a minimum of three sheet metal screws or pop rivets. Apply Aluminum Foil Duct Tape or silicone sealant to all screws or rivets installed in the vent pipe.

d. Ensure that the air inlet pipes are properly supported.

The PVC, CPVC, or ABS air inlet pipe should be cleaned and sealed with the pipe manufacturer's recommended solvents and standard commercial pipe cement for the material used. The ABS, PVC, CPVC, Dryer Vent or Flex Duct air inlet pipe should use a silicone sealant to ensure a proper seal at the appliance connection and the air inlet cap connection. Dryer vent or flex duct should use a screw type clamp to seal the vent to the appliance air inlet and the air inlet cap. Proper sealing of the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.

2 General venting

When a sidewall or vertical rooftop combustion air supply system is disconnected for any reason, the air inlet pipe must be resealed to ensure that combustion air will be free of contaminants and supplied in proper volume.

DANGER Failure to properly seal all joints and seams as required in the air inlet piping may result in flue gas recirculation, spillage of flue products and carbon monoxide emissions causing severe personal injury or death.

Vent and air piping

The Crest is certified as a Category II/IV boiler. **This product has been approved for use with stainless steel vent systems.** All venting systems used with a Crest boiler must be suitable for Category IV operation except for factory approved common vent systems operating as allowed in the Common Venting Section on page 20.

⚠WARNING Use only the materials, vent systems, and terminations listed in Table 2A-1. DO NOT mix vent systems of different types or manufacturers, unless listed in this manual. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Installations must comply with applicable national, state, and local codes. Stainless steel vent systems must be listed as a UL-1738 approved system for the United States and a ULC-S636 approved system for Canada.

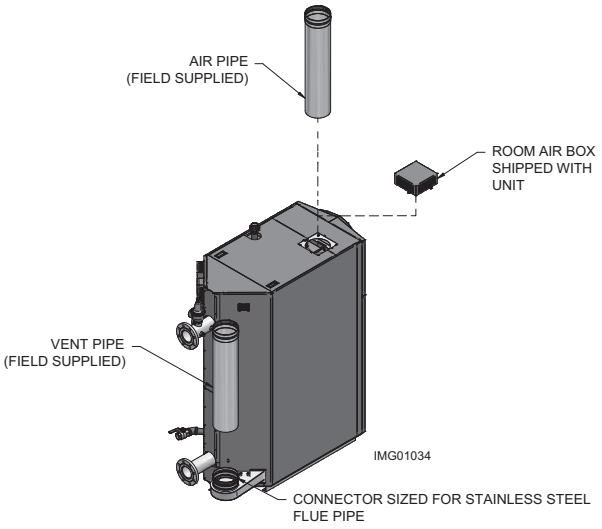
NOTICE Installation of a stainless steel vent system should adhere to the stainless steel vent manufacturer's installation instructions supplied with the vent system.

NOTICE The Crest is supplied with an integral FasNSeal vent connector (FIG. 2-1). The installer must use a specific vent starter adapter supplied by the vent manufacturer to adapt to different vent systems.

Air intake/vent connections

1. **Combustion Air Intake Connector** (FIG. 2-1) - Used to provide combustion air directly to the unit from outdoors. A fitting is provided with the unit for final connection. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.
2. **Vent Connector** (FIG. 2-1) - Used to provide a passageway for conveying combustion gases to the outside. A transition fitting is provided on the unit for final connection. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

Figure 2-1 *Combustion Air Adapter*



The Crest uses model specific combustion air intake and vent piping sizes as detailed in Tables 2B and 2C on page 18.

NOTICE Increasing or decreasing combustion air or vent piping to sizes not specified in this manual is not authorized.

Table 2A-1 *Approved Stainless Steel Vent Manufacturers*

Approved Stainless Steel Vent Manufacturers	
Make	**Model**
ProTech Systems (Dura-Vent Co.)	FasNSeal Vent
Z-Flex (Nova Flex Group)	Z-Vent
Heat Fab (Selkirk Corporation)	Saf-T Vent
Metal Fab	Corr/Guard
Securities Chimneys International	Secure Seal SS
Schebler Chimney Systems	eVent
ICC	VIC
Jeremias	--

2 General venting *(continued)*

Table 2A-2 *Approved Stainless Steel Terminations and Adapters - Category IV*

Model	ProTech		Z Flex		Heat Fab		
	Adapter	Intake	Adapter	Intake	Adapter	Flue	Intake
751-1001	Not Required	810003269	2SVDSA06	2SVEE0690	9601MAD	CCK06TM	9690 / 9692
1251	*See note	810003281	2SVDSA06	2SVEE0690	9801MAD	CCK08TM	9690 / 9692
1501-2001	*See note	810003357 / 810003369	2SVDSA08	2SVEE0890	9801MAD	CCK08TM	9890 / 9892

Model	Metal-Fab			Security Chimney			ICC		
	Adapter	Flue	Intake	Adapter	Flue	Intake	Adapter	Flue	Intake
751-1001	6FCGPVCA	MC 6-36"	6FCGSW90L	SS6PVCU	SS0MCU 4" - 24"	SS6ST90AU SSD0STAUK 4" - 24"	HM-06CA78	HM-06SCR-F HM-06RC-F	HE-06E90-F HM-06SCR-F
1251	8FCGLCA	MC 6-36"	6FCGSW90L	SS8CRESTU	SS0MCU 4" - 24"	SS6ST90AU SSD0STAUK 4" - 24"	HM-08CA78	HM-08SCR-F HM-08MC-F	HE-06E90-F HM-06SCR-F
1501-2001	8FCGLCA	MC 6-36"	8FCGSW90	SS8CRESTU	SS0MCU 4" - 24"	SSE8E9OU SD0STAUK 4" - 24"	HM-08CA78	HM-08SCR-F HM-08MC-F	HE-08E90-F HM-08SCR-F

Model	Jeremias		
	Adapter	Flue	Intake
751-1001	SWKL6-KLC	SWKL6-WRC	SWKL6-90ET
1251	SWKL8-KLC	SWKL8-WRC	SWKL6-90ET
1501-2001	SWKL8-KLC	SWKL8-WRC	SWKL8-90ET

*No adapter needed when using 8" FasNSeal vent length.

*Models 1251 - 1501: For installations using 6" vent, install a FasNSeal reducing adapter, available from the factory with kit #100295900. Reference the manufacturer's part number provided for Models 751 - 1001 when adapting to different vent systems.

Model	ProTech		Z Flex		Heat Fab		
	Adapter	Intake	Adapter	Intake	Adapter	Flue	Intake
2501	*See note	810003397 / 810003409	2SVDSA09	2SVEE990	9901MAD	CCK09TM	9890 / 9992
3001 - 3501	*See note	810003435 / 810003447	2SVDSA10	2SVEE1090	91001MAD	CCK10TM	91090 / 91092
4001	*See note	810003476 / 810003488	2SVDSA12	2SVEE1290	91201MAD	CCK12TM	91290 / 91292
5001 - 6001	*See note	810003516 / 810003528	2SVDSA14	2SVEE1490	91401MAD	CCK14TM	91490 / 91492

Model	Metal-Fab			Security Chimney			ICC		
	Adapter	Flue	Intake	Adapter	Flue	Intake	Adapter	Flue	Intake
2501	8FCGLCA	MC 6-36"	8FCGSW90	SS9CRESTU	SS0MCU 4" - 24"	SSE9E9OU SDOST90AUK 4" - 10"	HM-09CA78	HM-09SCR-F HM-09MC-F	HE-08E90-F HM-08SCR-F
3001 - 3501	10FCGLCA	MC 6-36"	10FCGSW90	SS10CRESTU	SS0MCU 4" - 24"	SSE10E9OU SDOST90AUK 4" - 10"	HM-10CA78	HM-10SCR-F HM-10MC-F	HE-10E90-F HM-10SCR-F
4001	12FCGLCA	MC 6-36"	12FCGSW90	SS12CRESTU	SS0MCU 4" - 24"	SSE12E9OU	HM-12CA78	HM-12SCR-F HM-12MC-F	HE-12E90-F HM-12SCR-F
5001 - 6001	14FCGLCA	MC 6-36"	14FCGSW90	SS14CRESTU	SS0MCU 4" - 24"	SSE14E9OU	HM-14CA78	HM-14SCR-F HM-14MC-F	HE-14E90-F HM-14SCR-F

Model	Jeremias		
	Adapter	Flue	Intake
2501	SWKL9-KLC	SWKL9-WRC	SWKL9-90ET
3001 - 3501	SWKL10-KLC	SWKL10-WRC	SWKL10-90ET
4001	SWKL12-KLC	SWKL12-WRC	SWKL12-90ET
5001 - 6001	SWKL14-KLC	SWKL14-WRC	SWKL14-90ET

*No adapter needed when using Standard FNS Vent Length.

2 General venting

***Table 2B** Direct Vent Minimum / Maximum Allowable Air / Vent Lengths*

Model	AIR INLET			VENT			Input De-Rate per 25 feet of Vent
	Air Intake Diameter	Air Intake Min. Length	Air Intake Max. Length	Vent Diameter	Vent Min. Length	Vent Max. Length	
0751-1001	6"	12'	100'	6"	18'	100'	0%
1251*	6"	12'	75'	6"	18'	75'	1%
1251	6"	12'	100'	8"	18'	100'	0%
1501*	8"	12'	75'	6"	18'	75'	1%
1501	8"	12'	100'	8"	18'	100'	0%
1751-2001	8"	12'	100'	8"	18'	100'	0%
2501	8"	12'	100'	9"	18'	100'	0%
2501*	8"	12'	100'	10"	18'	100'	0%
3001	10"	12'	100'	10"	18'	100'	0%
3501	10"	12'	100'	10"	18'	100'	0%
4001	12"	12'	100'	12"	18'	100'	0%
5001/6001	14"	12'	100'	14"	18'	100'	0%

*FB 1251 - 1501 models using 6" vent require the installation of a field supplied reducing adapter (see Table 2A-2 on page 17).
*FB 1251 - 1501 LP models using 6" diameter vent will de-rate 2.5% per 25 feet of vent.
*FB 2501 models using 10" vent diameter option must use appropriate increase adapters as needed.

***Table 2C** Room Air Minimum / Maximum Allowable Air / Vent Lengths*

Model	Vent Diameter	Vent Min. Length	Vent Max. Length	Input De-Rate per 25 feet of Vent
0751-1001	6"	18'	100'	0%
1251-1501*	6"	18'	100'	0%
1251-1501	8"	18'	100'	0%
1751-2001	8"	18'	100'	0%
2501	9"	18'	150'	0%
2501*	10"	18'	150'	0%
3001	10"	18'	150'	0%
3501	10"	18'	150'	0%
4001	12"	18'	150'	0%
5001/6001	14"	18'	150'	0%

*FB 1251 - 1501 models using 6" vent require the installation of a field supplied reducing adapter (see Table 2A-2 on page 17).
*FB 1251 - 1501 LP models using 6" diameter vent will de-rate 2.5% per 25 feet of vent.
*FB 2501 models using 10" vent diameter option must use appropriate increase adapters as needed.

2 General venting *(continued)*

When determining equivalent combustion air and vent length, add 5 feet (1.5m) for each 90° elbow and 3 feet (.9 m) for each 45° elbow.

EXAMPLE: 20 feet (6 m) of pipe + (4) 90° elbows + (3) 45° elbows = 49 equivalent feet (15 m) of piping.

Removing from existing vent

Follow the instructions in Section 1, page 10 of this manual when removing a boiler from an existing vent system.

Vent and air piping

Vent and air system:

NOTICE Installation must comply with local requirements and with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

You must also install air piping from outside to the boiler air intake adapter. The resultant installation is direct vent (sealed combustion).

You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Crest using any other means.

⚠WARNING DO NOT mix components from different systems. The vent system could fail, causing leakage of flue products into the living space. Use only approved stainless steel pipe and fittings.

NOTICE When installing outdoor models OF(N,L), reference the Outdoor Crest Supplemental Manual for further information.

Vent, air piping and termination:

The Crest vent and air piping can be installed through the roof or through a sidewall. Follow the procedures in this manual for the method chosen. Refer to the information in this manual to determine acceptable vent and air piping length.

Air contamination

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the boiler, they can form strong acids. The acid can eat through the boiler wall, causing serious damage and presenting a possible threat of flue gas spillage or boiler water leakage into the building.

Please read the information given in Table 1A, page 9, listing contaminants and areas likely to contain them. If contaminating chemicals will be present near the location of the boiler combustion air inlet, have your installer pipe the boiler combustion air and vent to another location, per this manual.

⚠WARNING If the boiler combustion air inlet is located in a laundry room or pool facility, for example, these areas will always contain hazardous contaminants.

⚠WARNING To prevent the potential of severe personal injury or death, check for areas and products listed in Table 1A, page 9 before installing the boiler or air inlet piping.

If contaminants are found, you MUST:

- Remove products permanently.

—OR—

- Relocate air inlet and vent terminations to other areas.

2 General venting

Common venting

Crest boilers may be common vented; however, the following criteria MUST BE followed:

1. Only Crest boilers may be connected to common flue applications. DO NOT mix other manufacturer's appliances or other Lochinvar models. Common air intake is not allowed.
2. Crest boilers connected to the common vent must all be of the same size.
3. Each Crest boiler must have a Lochinvar supplied flue damper installed (see Table 2D).
4. A condensate drain must be installed above the flue damper.
5. Only vertical direct vent, positive pressure, Category IV or vertical/chimney vent, negative pressure, Category II may be used when common venting Crest boilers. Sidewall venting is not allowed.
6. Crest boilers in a common vent must be connected and controlled with the integral Crest SMART TOUCH Cascade.
   a. The Leader may be controlled through the Crest SMART TOUCH control through BMS (external 0 - 10V signal), ModBus or its own internally calculated set point.
   b. The Cascade (Members) must be controlled by the Crest Leader boiler using the Lead/Lag Cascade option.

For approved common vent sizing, contact the factory.

⚠WARNING When Crest boilers are common vented, the criteria above MUST BE followed. Failure to follow all these requirements will result in severe personal injury, death, or substantial property damage.

NOTICE When Crest boilers are common vented, hot water generators MUST BE piped to the primary heating loop and tank thermostats must not be connected to the Crest.

NOTICE A field supplied inline condensate collection section MUST BE installed directly above the backflow preventer.

NOTICE When using polypropylene common vent on Models 751 - 3501, a field supplied polypropylene to stainless steel adapter MUST BE installed between the backflow preventer and the unit connection.

Table 2D Flue Damper Kits

Flue Damper Kits		
Model	Damper Size	Kit Number
FB0751	6"	100056142
FB1001	6"	100056142
FB1251	8"	100141561
FB1501	8"	100141561
FB1751	8"	100141561
FB2001	8"	100141561
FB2501	9"	100141562
FB3001	10"	100141563
FB3501	10"	100141563
FB4001	12"	100141564
FB5001/6001	14"	100141565

PVC/CPVC (Models 751 - 4001 only)

This product has been approved for use with the PVC/CPVC vent materials listed in Table 2E on page 21.

NOTICE Factory installed vent connections are sized for stainless steel venting.

Installing vent and air piping

⚠WARNING The vent connection to the appliance must be made with a minimum of 10 equivalent feet of CPVC pipe (field provided). The field provided vent fittings must be cemented to the CPVC pipe section using an "All Purpose Cement" suitable for PVC and CPVC pipe. Use only the vent materials, primer, and cement specified in Table 2E to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

NOTICE Use only cleaners, primers, and solvents that are approved for the materials which are joined together.

NOTICE All PVC vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the boiler (to allow drainage of condensate).

⚠WARNING Insulation should not be used on PVC or CPVC venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

NOTICE CPVC vent or stainless steel pipe and vent fittings must be used in closet and alcove installations.

2 General venting *(continued)*

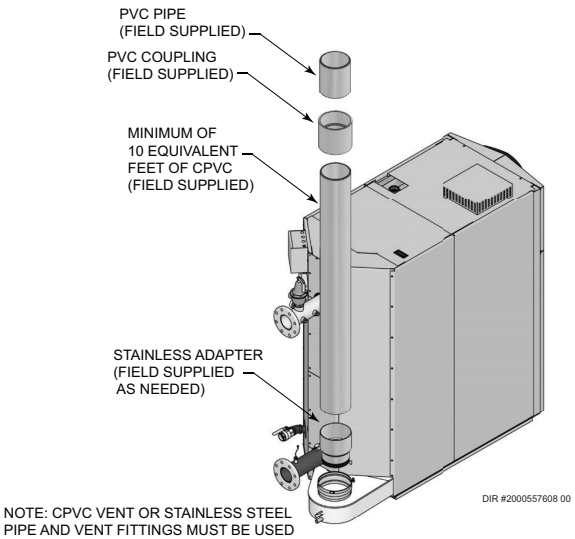
***Table 2E** PVC/CPVC Vent Pipe and Fittings*

Approved PVC/CPVC Vent Pipe and Fittings		
Item	**Material**	**Standard**
Vent pipe	PVC Schedule 40, 80	ANSI/ASTM D1785
	PVC - DWV	ANSI/ASTM D2665
	CPVC Schedule 40, 80	ANSI/ASTM F441
Vent fittings	PVC Schedule 40	ANSI/ASTM D2466
	PVC Schedule 80	ANSI/ASTM D2467
	CPVC Schedule 80	ANSI/ASTM F439
	PVC - DWV	ANSI/ASTM D2665
Pipe Cement / Primer	PVC	ANSI/ASTM D2564
	CPVC	ANSI/ASTM F493
NOTICE: DO NOT USE CELLULAR (FOAM) CORE PIPE		

NOTE: In Canada, CPVC and PVC vent pipe, fittings and cement/primer must be ULC-S636 certified.

1. Work from the boiler to vent or air termination. Do not exceed the lengths given in this manual for the air or vent piping.
2. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends.
3. Chamfer outside of each pipe end to ensure even cement distribution when joining.
4. Clean all pipe ends and fittings using a clean dry rag. (Moisture will retard curing and dirt or grease will prevent adhesion.)
5. Dry fit vent or air piping to ensure proper fit up before assembling any joint. The pipe should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
6. Priming and Cementing:
   a. Handle fittings and pipes carefully to prevent contamination of surfaces.
   b. Apply a liberal even coat of primer to the fitting socket and to the pipe end to approximately 1/2" beyond the socket depth.
   c. Apply a second primer coat to the fitting socket.
   d. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket along with an even coat of approved cement to the fitting socket.
   e. Apply a second coat of cement to the pipe.
   f. While the cement is still wet, insert the pipe into the fitting, if possible twist the pipe a 1/4 turn as you insert it. **NOTE:** If voids are present, sufficient cement was not applied and joint could be defective.
   g. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

***Figure 2-2** Near Boiler PVC/CPVC Venting (Flue connections from the factory are sized for stainless steel venting.)*



NOTE: CPVC VENT OR STAINLESS STEEL PIPE AND VENT FITTINGS MUST BE USED IN CLOSET AND ALCOVE INSTALLATIONS.

***Table 2F** PVC Adapter Kits*

PVC Adapter Kits		
Model	**Vent Size**	**Kit Number**
751-1001	6"	100289537
1251	6"	100289537
1251	8"	100267012
1501	6"	100289537
1501	8"	100267012
1751-2001	8"	100267012
2501*	10"	100316610
3001	10"	100314852
3501	10"	100314852
4001	12"	Field Supplied
*Adapts 9" SS to 10" CPVC/PVC **NOTICE: A MINIMUM OF 10 EQUIVALENT FEET OF CPVC (FIELD SUPPLIED) MUST BE INSTALLED DIRECTLY AFTER ADAPTER IN ALL APPLICATIONS**		

2 General venting

Polypropylene (Models 751 - 4001 only)

This product has been approved for use with polypropylene vent with the manufacturers listed in Table 2G.

NOTICE Factory installed vent connections are sized for stainless steel venting.

All terminations must comply with listed options in this manual and be a single-wall vent offering.

For support and special connections required, see the manufacturer's instructions. All vent is to conform to standard diameter and equivalent length requirements established.

When determining equivalent combustion air and vent length for polypropylene single-wall piping contact the manufacturer.

***Table 2G** Polypropylene Vent Pipe and Fittings*

Approved Polypropylene Vent Manufacturers	
Make	**Model**
Centrotherm Eco Systems	InnoFlue SW/Flex
Duravent (M & G Group)	PolyPro Single-Wall / PolyPro Flex

NOTICE The installer must use a specific vent starter adapter at the flue collar connection. The adapter is supplied by the vent manufacturer to adapt to its vent system. See Table 2G for approved vent adapters.

NOTICE All vent connections MUST be secured by the vent manufacturer's joint connector (FIG. 2-3).

⚠WARNING Insulation should not be used on polypropylene venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

⚠WARNING Use only the adapters and vent system listed in Tables 2G and 2H. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Installations must comply with applicable national, state, and local codes. For Canadian installation, polypropylene vent must be listed as a ULC-S636 approved system.

NOTICE Installation of a polypropylene vent system should adhere to the vent manufacturer's installation instructions supplied with the vent system.

***Figure 2-3** Near Boiler Polypropylene Venting*

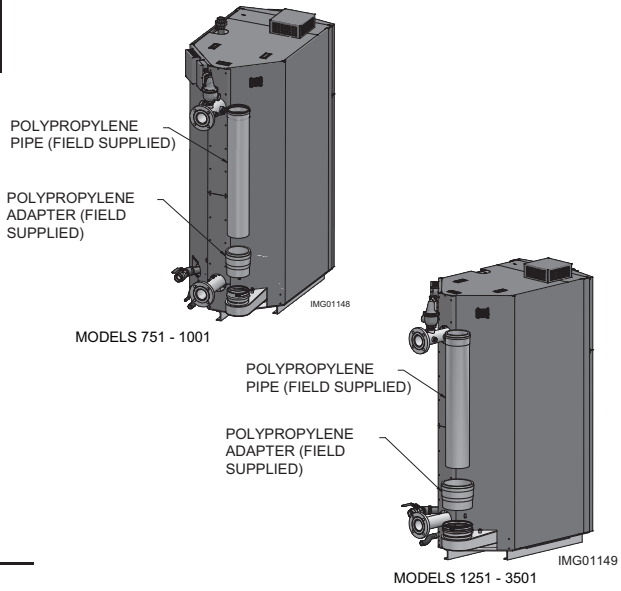


***Table 2H** Approved Polypropylene Terminations*

Model	Manufacturer	Vent Model	Vent Type	Adapter Number	Joint Connector	Sidewall Kit*	Retaining Bracket / Adapter*
751-1001	Centrotherm Eco Systems	Innoflue	Single-Wall Flex	ISSA0606	--	--	IATP0606 / ISTAGL0606
	DuraVent (M & G)	PolyPro	Single-Wall Flex	FSA-06M-6PPF	--	6PPS-HLKL	--
1251-2001	Centrotherm Eco Systems	Innoflue	Single-Wall	ISSA0808	--	--	--
	DuraVent (M & G)	PolyPro	Single-Wall	FSA-08M-8PPF	--	8PPS-HSTL	--
2501	Centrotherm	Innoflue	Single-Wall	ISSA0910	--	--	--
3001-3501	Centrotherm Eco Systems	Innoflue	Single-Wall	ISSA1010	--	--	--
4001	Centrotherm	Innoflue	Single-Wall	ISSA1212	N/A	N/A	N/A
5001-6001	N/A	N/A	N/A	N/A	N/A	N/A	N/A

* These parts are only needed if the sidewall termination assembly is used (see FIG. 4-1C on page 26).

3 Vertical direct venting

Vent/air termination – vertical

⚠WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death or substantial property damage.

⚠WARNING Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe except as noted in Section 2 on page 20. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Installation must comply with local requirements and with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1 - latest edition for U.S. installations or CSA B149.1 Installation Code for Canadian installations.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 18 of this manual.
2. The vent must terminate at least 3 feet above the highest place in which the vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.
3. The air piping must terminate in a down-turned 180° return pipe no further than 2 feet (.6 m) from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.
4. The vent piping must terminate in an up-turned coupling as shown in FIG. 3-1. The top of the coupling or the rain cap must be at least 36" (914 mm) above the air intake. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet (.6 m) apart and with the vent termination at least 36" (914 mm) above the air intake.

⚠WARNING Rooftop vent and air inlet terminations must terminate in the same pressure zone, unless vertical vent sidewall air is set up as shown in the General Venting - Vertical Vent, Sidewall Air Section.

Figure 3-1 *Vertical Termination of Air and Vent*

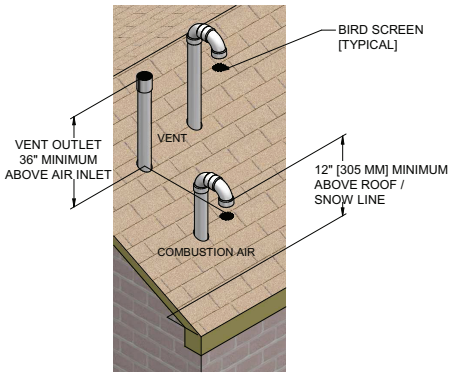
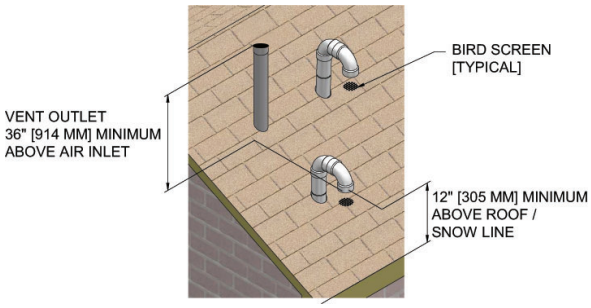


Figure 3-2 *Vertical Termination of Air and Vent w/Rain Cap*



5. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

Prepare roof penetrations

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole per the vent manufacturer's instructions.
   b. Insert a galvanized metal thimble in the vent pipe hole (when required by local codes).
3. Space the air and vent holes to provide the minimum spacing shown in FIG. 3-1.
4. Follow all local codes for isolation of vent pipe when passing through floors, ceilings, and roofs.
5. Provide flashing and sealing boots sized for the vent pipe and air pipe.

Termination and fittings

1. Prepare the vent termination coupling and the air termination elbow (FIG. 3-1) by inserting bird screens. Bird screens should be obtained locally.
2. The air piping must terminate in a down-turned 180° return bend as shown in FIG. 3-1. Locate the air inlet pipe no further than 2 feet (.6 m) from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.

3 Vertical direct venting

3. The vent piping must terminate in an up-turned coupling as shown in FIG. 3-1. The top of the coupling or the rain cap must be at least 36" (914 mm) above the air intake. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet (.6 m) apart and with the vent termination at least 36" (914 mm) above the air intake.
4. Maintain the required dimensions of the finished termination piping as shown in FIG. 3-1.
5. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

Multiple vent/air terminations

1. When terminating multiple Crest boilers, terminate each vent/air connection as described in this manual (FIG. 3-3).

⚠WARNING Terminate all vent pipes at the same height and all air pipes at the same height to avoid recirculation of flue products and the possibility of severe personal injury, death, or substantial property damage.

2. Place roof penetrations to obtain minimum clearance of 36 inches (914 mm) between edge of air intake elbow and adjacent vent pipe of another boiler for U.S. installations (see FIG. 3-3). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet of a Crest boiler is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

Figure 3-3 *Vertical Terminations with Multiple Boilers*

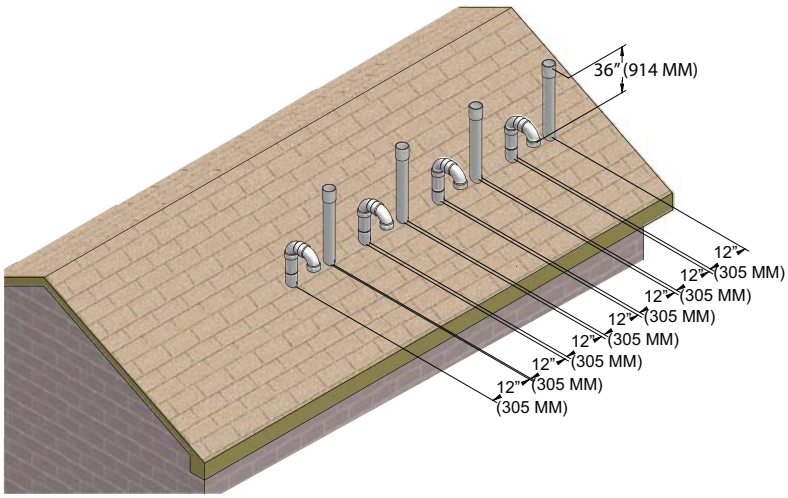


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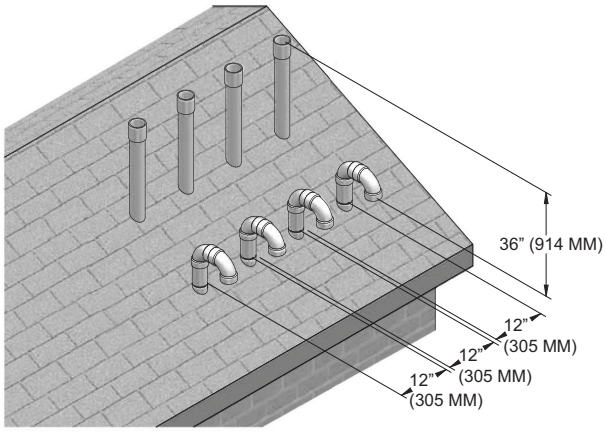
Figure 3-4 *Alternate Vertical Terminations with Multiple Boilers*



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4 Sidewall direct venting

Vent/air termination – sidewall

⚠WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage.

⚠WARNING A gas vent extending through an exterior wall shall not terminate adjacent to a wall or below building extensions such as eaves, parapets, balconies, or decks. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠WARNING Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe except as noted in Section 2 on page 20. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ CAUTION Sidewall venting commercial products will result in large exhaust plumes in cold climates. Consideration should be taken when locating in proximity to windows, doors, walkways, etc.

NOTICE Installation must comply with local requirements and with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 18 of this manual.

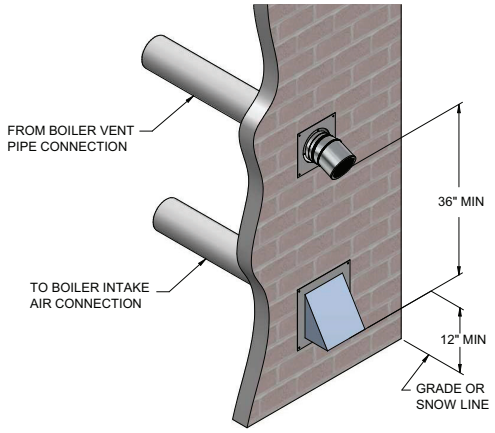
2. You must consider the surroundings when terminating the vent and air:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or pets.
   e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.

⚠WARNING Sidewall vent and air inlet terminations must terminate in the same pressure zone.

   f. Do not terminate above any door or above or below any window. Condensate can freeze, causing ice formations.
   g. Locate or guard vent to prevent condensate damage to exterior finishes.
   h. Position the vent/air terminations on the same wall where wind blowing from any direction will not create a difference in pressure between the terminations.

Figure 4-1A *Sidewall Termination of Air and Vent*

NOTICE PVC/CPVC or ABS is acceptable air inlet pipe material.



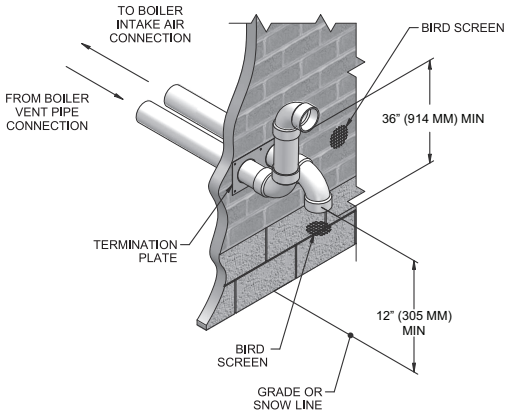
3. Maintain clearances as shown in FIG.'s 4-1A thru 4-4, pages 25 thru 27. The vent termination should not be located in traffic areas such as walkways, adjacent buildings, operable windows, or doors. Also maintain the following:
   a. Vent must terminate:
      - At least 6 feet (1.8 m) from adjacent walls.
      - Not less than 7 feet (2.1 m) above grade where located adjacent to public walkways.
      - No closer than 12 inches (305 mm) below roof overhang.
      - At least 3 feet (.9 m) above any forced air intake within 10 feet (3 m).
      - No closer than 4 feet (1.2 m) horizontally from any door or window or any other gravity air inlet.
   b. Air inlet must terminate at least 12 inches (305 m) above grade or snow line; at least 36 inches (914 mm) below the vent termination.
   c. Do not terminate closer than 4 feet (1.2 m) horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 4 feet (1.2 m) horizontally.

4. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

4 Sidewall direct venting

Vent/air termination – sidewall

Figure 4-1B *PVC/CPVC/ Polypropylene Sidewall Termination of Air and Vent w/Field Supplied Fittings (Models 751 - 3501 only)*



3. The air piping must terminate in a down-turned elbow as shown in FIG. 4-1B. This arrangement avoids recirculation of flue products into the combustion air stream.
4. The vent piping must terminate in an elbow pointed outward or away from the air inlet, as shown in FIG. 4-1B.

⚠WARNING Do not exceed the maximum lengths of the outside vent piping shown in FIG. 4-1C. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential boiler shutdown.

Figure 4-1C *PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent (Models 751 - 1001 only)*

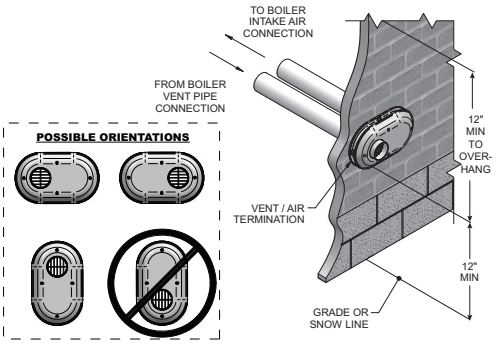


Table 4A *Sidewall Vent Kits*

Model	Kit #	Air	Vent	Centerline Width
751 - 1001	100157612	6" (152 mm)	6" (152 mm)	7 3/4" (197 mm)

Figure 4-2A *PVC/CPVC/ Polypropylene Sidewall Termination w/Field Supplied Fittings (Models 751 - 3501 only)*

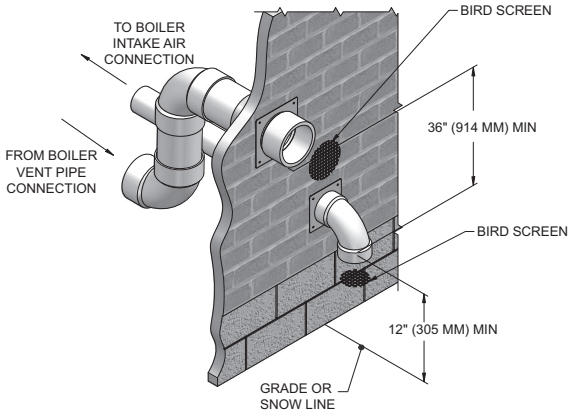
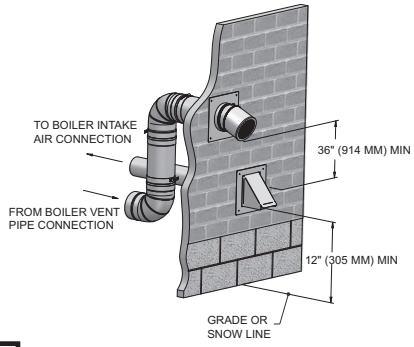


Figure 4-2B *Stainless Steel Sidewall Termination w/Field Supplied Fittings (Models 751 - 6001 only)*



NOTICE PVC/CPVC or ABS is acceptable air inlet pipe material.

5. Maintain clearances as shown in FIG.'s 4-1A thru 4-4, pages 25 thru 27. Also maintain the following:
   a. Vent must terminate:
      - At least 6 feet (1.8 m) from adjacent walls.
      - No closer than 12 inches (305 mm) below roof overhang.
      - At least 7 feet (2.1 m) above any public walkway.
      - At least 3 feet (.9 m) above any forced air intake within 10 feet (3 m).
      - No closer than 4 feet (1.2 m) below or horizontally from any door or window or any other gravity air inlet.
   b. Air inlet must terminate at least 12 inches (305 mm) above grade or snow line; at least 3 feet (.9 m) below the vent termination (FIG. 4-1B); and the vent pipe must not extend more than 24 inches (610 mm) vertically outside the building.
   c. Do not terminate closer than 4 feet (1.2 m) horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 4 feet (1.2 m) horizontally.
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

4 Sidewall direct venting *(continued)*

Vent/air termination – sidewall

Figure 4-3 *Clearance to Doors and Windows*

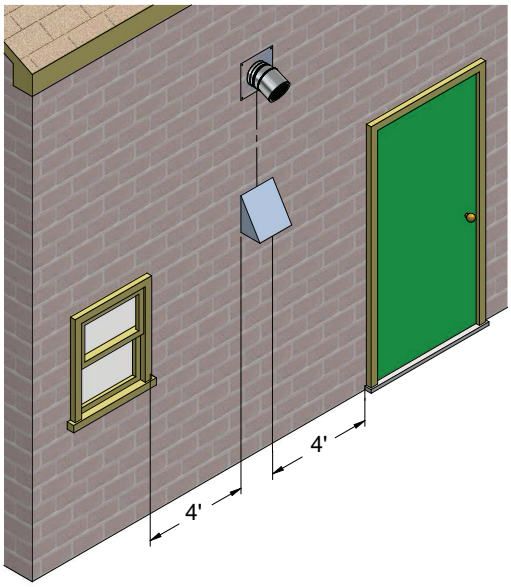
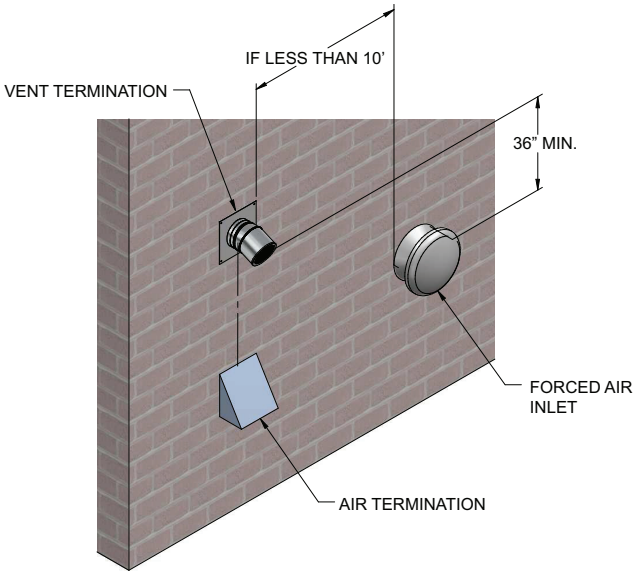


Figure 4-4 *Clearance to Forced Air Inlets*



⚠ CAUTION Sidewall venting commercial products will result in large exhaust plumes in cold climates. Consideration should be taken when locating in proximity to windows, doors, walkways, etc.

Prepare wall penetrations

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.

   Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole per the vent manufacturer's instructions.
2. Install the vent and air intake piping. Seal all gaps between the pipes and wall with RTV silicone sealant.
3. Seal all wall cavities.

Termination and fittings

1. The air termination must be oriented at least 12 inches above grade or snow line as shown in FIG. 4-1A, page 25.
2. Maintain the required dimensions of the finished termination piping as shown in FIG. 4-1A, page 25.
3. Do not extend exposed vent pipe outside of the building more than what is shown in this document. Condensate could freeze and block vent pipe.
4. Stainless steel terminations are designed to penetrate walls with a thickness up to 9.25 inches of standard construction.

Multiple vent/air terminations

1. When terminating multiple Crest boilers terminate each vent/air connection as described in this manual (FIG. 4-5).

⚠ WARNING All vent pipes and air inlets must terminate at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

4 Sidewall direct venting

2. Place wall penetrations to obtain minimum clearance of 36 inches (914 mm) between vent pipe and adjacent air inlet, as shown in FIG. 4-5 for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 Installation Code.

3. The air inlet of a Crest is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

Figure 4-5 *Multiple Vent Terminations (must also comply with* ***Figure 4-1A****)*

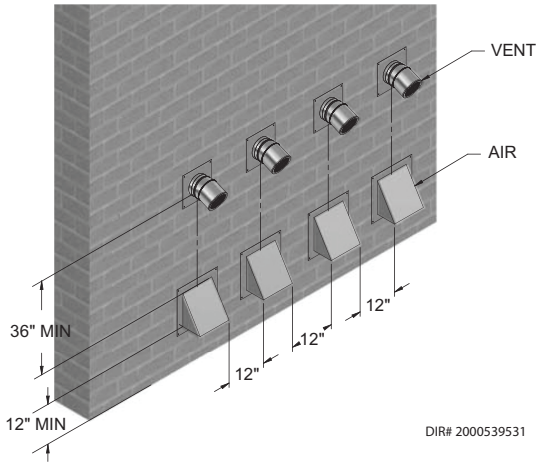


Figure 4-6 *Direct Vent Terminations*

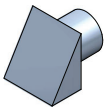
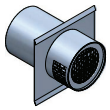
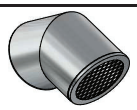
DIRECT VENT TERMINATIONS			
Air Inlet		Vent Termination	
Dryer Inlet		Straight	
90° Elbow		Mitered	
		23° Elbow	

Figure 4-7 *Room Air (Direct Exhaust Terminations)*

ROOM AIR (DIRECT EXHAUST TERMINATIONS)	
Vent Termination	
23° Elbow	
45° Elbow	

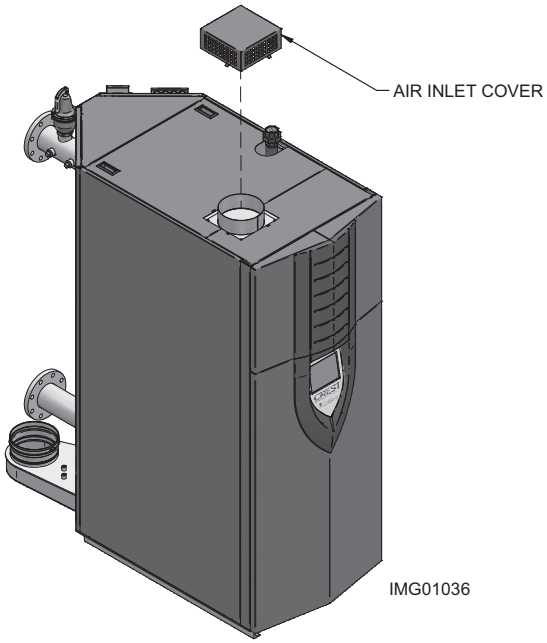
Room air

The Crest boiler may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room.

Follow the requirements in the General Venting, Sidewall Direct Venting, and Vertical Direct Venting sections for vent material specifications, vent length requirements, and vent termination requirements.

Install the air inlet cover (shipped loose with the boiler) per FIG. 4-8. Combustion and ventilation air must be supplied to the equipment room per the requirements on pages 12 and 13 of this manual for proper operation of the Crest boiler when utilizing the single pipe method.

Figure 4-8 *Room Air Installation*



5 Hydronic piping

System water piping methods

The Crest is designed to function in a closed loop pressurized system not less than 12 psi (83 kPa) (Non-metallic system piping must have an oxygen barrier to be considered a closed loop). A temperature and pressure gauge is included to monitor system pressure and outlet temperature and should be located on the boiler outlet.

It is important to note that the boiler has a pressure drop which must be figured in when sizing the circulators. Each boiler installation must have an air elimination device, which will remove air from the system.

Install the boiler so the gas ignition system components are protected from water (dripping, spraying, etc.) during appliance operation or basic service of circulator replacement, valves, and others.

Observe a minimum of 1/4 inch (6 mm) clearance around all un-insulated hot water pipes when openings around the pipes are not protected by non-combustible materials.

Low water cutoff device

An electronic low water cutoff is provided as standard equipment on all models. The low water cutoff should be inspected every 6 months.

Chilled water system

If the boiler supplies hot water to heating coils in air handler units, flow control valves or other devices must be installed to prevent gravity circulation of heater water in the coils during the cooling cycle. A chilled water medium must be piped in parallel with the heater.

Freeze protection

Freeze protection for new or existing systems must use glycol that is specially formulated for this purpose. This includes inhibitors, which prevent the glycol from attacking the metallic system components. Make certain to check that the system fluid is correct for the glycol concentration and inhibitor level. The system should be tested at least once a year and as recommended by the producer of the glycol solution. Allowance should be made for the expansion of the glycol solution in the system piping.

⚠WARNING Use only inhibited propylene glycol solutions, which are specifically formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems.

General piping information

IMPORTANT All boiler piping must contain an oxygen barrier. This will help prevent any excess oxygen from entering the system.

Basic steps are listed below along with illustrations on the following pages, which will guide you through the installation of the Crest (FIG's 5-2 thru 5-5).

1. Connect the system return to the flanged connection marked "Inlet", make sure to install with a suitable gasket between flanges.
2. Connect the system supply to the flanged connection marked "Outlet", make sure to install with a suitable gasket between flanges.
3. Install purge and balance valve or shutoff valve and drain on system return to purge air out of each zone.
4. Install a backflow preventer on the cold feed makeup water line.
5. Install a pressure reducing valve on the cold feed makeup water line, (15 psi (103 kPa) nominal). Check temperature and pressure gauge, which should read a minimum pressure of 12 psi (83 kPa).
6. Install the circulators as shown on the piping diagrams in this section. Make sure the circulators are properly sized for the system and friction loss. Install check valves with each boiler circulator.
7. Install an expansion tank on the system supply. Consult the tank manufacturer's instruction for specific information relating to tank installation. Size the expansion tank for the required system volume and capacity.
8. Install an air elimination device on the system supply.
9. This appliance is supplied with a relief valve sized in accordance with ASME Boiler and Pressure Vessel Code, Section IV ("Heating Boilers"). The safety relief valve is installed at the factory and is located on the rear of the boiler. Pipe the discharge of the safety relief valve to prevent injury in the event of pressure relief. Pipe the discharge to a drain. Provide piping that is the same size as the safety relief valve outlet. Never block the outlet of the safety relief valve.
10. Install a field supplied strainer to prevent damage to the heat exchanger caused by debris entering from the system piping. When installing in a pre-existing system, a strainer/filter capable of removing debris left in the system is recommended.

See the piping illustrations included in this section, FIG.'s 5-2 thru 5-5 for suggested guidelines in piping the Crest.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 Hydronic piping

Circulator sizing

The Crest heat exchanger does have a pressure drop, which must be considered in your system design. Refer to the graphs in FIG.'s 5-1A and 5-1B for pressure drop through the Crest heat exchanger.

Figure 5-1A *Pressure Drop vs. Flow (Models 751 - 2001)*

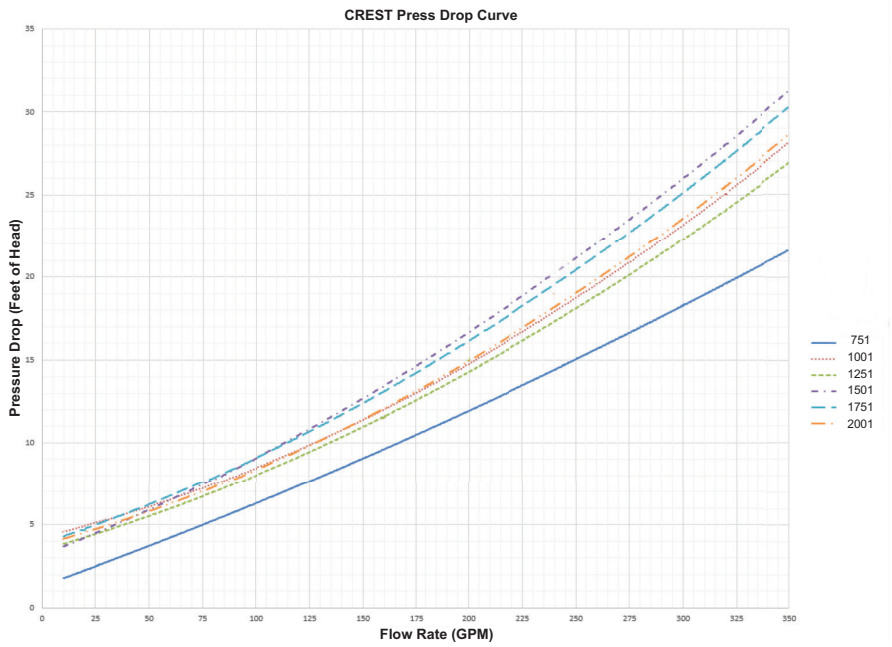
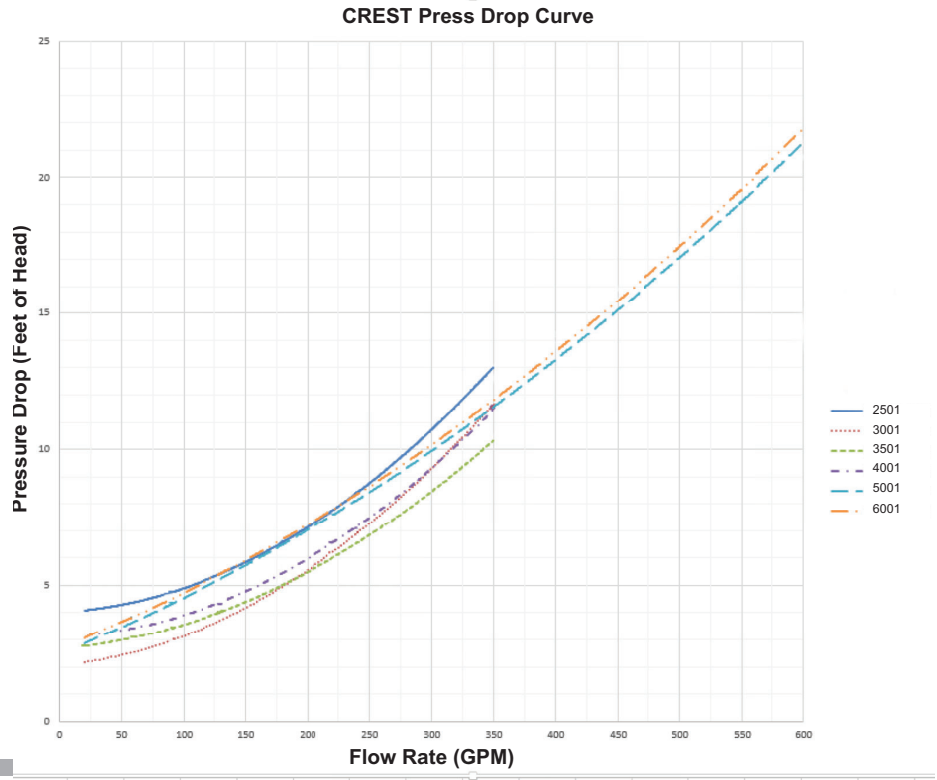


Figure 5-1B *Pressure Drop vs. Flow (Models 2501 - 6001)*



5 Hydronic piping *(continued)*

Table 5A *Sizing Information for Temperature Rise Applications_20°F, 40°F and 60°F*

TEMPERATURE RISE APPLICATIONS							
Model	BOILER CONNECTION SIZE	20°F		40°F		60°F	
		GPM	FT/HD	GPM	FT/HD	GPM	FT/HD
FB 0751	3"	72	4.8	36	3.0	24	2.5
FB 1001	3"	96	8.3	48	6.0	32	5.5
FB 1251	3"	120	9.2	60	6.0	40	4.1
FB 1501	4"	144	12.3	72	7.3	48	5.8
FB 1751	4"	168	13.8	84	8.1	56	6.7
FB 2001	4"	192	14.5	96	8.1	64	6.6
[FB 751 - 2001 models are based on 96% AHRI Efficiency]							
FB 2501	4"	240	8.4	120	5.3	80	4.8
FB 3001	4"	288	8.0	144	4.0	96	3.3
FB 3501	4"	336	9.9	168	5.0	112	3.8
FB 4001	4"	350*	10.9	192	5.9	128	4.4
FB 5001	6"	480	13.9	240	7.6	160	5.5
FB 6001	6"	576	17.2	288	9.4	192	6.8
[Models FB 2501 - 3501 and 6001 based on 96% AHRI Efficiency and Models FB 4001 - 5001 based on 96% Efficiency] *Flow is based on 22°F ΔT.							

NOTICE The pressure drop reflected in FIG. 5-1 is for the **boiler only**. Additional allowances must be made for piping, especially if sizing pumps for Primary/Secondary applications.

NOTICE It is required that boiler piping systems utilize ***Primary/Secondary or Fixed or Variable Flow Primary*** configurations as shown in FIG.'s 5-2 thru 5-5. The use of other boiler piping configurations could result in improper building and system flow rates leading to inadvertent boiler high limit shutdowns and poor system performance.

5 Hydronic piping

Near boiler piping components

1. **Boiler piping:**
   Boiler system piping should be sized per the pipe requirements listed in Tables 5A and 5C.
2. **Boiler circulating pump:**
   Field supplied. When using Primary/Secondary piping the boiler circulating pump should be sized per Table 5A.
3. **Hot Water Generator circulating pump:**
   Field supplied. When installed in a Primary/Secondary arrangement, the Crest requires an additional pump for the Hot Water Generator Loop. The pump should be sized per Table 5A. Consult the indirect water heater operating guide to determine flow characteristics for the selected product used. The pump's total flow and heat requirements are the sum of the boiler and the indirect water heater.
4. **Boiler isolation valves:**
   Field supplied. Full port valves are required. Failure to use full port valves could result in a restricted flow rate through the boiler.
5. **Check valves:**
   Field supplied. Check valves are required for installation as shown in FIG.'s 5-2 and 5-3. Failure to install check valves could result in a reverse flow condition during pump(s) off cycle.
6. **Domestic indirect hot water isolation valves:**
   Field supplied. Full port valves are required. Failure to use full port valves could result in a restricted flow rate through the boiler.
7. **Anti-scald mixing valve:**
   Field supplied. An anti-scald mixing valve is recommended when storing domestic hot water above 115°F (46°C).
8. **Pressure relief valve:**
   Factory supplied. The pressure relief valve is sized to ASME specifications.
9. **System temperature sensor:**
   Lochinvar supplies a system temperature sensor. The sensor is to be installed in the heating loop downstream from the boiler hot water piping and heating loop junction. The sensor should be located far enough downstream to sense system diluted water temperature.
10. **Water Meter:**
    Field supplied. A water meter to monitor makeup water is recommended. Makeup water volume should not exceed 5% of total system per year.

NOTICE A system supply sensor (factory supplied) MUST BE installed with Primary/Secondary systems for proper boiler operation.

11. **Y-Strainer:**
    Field supplied. Install a Y-strainer or equivalent multi-purpose strainer just before the boiler pump at the inlet of the heat exchanger. This item is used to remove system debris from older hydronic systems and to protect newer systems.

⚠ CAUTION The maximum allowable water flow rate through a single Crest boiler is 350 GPM for the 751 - 4001 models and up to 600 GPM for the 5001 - 6001 models. Exceeding this flow rate will result in damage to the heat exchanger and/or piping.

NOTICE Reference Table 5B1 for the minimum recommended flow rate through a single Crest boiler at full fire to maintain a 80°F temperature rise. Reference Table 5B2 for the absolute minimum flow rate through a single Crest boiler.

Table 5B1 *Minimum Flow Rate with the Boiler at Full Fire*

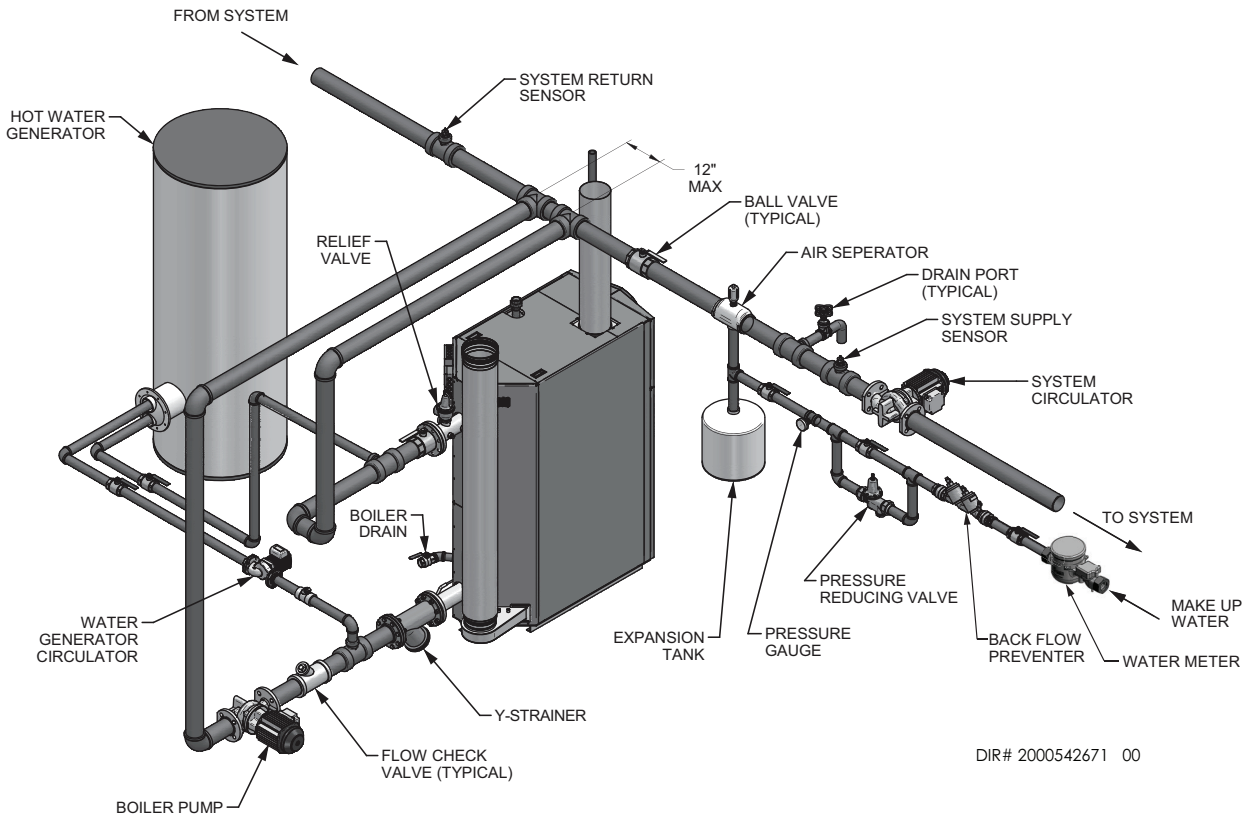
TEMPERATURE RISE APPLICATIONS	
MODEL	**FLOW RATE (GPM)**
FB(N,L)0751	18
FB(N,L)1001	24
FB(N,L)1251	30
FB(N,L)1501	36
FB(N,L)1751	42
FB(N,L)2001	48
FB(N,L)2501	60
FB(N,L)3001	72
FB(N,L)3501	84
FB(N,L)4001	96
FB(N,L)5001	120
FB(N,L)6001	144
[Based on 80°F Temperature Rise]	

Table 5B2 *Absolute Minimum Flow Rate*

ABSOLUTE MINIMUM FLOW RATE	
MODEL	**FLOW RATE (GPM)**
FB(N,L)0751	18
FB(N,L)1001	18
FB(N,L)1251	18
FB(N,L)1501	25
FB(N,L)1751	25
FB(N,L)2001	25
FB(N,L)2501	25
FB(N,L)3001	25
FB(N,L)3501	45
FB(N,L)4001	45
FB(N,L)5001	50
FB(N,L)6001	60

5 Hydronic piping *(continued)*

Figure 5-2 *Single Boiler - Recommended - Primary / Secondary Piping with a Hot Water Generator*



NOTICE System flow should always remain higher than the required flow for the boiler(s) when the boiler(s) is in operation to prevent short cycling and high limit issues.

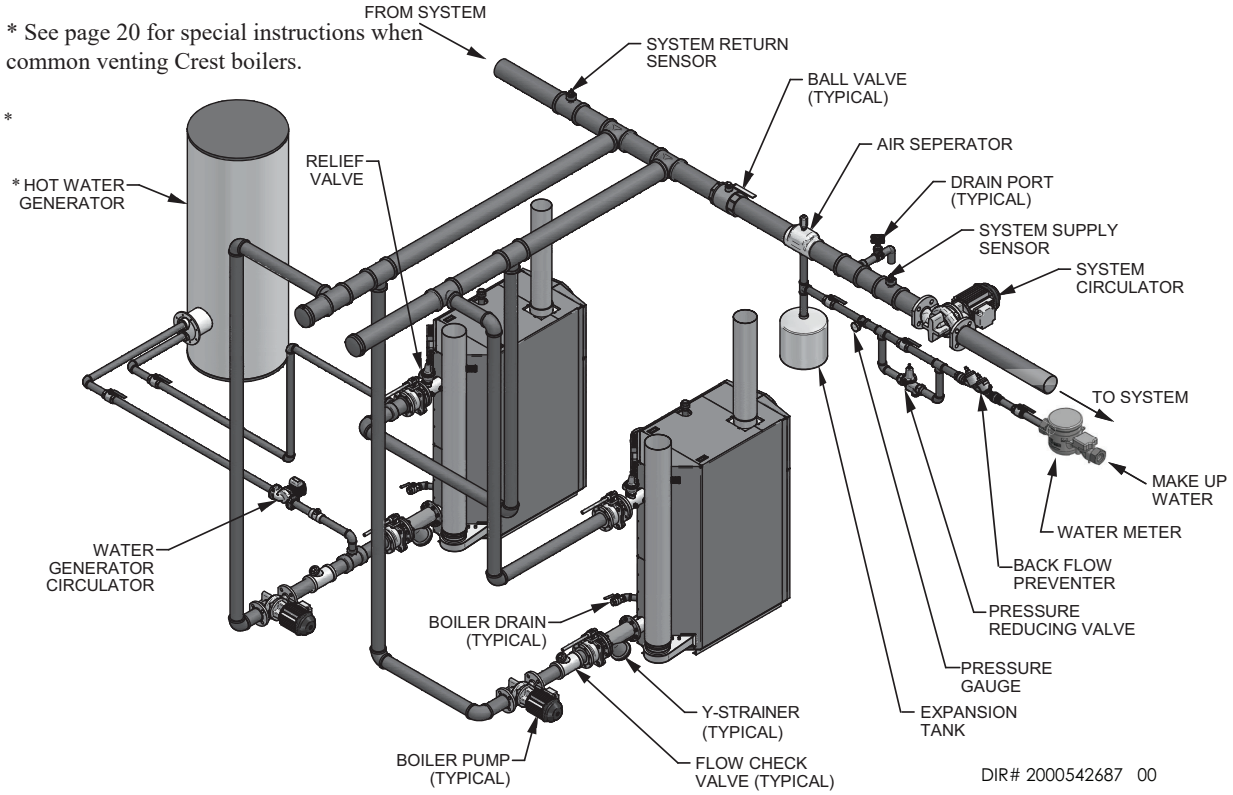
NOTICE Please note that these illustrations are meant to show piping concepts only, the installer is responsible for all equipment. The installer must follow all manufacturer's installation instructions for each system component. The installer is responsible for compliance with local codes.

5 Hydronic piping

Model	Number of Units						
	2	3	4	5	6	7	8
	Recommended Common Header Pipe Sizes in Inches						
FB 0751	4	4	5	5	6	6	8
FB 1001	4	5	5	6	8	8	8
FB 1251	5	5	6	8	8	8	10
FB 1501	5	6	8	8	8	10	10
FB 1751	5	6	8	8	10	10	10
FB 2001	6	6	8	8	10	10	12
FB 2501	5	5	6	8	8	8	10
FB 3001	5	6	8	8	8	10	10
FB 3501	5	6	8	8	10	10	10
FB 4001	6	6	8	8	10	10	12
FB 5001	6	8	8	10	10	12	12
FB 6001	8	8	10	10	12	12	14
[Based on a boiler ΔT of 30°F.]							

NOTICE A system supply sensor (factory supplied) MUST BE installed for proper boiler operation.

Figure 5-3 *Multiple Boilers - Common Header - Recommended - Primary / Secondary Flow*

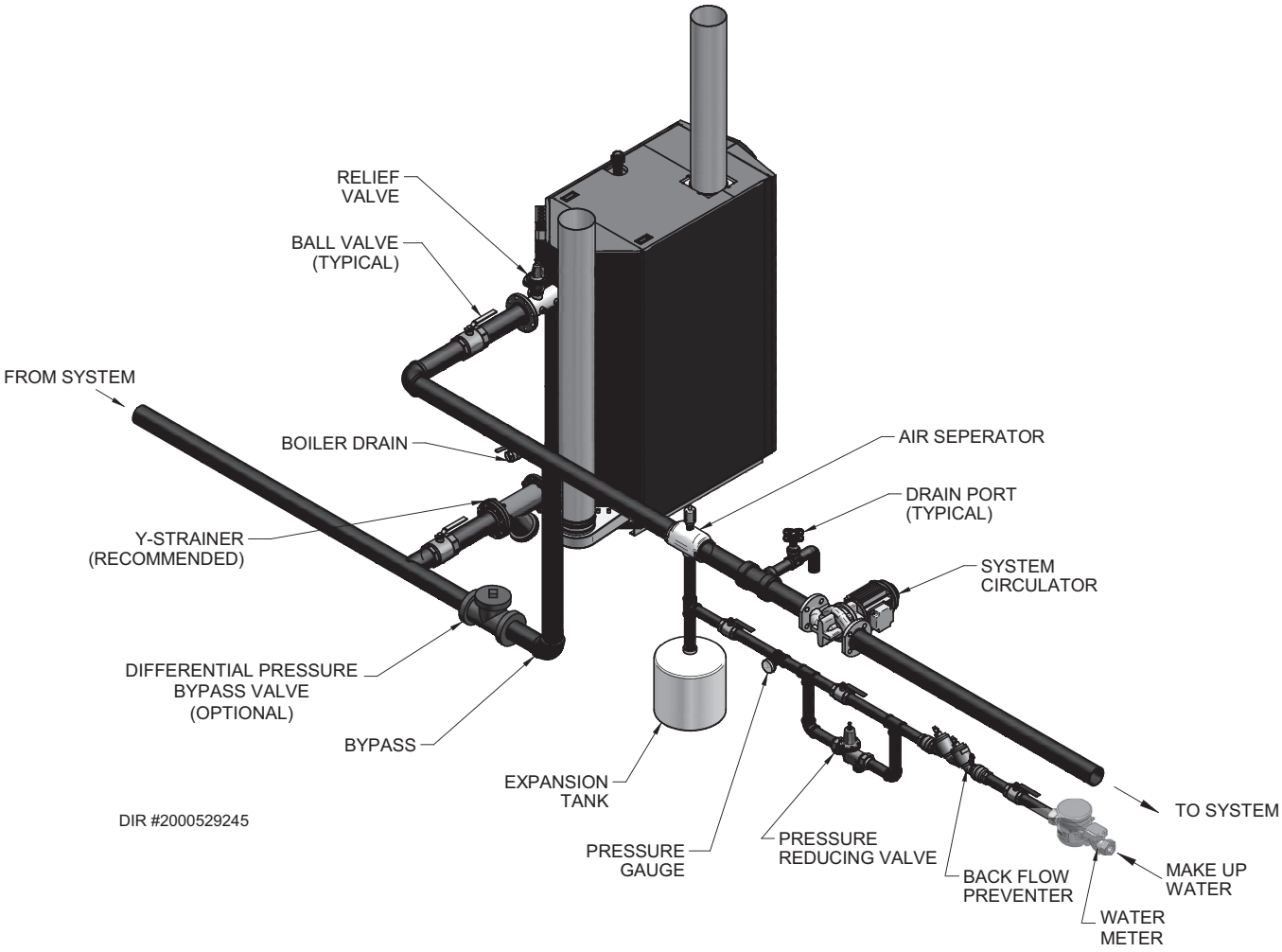


NOTICE System flow should always remain higher than the required flow for the boiler(s) when the boiler(s) is in operation to prevent short cycling and high limit issues.

NOTICE Please note that these illustrations are meant to show piping concepts only, the installer is responsible for all equipment. The installer must follow all manufacturer's installation instructions for each system component. The installer is responsible for compliance with local codes.

5 Hydronic piping *(continued)*

Figure 5-4 *Single Boiler - Alternate - Fixed or Variable Flow Primary System Piping*

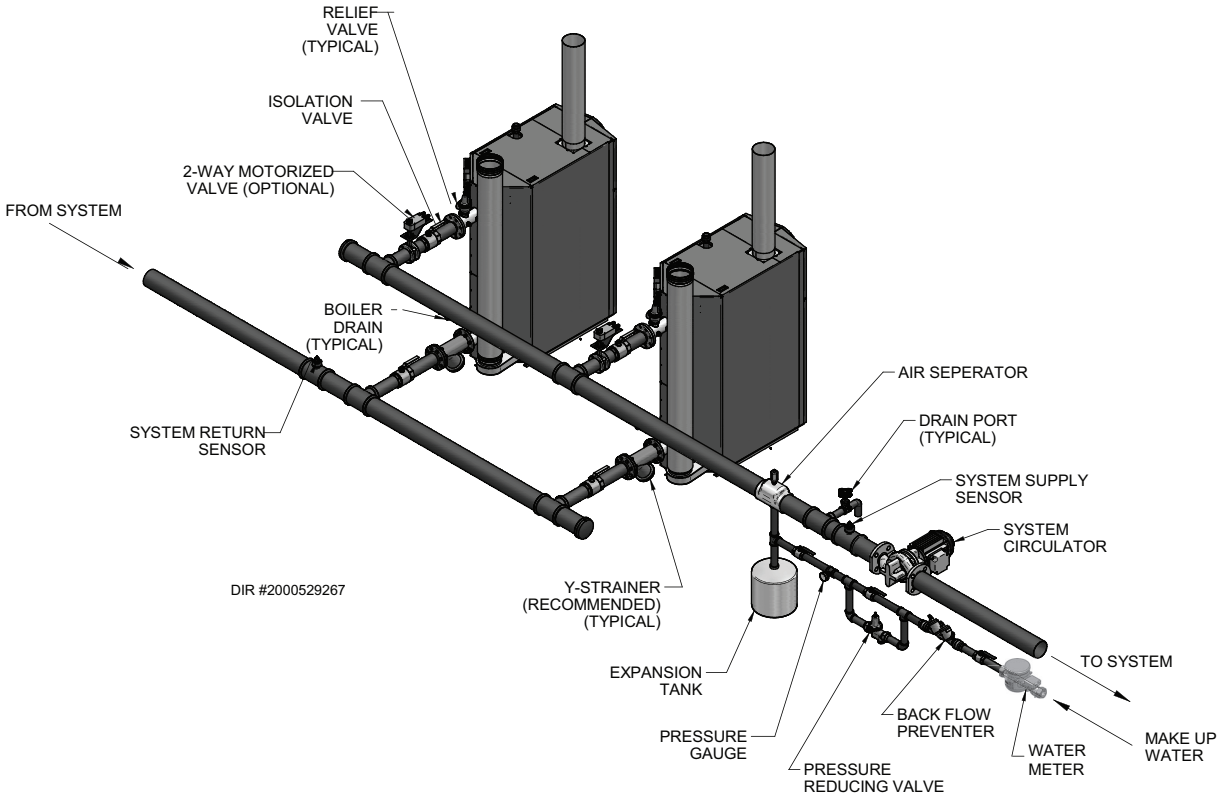


NOTICE Please note that these illustrations are meant to show piping concepts only, the installer is responsible for all equipment. The installer must follow all manufacturer's installation instructions for each system component. The installer is responsible for compliance with local codes.

5 Hydronic piping

Model	Number of Units						
	2	3	4	5	6	7	8
	Recommended Common Header Pipe Sizes in Inches						
FB 0751	4	4	5	5	6	6	8
FB 1001	4	5	5	6	8	8	8
FB 1251	5	5	6	8	8	8	10
FB 1501	5	6	8	8	8	10	10
FB 1751	5	6	8	8	10	10	10
FB 2001	6	6	8	8	10	10	12
FB 2501	5	5	6	8	8	8	10
FB 3001	5	6	8	8	8	10	10
FB 3501	5	6	8	8	10	10	10
FB 4001	6	6	8	8	10	10	12
FB 5001	6	8	8	10	10	12	12
FB 6001	8	8	10	10	12	12	14
[Based on a boiler ΔT of 30°F.]							

Figure 5-5 *Multiple Boilers - Alternate - Common Header - Fixed or Variable Flow Primary*



NOTICE Please note that these illustrations are meant to show piping concepts only, the installer is responsible for all equipment. The installer must follow all manufacturer's installation instructions for each system component. The installer is responsible for compliance with local codes.

NOTICE When installing multiple Crest boilers in fixed or variable flow primary applications, utilize a reverse-return or other piping method to ensure balanced flow through each boiler.

6 Gas connections

Gas supply

NOTICE Ensure that the high gas pressure regulator is at least 10 feet (3 m) upstream of the appliance.

NOTICE The gas inlet size has been designed to allow the minimum of 10 feet between the boiler and regulator and for a maximum pressure drop of 1" w.c.

1. It is recommended to install one (1) gas regulator for each Crest boiler.
2. Gas regulators should be installed in a horizontal orientation unless otherwise recommended by the regulator manufacturer.
3. It is recommended to install a filter at the inlet of a gas regulator to prevent debris from entering the regulator.
4. Gas regulators should be installed the greater of either 20 inches or 10 pipe diameters from the nearest fitting, elbow, or valve to the outlet of the regulator.
5. It is recommended that the gas regulator outlet size match the gas inlet size of the boiler and to not change the pipe size between them. If the pipe diameter must be increased, a bell reducer type fitting should be located at the regulator outlet and the boiler inlet, maintaining the distance indicated in Step 4.
6. Gas regulators must be properly vented to ensure proper function:
   a. Vent pipe must be no smaller than the regulator vent connection size.
   b. Each regulator must have a separate vent line.
   c. Vent lines must not be combined together or with any other equipment that also requires atmospheric vents.
   d. Excessive gas regulator vent length will detrimentally affect regulator performance:
   - Gas regulators must be properly vented according to the regulator manufacturer's instructions.
   - It is recommended that regulator vent length not exceed 15 equivalent feet (4.5 m).
   - When regulator vent must exceed 15 equivalent feet, it is recommended to use a ventless regulator equipped with a vent limiter.
   - If a ventless regulator cannot be utilized, it is recommended to increase vent diameter by one pipe size after the initial 15 equivalent feet and every additional 10 equivalent feet.

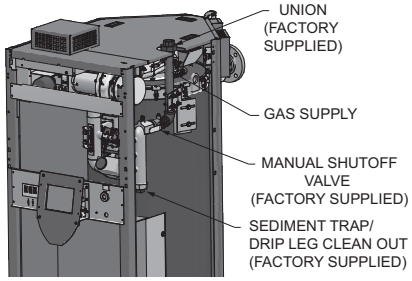
   e. Proper measures must be taken to prevent water, snow, insects, or other debris from obstructing the vent.

Connecting gas supply piping

NOTICE For dual fuel models, reference the Crest Dual Fuel Supplemental Manual.

1. Refer to FIG. 6-1 to pipe gas to the boiler.
   a. Install ground joint union for servicing, when required.
   b. In Canada – When using manual main shutoff valves, it must be identified by the installer.

Figure 6-1 *Gas Supply Piping*



2. Support piping with hangers, not by the boiler or its accessories.

⚠WARNING The gas valve and blower will not support the weight of the piping. Do not attempt to support the weight of the piping with the boiler or its accessories. Failure to comply could result in severe personal injury, death, or substantial property damage.

3. Purge all air from the gas supply piping.
4. Before placing the boiler in operation, check the boiler and its gas connection for leaks.
   a. The appliance must be disconnected from the gas supply piping system during any pressure testing of that system at a test pressure in excess of 1/2 PSIG (3.5 kPa).
   b. The appliance must be isolated from the gas supply piping system by closing a manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG (3.5 kPa).
   c. The appliance and its gas connection must be leak tested before placing it in operation.

⚠WARNING Do not check for gas leaks with an open flame – use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

5. Use pipe sealing compound compatible with propane gases. Apply sparingly only to male threads of the pipe joints so that pipe dope does not block gas flow.

⚠WARNING Failure to apply pipe sealing compound as detailed in this manual can result in severe personal injury, death, or substantial property damage.

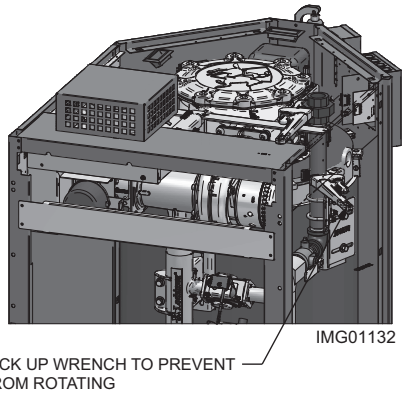
Table 6A *Gas Inlet Size*

Model	Gas Inlet Size
FB0751 - FB1001	1 1/4"
FB1251 - FB2001	1 1/2"
FB2501 - FB3501	2"
FB4001 - FB5001	2 1/2"
FB6001	3"

6 Gas connections

⚠WARNING Use two wrenches when tightening gas piping at boiler (FIG. 6-2), using one wrench to prevent the boiler gas line connection from turning. Failure to support the boiler gas connection pipe to prevent it from turning could damage gas line components.

Figure 6-2 *Inlet Pipe with Backup Wrench*



NOTICE Maximum inlet gas pressure must not exceed the value specified. Minimum value listed is for the purposes of input adjustment.

Natural gas:

⚠WARNING Check boiler rating plate to determine which fuel the boiler is set for. Crest boilers CANNOT be field converted. Failure to comply could result in severe personal injury, death, or substantial property damage.

Pipe sizing for natural gas

1. Refer to Table 6B for pipe length and diameter. Based on rated boiler input (divide by 1,000 to obtain cubic feet per hour).
   a. Table 6B is only for natural gas with specific gravity 0.60, with a pressure drop through the gas piping of 0.3 inches w.c.
   b. For additional gas pipe sizing information, refer to the National Fuel Gas Code, NFPA 54 / ANSI Z223.1 - latest edition, or in Canada CSA B149.1 Installation Code.

Natural gas supply pressure requirements

1. Target a supply pressure of 7 inches w.c. (1.7 kPa) measured when the boiler is operating at minimum input rate. Gas pressure can be adjusted higher or lower than 7 inches w.c. as needed.
2. Pressure required at the gas valve inlet pressure port:
   • Maximum 14 inches w.c. (3.5 kPa) with boiler operating.
   • Minimum 4 inches w.c. (.99 kPa) with boiler operating.
3. Install 100% lockup gas pressure regulator in supply line for each boiler if inlet pressure exceeds 14 inches w.c. (3.5 kPa).
4. Gas valves used on Crest boilers are rated for at least 27 inches w.c. (6.7 kPa).

Propane Gas:

⚠WARNING Check boiler rating plate to determine which fuel the boiler is set for. Crest boilers CAN NOT be field converted. Failure to comply could result in severe personal injury, death, or substantial property damage.

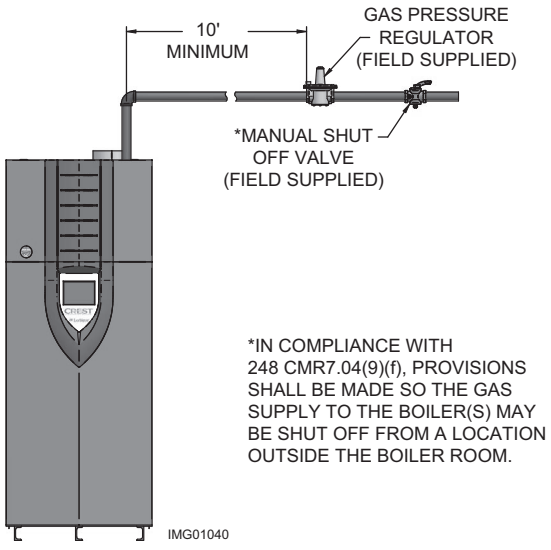
Pipe sizing for propane gas

1. Contact gas supplier to size pipes, tanks, and 100% lockup gas pressure regulator.

Propane Supply Pressure Requirements

1. Target a supply pressure of 11 inches w.c. (2.7 kPa) measured when the boiler is operating at minimum input rate. Gas pressure can be adjusted higher or lower than 11 inches w.c. as needed.
2. Adjust propane supply regulator provided by the gas supplier for 14 inches w.c. (3.5 kPa) maximum pressure.
3. Pressure required at gas valve inlet pressure port:
   • Maximum 14 inches w.c. (3.5 kPa) with boiler operating.
   • Minimum 4 inches w.c. (.99 kPa) with boiler operating.

Figure 6-3 *Gas Supply Piping to Regulator*



6 Gas connections *(continued)*

Table 6B *Natural Gas Pipe Size Chart*

TABLE - 6B
Capacity of Schedule 40 Metallic Pipe in Cubic Feet of Natural Gas Per Hour
(based on .60 specific gravity, 0.30" w.c. pressure drop)

Pipe Size (Inches)	Length of Pipe in Straight Feet													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/2	131	90	72	62	55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3/4	273	188	151	129	114	104	95	89	83	79	70	63	58	N/A
1	514	353	284	243	215	195	179	167	157	148	131	119	109	102
1 1/4	1,060	726	583	499	442	400	368	343	322	304	269	244	224	209
1 1/2	1,580	1,090	873	747	662	600	552	514	482	455	403	366	336	313
2	3,050	2,090	1,680	1,440	1,280	1,160	1,060	989	928	877	777	704	648	602
2 1/2	4,860	3,340	2,680	2,290	2,030	1,840	1,690	1,580	1,480	1,400	1,240	1,120	1,030	960
3	8,580	5,900	4,740	4,050	3,590	3,260	3,000	2,790	2,610	2,470	2,190	1,980	1,820	1,700
4	17,500	12,000	9,660	8,270	7,330	6,640	6,110	5,680	5,330	5,040	4,460	4,050	3,720	3,460

Check inlet gas supply

⚠ WARNING DO NOT adjust or attempt to measure gas valve outlet pressure. Attempting to alter or measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

The gas piping must be sized for the proper flow and length of pipe, to avoid excessive pressure drop. Both the gas meter and the gas regulator must be properly sized for the total gas load.

If gas pressure drops more than 1 inch w.c. (249 Pa) between maximum and minimum input rate, the meter, regulator, or gas line may be undersized or in need of service. Perform the steps below when checking inlet gas supply:

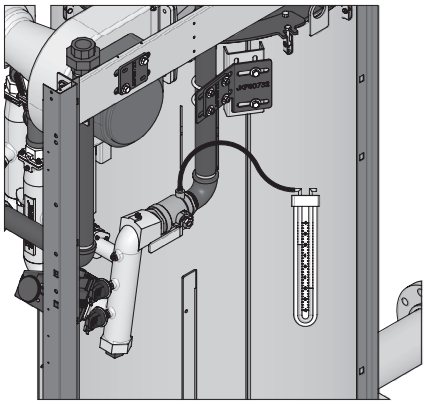
1. Turn the main power switch to the "OFF" position.
2. Shut off gas supply at the manual gas valve in the gas piping to the appliance.
3. Remove the 1/8" pipe plug on the flange to the factory supplied gas shutoff valve and install a suitable 1/8" fitting (field supplied) for the manometer tubing. Place the tubing of the manometer over the tap once the 1/8" fitting is installed as shown in FIG. 6-4.
4. Slowly turn on the gas supply at the factory installed manual gas valve.
5. Turn the power switch to the "ON" position.
6. Adjust the temperature set point on the control panel of the SMART TOUCH control module to call for heat or utilize Service Mode, see page 51 of this manual.
7. Observe the gas pressure with the burner operating at 100% of rated input. Without turning off the boiler, reduce the burner to the minimum input rate and observe the gas pressure with the burner at the minimum input rate. Percent of burner input will be displayed on the Modulation Screen.
8. Ensure inlet pressure is within specified range. Minimum and maximum gas supply pressures are specified in this section of the manual.
9. If gas supply pressure is within normal range and no adjustments are needed, proceed on to Step 11.
10. If the gas pressure is out of range, contact the gas utility, gas supplier, qualified installer or service agency to determine the necessary steps to provide proper gas pressure to the control.
11. Turn the power switch to the "OFF" position.
12. Shut off the gas supply at the manual gas valve in the gas piping to the appliance.
13. Remove the manometer from the pressure tap on top of the gas valve. Remove the 1/8" (3 mm) field supplied fitting and reinstall the pipe plug removed in Step 3.

6 Gas connections

⚠WARNING Do not check for gas leaks with an open flame -- use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

14. Turn on the gas supply at the manual gas valve.
15. Turn the power switch to the "ON" position.
16. Adjust the temperature set point on the control panel of the SMART TOUCH control module to the desired water temperature so the appliance will call for heat.
17. Check burner performance by cycling the system while you observe burner response. The burner should ignite promptly. Flame pattern should be stable. Turn system off and allow burner to cool, then cycle burner again to ensure proper ignition and flame characteristics.

Figure 6-4 *Inlet Gas Supply Check*



Gas valve replacement

⚠WARNING The gas valve MUST NOT be replaced with a conventional gas valve under any circumstances. Failure to follow all precautions could result in fire, explosion, or death!

⚠WARNING DO NOT adjust or attempt to measure gas valve outlet pressure. Attempting to alter or measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

7 Field wiring

⚠ WARNING ELECTRICAL SHOCK HAZARD – For your safety, turn off electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

NOTICE Wiring must be N.E.C. Class 1.

If original wiring as supplied with boiler must be replaced, use only type 105°C wire or equivalent.

Boiler must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – latest edition.

⚠ CAUTION Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Installation must comply with:

1. National Electrical Code and any other national, state, provincial, or local codes, or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

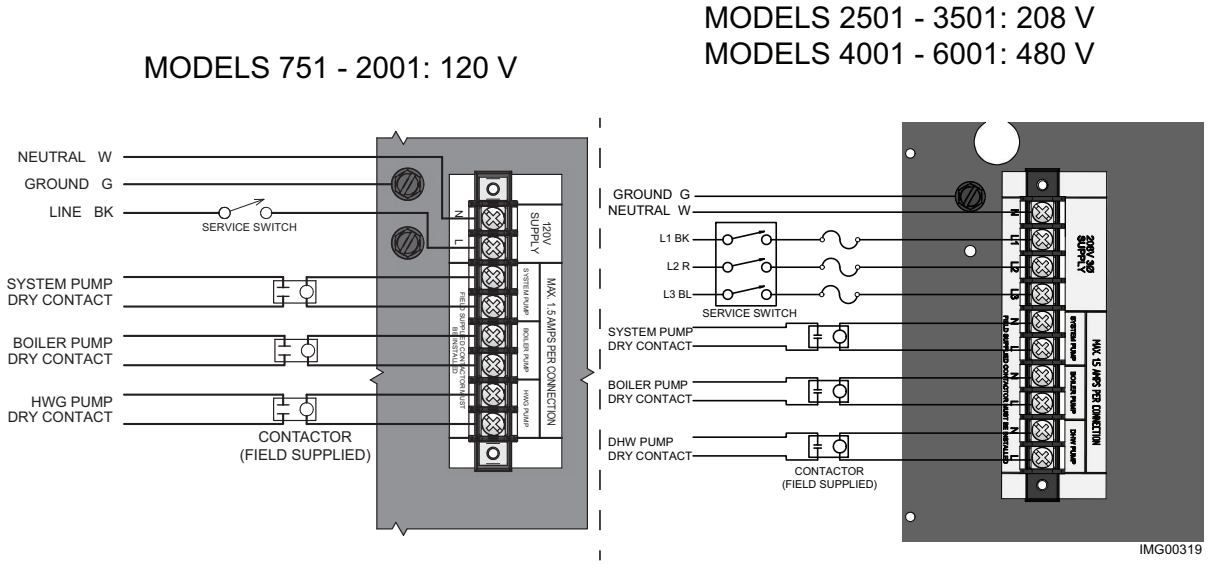
Line voltage connections - Models 751 - 2001, 120 VAC, 1Φ

1. Connect 120 VAC 1Φ power wiring to the line voltage terminal strip in the junction box, as shown in FIG. 7-1.
2. Provide and install a fused disconnect or service switch sized per the boiler amp draw (shown on the boiler rating plate) as required by the code (see FIG. 7-1).
3. When connecting the boiler, system and hot water generator pumps connect the wiring to the line voltage terminal strip as shown in FIG. 7-1. Maximum current is 1.5 amps. Install a field supplied contactor between the pump(s) and the boiler connections.
4. For alternate voltages, consult factory.

Line voltage connections - Models 2501 - 3501 208 VAC 3Φ / 4001 - 6001 480 VAC 3Φ

1. Connect 208 / 480 VAC 3Φ Wye power wiring to the line voltage terminal strip in the junction box, as shown in FIG. 7-1.
2. Provide and install a fused disconnect or service switch sized per the boiler amp draw (shown on the boiler rating plate) as required by the code (see FIG. 7-1).
3. When connecting the boiler, system and hot water generator pumps connect the wiring to the line voltage terminal strip as shown in FIG. 7-1. Maximum current is 1.5 amps. Install a field supplied contactor between the pump(s) and the boiler connections.
4. If the neutral wire is not used (480 VAC 3Φ Wye) or is unavailable (480 VAC 3Φ Delta), connect a jumper between the neutral and the ground terminals on the line voltage terminal strip.
5. For alternate voltages, consult factory.

***Figure 7-1 Boiler** Line Voltage Field Wiring Connections*

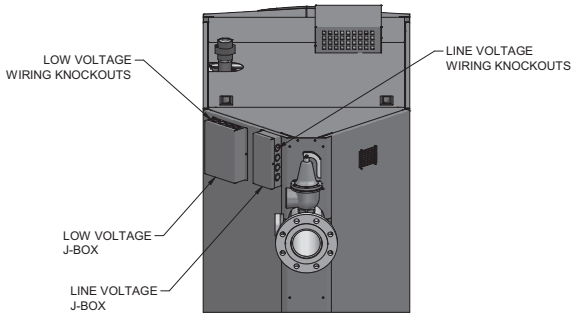


7 Field wiring

Low voltage connections

1. Route all low voltage wires through the knockouts in the rear of the boiler, as shown in FIG. 7-2.
2. Connect low voltage wiring to low voltage connection board as shown in FIG. 7-3 on page 44 of this manual and the boiler wiring diagram.

***Figure 7-2** Routing Field Wiring*



Enable

1. Connect the room thermostat or boiler enable contacts (isolated contact only) to terminals 7 and 8, as shown in FIG. 7-3.
2. If a thermostat is used, install the thermostat on the inside wall away from influences of drafts, hot or cold water pipes, lighting fixtures, television, sunlight, or fireplaces.
3. Thermostat anticipator (if applicable):
   a. If connected directly to boiler, set for 0.1 amps.
   b. If connected to relays or other devices, set to match total electrical power requirements of connected devices. See device manufacturers' specifications and thermostat instructions for details.

Outdoor temperature sensor

1. Connect the outdoor temperature sensor (FIG. 7-3) to the Outdoor Sensor terminals on the connection board to enable outdoor reset operation of the Crest.
2. Mount the sensor on an exterior wall, shielded from direct sunlight or flow of heat or cooling from other sources.
3. Route sensor wires through a knockout at the rear of the boiler (see FIG. 7-2).

Variable speed system pump

If a variable speed pump is used in the primary loop, and a 0-10V signal is available from the pump speed control, this signal can be used by the SMART TOUCH control to anticipate changes in the building heat load. By connecting this 0 - 10V signal to the 0 - 10V SYS PUMP IN terminals, the boiler (or cascade) can modulate up and down as the primary flow increases and decreases.

ModBus / BACnet

The RS-485 ModBus / BACnet cable is connected to the ModBus terminals. Use shielded, 2-wire twisted pair cable. If desired, the shield can be connected to ground by installing a jumper wire between terminals 1 and 3 on connector X5 on the ModBus interface module.

Hot Water Generator (HW) thermostat

1. Connect the HW tank thermostat to the Tank Thermostat terminals on the connection board (FIG. 7-3).

Hot Water Generator (HW) tank sensor

1. By installing a HW tank sensor, the SMART TOUCH control can perform the tank thermostat function. The SMART TOUCH control automatically detects the presence of this sensor, and generates a HW call for heat when the tank temperature drops 6°F (3°C) below the tank set point, and finishes the call for heat when the tank temperature reaches the tank set point.
2. A #100170544 sensor MUST be used with any indirect tank. Failure to use the correct sensor will result in the tank temperature being either above or below the set point. Connect the correct sensor to the Tank Sensor terminals (see FIG. 7-3).

NOTICE See page 20 for special instructions when common venting Crest boilers.

Louver relay

If louvers need to operate before the boiler fires, they can be controlled by this output. Connect these terminals to a 24V relay coil, which is wired to operate the louvers (FIG. 7-3).

Louver proving switch

Louvers are used to provide combustion air for the room air option. A louver proving switch should be connected to the appropriate terminals and are verified prior to operation (see FIG. 7-3).

Boiler pump speed output

This 0 - 10V output is available to control the speed of a variable speed boiler pump. The SMART TOUCH control will vary the speed of this pump in order to maintain a minimum ΔT (set by the installer, see the Crest Service Manual) across the heat exchanger, as well as prevent high limit lockouts when the flow in the primary loop is extremely low. Connect this output to the 0 - 10V input on the boiler pump speed control.

NOTICE The system supply temperature must be provided for this feature to work. The temperature can be sensed directly with a system supply sensor, or sent through ModBus/BACnet. This feature is to be used with primary /secondary piping systems.

Rate output

This output provides a 0 - 10V signal that is proportional to the firing rate of the boiler. This may be used by a BMS system to monitor the actual rate of the boiler.

7 Field wiring *(continued)*

Auxiliary switch 1 & 2

Additional field supplied limit controls may be connected to the auxiliary switch inputs. If additional limit controls fail or open, it will result in a manual reset lockout.

System supply sensor

1. By installing the system supply sensor into the supply of the primary loop, the temperature of the system supply can be controlled. The SMART TOUCH control automatically detects the presence of this sensor, and controls the boiler firing rate to maintain the system supply temperature to the set point.

NOTICE DO NOT INSTALL THE SYSTEM SUPPLY SENSOR INTO THE SYSTEM RETURN.

2. For system supply sensor wiring information reference (FIG. 7-3).

NOTICE Unless a firing rate is being provided by a BMS system, a system supply sensor (factory supplied) MUST BE installed with Primary/Secondary piping systems for proper boiler operation.

Boiler management system

1. An external control may be connected to control either the firing rate or the set point of the boiler. Connect the 0 - 10 VDC terminals to the 0 - 10 VDC output of the external control. The SMART TOUCH control can be enabled using the Enable output (see page 44) or using the voltage applied to the 0 - 10 VDC input. Reference the Crest Service Manual for more details.

2. Make sure terminal #34 on the Low Voltage Connection Board is connected to the (-) or COM output terminal of the external control, and 0 - 10 VDC terminal #33 is connected to the 0 - 10 VDC terminal of the external control.

Runtime contacts

The SMART TOUCH control closes a set of dry contacts whenever the burner is running. This is typically used by Building Management Systems to verify that the boiler is responding to a call for heat.

Alarm contacts

The SMART TOUCH control closes another set of contacts whenever the boiler is locked out or the power is turned off. This can be used to turn on an alarm, or signal a Building Management System that the boiler is down.

System return sensor

1. Install the system return sensor into the return of the primary loop.
2. Connect the terminals to the system return sensor as shown in FIG. 7-3.

Wiring of the cascade

When wiring the boilers for Cascade operation, select one boiler as the Leader boiler. The remaining boilers will be designated as Members. See page 54 “Configuration of the Cascade” for a detailed explanation of this procedure.

Connect the system supply sensor and outdoor air sensor (if used) to the Leader boiler. For the Cascade system to work properly the system supply sensor must be installed. The location of the system supply sensor should be downstream of the boiler connections in the main system loop (FIG.’s 5-2 through 5-5). The system supply sensor should be wired to the Low Voltage Connection Board at the terminals marked for the system sensor (see FIG. 7-3). The Leader control will use the water temperature at the system supply sensor to control the operation of the Cascade.

If outdoor air reset is desired, the outdoor air sensor should be wired to the Low Voltage Connection Board at the terminals marked for the outdoor air sensor (FIG. 7-3). If the outdoor air sensor is connected, the Leader control will calculate the water temperature set point based on the programmed reset curve parameters. If the outdoor air sensor is not connected, the Leader control will maintain the fixed water temperature set point that is programmed into the control.

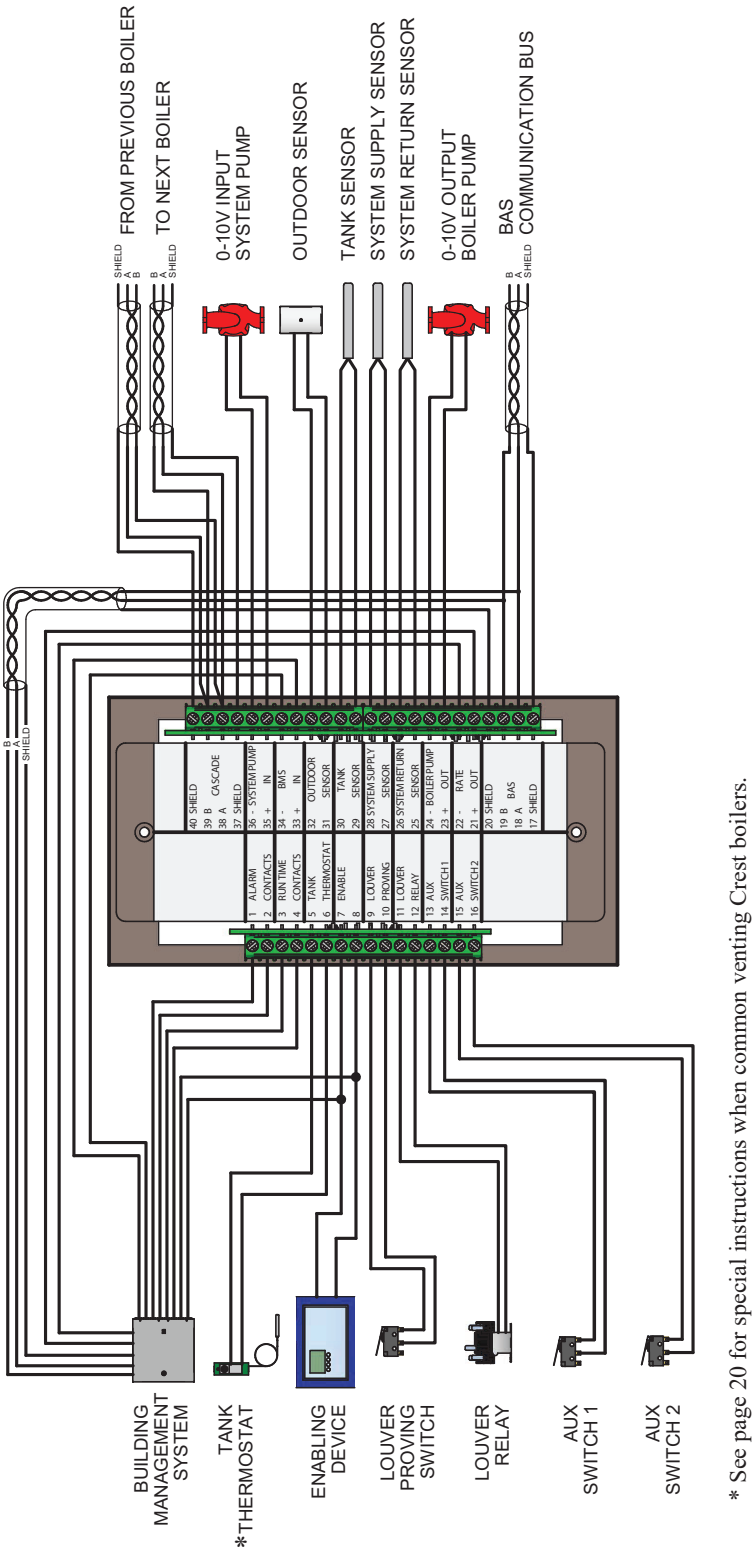
If a Thermostat or Zone Control Enable output is available, it should be wired to the Low Voltage Connection Board on the Leader boiler at the terminals marked Enable (FIG. 7-3). If the boilers are to run continuously, connect a jumper wire between the R and W terminals for the Enable input. This will initiate a call for heat on the Cascade.

Communication between the Leader boiler and the Member boilers is accomplished by using shielded, 2-wire twisted pair communication cable. Connect one of the twisted pair wires to Cascade terminal A on each of the Low Voltage Connection boards, and the other wire of the twisted pair to Cascade terminal B on each of the Low Voltage Connection Boards. Connect the shield wires to one of the shield terminals on the Low Voltage Connection Boards (FIG. 7-3). If more than two boilers are on the Cascade, daisy chain the wiring from the Cascade terminals on the second boiler to the Cascade terminals on the third boiler, then from the third to the forth, and so on. The connections between boilers can be made in any order, regardless of the addresses of the boilers. Try to keep each cable as short as possible.

When the Member 1 boiler is programmed as an alternate leader this allows the Member 1 boiler to automatically assume control of the Cascade should it lose communication with the Leader boiler. When programmed to YES, it is recommended that the Member 1 boiler have its own set of external sensors installed (such as the system supply sensor), to maintain the same level of temperature control as with the Leader boiler. Voltage signals (such as 0 - 10V system pump speed input) can be connected to both boilers.

7 Field wiring

Figure 7-3 *Low Voltage Field Wiring Connections*



8 Condensate disposal

Condensate drain

1. The Crest is a high efficiency appliance that produces condensate.
2. The rear of the boiler has a 1 inch (25.4 mm) stainless steel drain fitting and a 3/8 inch (9.8 mm) stainless steel vent line for connection to the condensate trap.
3. Connect the 1 inch (25.4 mm) fitting to the 1 inch (25.4 mm) fitting on the condensate trap with the factory supplied silicone hose. Secure the hose to the condensate trap and the boiler using the factory supplied hose clamps.
4. Connect the 3/8 inch (9.8 mm) fitting to the 3/8 inch (9.8 mm) fitting on the condensate trap (shipped loose) with the factory supplied silicone hose. Secure the hose to the condensate trap and the boiler using the factory supplied hose clamps.
5. The condensate trap must be installed at the same level or below the boiler base.
6. The condensate trap is sized for a 1" PVC outlet connection pipe.
7. Plug the wiring connection from the condensate trap into the connector located on the back of the unit.
8. Slope condensate tubing down and away from the boiler into a drain or condensate neutralizing filter. Condensate from the Crest will be slightly acidic (typically with a pH from 3 to 5). Install a neutralizing filter if required by local codes.

   A neutralizer kit (FIG. 8-1) is available from the factory. The neutralizer kit must be placed on a surface that is a minimum of 3 inches lower than the condensate trap with field supplied piping (vacuum break) installed between the condensate trap and the neutralizer kit.
9. Do not expose condensate line to freezing temperatures.

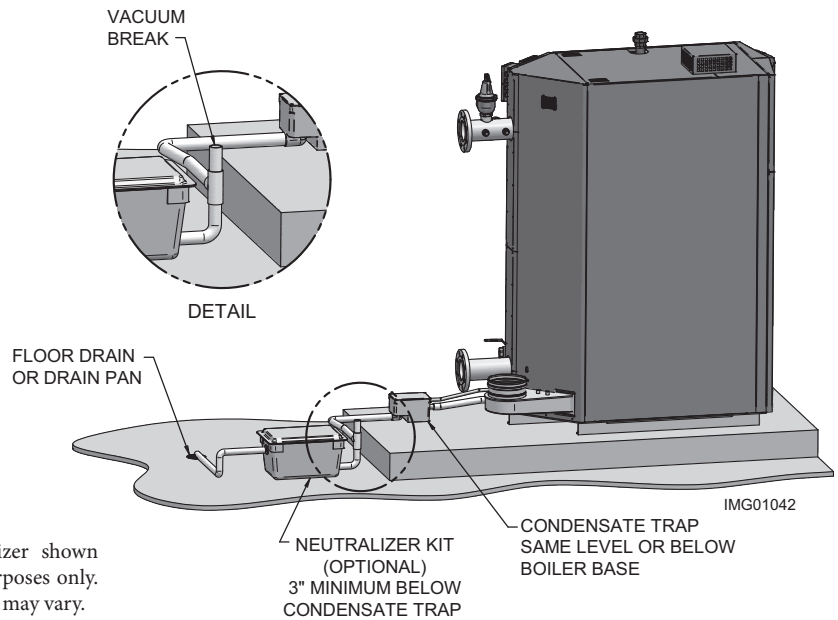
NOTICE Use materials approved by the authority having jurisdiction. In the absence of other authority, PVC and CPVC pipe must comply with ASTM D1785 or D2845. Cement and primer must comply with ASME D2564 or F493. For Canada use CSA or ULC certified PVC or CPVC pipe, fittings, and cement.

NOTICE To allow for proper drainage on large horizontal runs, a second line vent may be required and tubing size may need to increase to 1 inch (25 mm).

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate is allowed to freeze in the line or if the line is obstructed in any other manner, condensate can exit from the boiler tee, resulting in potential water damage to property.

10. A condensate removal pump is required if boiler is below the drain. When installing a condensate pump, select one approved for use with condensing boilers and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. The switch should be wired to the auxiliary device proving switch terminals on the low voltage connection board.

Figure 8-1 *Condensate Disposal*



NOTE: Neutralizer shown for illustrative purposes only. Actual neutralizer may vary.

9 Start-up

Pre-Commissioning Cleaning

1. Prior to fill and start-up, flush the entire heating system.
2. Clean the entire heating system with an approved pre-commissioning cleaner (comparable to Sentinel X300 or X400 and Fernox F3 or DS40) in accordance with the manufacturer's recommendation to remove debris and prolong the life of the heat exchanger.
3. Clean all water filtering devices in the system.
4. Flush the cleaning solution out of the entire system and refill.

Fill water

Check/control fill water chemistry

IMPORTANT Conduct water quality testing prior to installing the appliance. Various solutions are available to adjust water quality.

The manufacturer recommends the following for properly filling your boiler with the appropriate water chemistry for closed loop boilers. Good fill water quality will help extend the life of the appliance by reducing the effects of lime scale buildup and corrosion in closed loop systems.

Hardness between 5 and 12 grains per gallon

1. Consult local water treatment companies for hard water areas (above 12 grains per gallon hardness).
2. Hardness levels that are above 12 grains/gallon can lead to lime scale buildup throughout the boiler system. If the fill water is below 5 grains/gallons, usually due to use of a water softener, it is recommended to mix in some potable water at the inlet to increase the hardness of the water to above 5 grains/gallons.

pH between 6.5 and 8.5

1. pH levels below 6.5 can cause an increase in the rate of corrosion. pH of 8.5 or higher can potentially cause lime scale buildup.

Total Dissolved Solids (TDS) less than 350 ppm

1. Total dissolved solids are all minerals, salts, metals, and charged particles that are dissolved in water.
2. The greater the amounts of TDS present, the higher the corrosion potential due to increased conductivity in the water.

Chloride concentration less than 150 ppm

1. Do not fill boiler or operate with water containing chlorine in excess of 150 ppm.
2. Filling with fresh drinking water should be acceptable.
3. Do not use the boiler to directly heat swimming pool or spa water.

Boiler water

CAUTION Do not use petroleum based cleaning or sealing compounds in the boiler system. Gaskets and seals in the system may be damaged. This can result in substantial property damage.

DO NOT use "homemade cures" or "boiler patent medicines". Serious damage to boiler, personnel, and/or property may result.

Table 9A Boiler Water Chemistry

BOILER WATER CHEMISTRY	
Specification	**Range**
Dissolved Solids	< 2000 ppm
pH Level	6.5 to 9.5
Chloride	< 150 ppm

- Monitoring pH, chlorides, TDS, and hardness levels can prolong the life of the appliance by reducing lime scale buildup, corrosion, and erosion. Check for leaks to ensure that fresh water is not entering the system.
- Continual fresh makeup water will reduce boiler life.
- Mineral buildup in the heat exchanger reduces heat transfer, overheats the stainless steel heat exchanger, and causes failure.
- The addition of oxygen carried in by makeup water can cause internal corrosion in system components.
- Leaks in the boiler or piping must be repaired at once to prevent excessive makeup water. For this purpose, it is recommended to install a water meter to easily check the amount of makeup water entering the system. Makeup water volume should not exceed 5% of the total system volume per year. Note: When makeup water is added, make sure the chemical additives are added to maintain the correct level.
- An approved multi-metal corrosion inhibitor (comparable to Sentinel X100 or Fernox F1) is recommended at the correct concentration and in the manner recommended by the manufacturer.

Freeze protection

⚠WARNING Ethylene glycol is toxic, DO NOT use as your freeze protection. Ethylene glycol has a sweet aroma which children and pets could mistake as food and ingest; leading to death.

1. Use glycol only if needed for freeze protection.
2. Propylene glycol is the recommended freeze protection.

9 Start-up *(continued)*

3. Make sure to flush the boiler system before adding glycol.
4. Determine the freeze protection fluid quantity using system water content, following the fluid manufacturer's instructions. Boiler water content is listed on page 6. Remember to include expansion tank water content.
5. Local codes may require a backflow preventer or actual disconnect from city water supply.
6. When using freeze protection fluid with automatic fill, it is suggested to install a water meter to monitor water makeup. Freeze protection fluid may leak before the water begins to leak, causing the concentration to drop, which reduces the freeze protection level.
7. The freeze protection set points may be lowered when freeze protection fluid is used (see the Crest Service Manual).
8. Consult the glycol manufacturer for details on the suggested mix of glycol and water for the desired freeze protection level and the de-rate effect it will have on the boiler output.

Test / replace freeze protection fluid

1. For systems using freeze protection fluids, follow the fluid manufacturer's instructions.
2. Freeze protection fluid must be replaced periodically due to degradation of inhibitors over time.
3. It is recommended to test the glycol concentration annually and adjust within the desired set points.

Oxygen prevention

CAUTION Eliminate all system leaks. Continual fresh makeup water will reduce boiler life. Minerals can build up in the heat exchanger, reducing heat transfer, overheating the heat exchanger, and causing heat exchanger failure.

Dissolved oxygen can have a negative effect on the boiler system. Oxygen can cause iron oxide to generate iron deposits. Oxygen may also increase the rate of corrosion on non-stainless steel parts of the system. A low pH level combined with oxygen further enhances its corrosive effects. After boiler installation, check for air leaks in the following areas:

- Suction gasket
- Pump
- Air valve
- O-ring gaskets

Precautions include installing a water meter to evaluate the fresh water volume entering the system (should be no more than 5% system volume). Additional volumes of fresh water could indicate that a leak is present.

Fill and test water system

1. Fill system only after ensuring the water meets the requirements of this manual.
2. Close automatic and manual air vents and boiler drain valve.
3. Fill to correct system pressure. Correct pressure will vary with each application.
   a. The minimum cold water fill pressure for a system is 12 psi.
   b. Pressure will rise when the boiler is turned ON and system water temperature increases.
4. At initial fill and during boiler startup and testing, check the system thoroughly for any leaks. Repair all leaks before proceeding further.

Purge air from water system

1. Purge air from system:
   a. Connect a hose to the purge valve (see purge/drain valve in the piping diagrams on pages 33 through 36). Route the hose to an area where water can drain and be seen.
   b. Close the boiler or system isolation valve between the purge valve and fill connection to the system.
   c. Close zone isolation valves.
   d. Open the quick-fill valve on the cold water makeup line.
   e. Open purge valve.
   f. Open the isolation valves one zone at a time. Allow water to run through the zone, pushing out the air. Run until no noticeable air flow is present. Close the zone isolation valves and proceed with the next zone. Follow this procedure until all zones are purged.
   g. Close the quick-fill water valve and purge valve and remove the hose. Open all isolation valves. Watch that system pressure rises to correct cold-fill pressure.
   h. After the system has operated for a while, eliminate any residual air by using the manual air vents located throughout the system.
   i. If purge valves are not installed in the system, open the manual air vents in the system one at a time, beginning with the lowest floor. Close the vent when water squirts out. Repeat with remaining vents.
2. Open the automatic air vent (diaphragm-type or bladder type expansion tank systems only) one turn.
3. Open other vents:
   a. Starting on the lowest floor, open air vents one at a time until water squirts out.
   b. Repeat with remaining vents.
4. Refill to correct pressure.

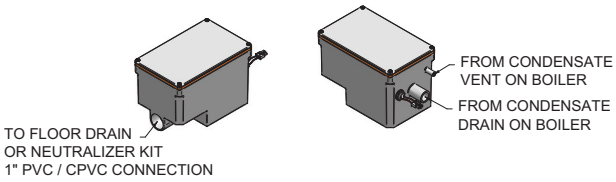
9 Start-up

Check for gas leaks

⚠WARNING Before starting the boiler, and during initial operation, smell near the floor and around the boiler for gas odorant or any unusual odor. Remove the top access panel and smell the interior of the boiler enclosure. Do not proceed with startup if there is any indication of a gas leak. Use an approved leak detection solution. Repair any leaks at once.

⚠WARNING DO NOT adjust or attempt to measure gas valve outlet pressure. The gas valve is factory set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter or measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

Figure 9-1 *Condensate Trap*



⚠WARNING Propane boilers only – Your propane supplier mixes an odorant with the propane to make its presence detectable. In some instances, the odorant can fade, and the gas may no longer have an odor. Before startup (and periodically thereafter), have the propane supplier verify the correct odorant level in the gas.

Check thermostat circuit(s)

1. Disconnect the two external wires connected to the enable terminals on the connection board.
2. Connect a voltmeter across these two incoming wires. Close each thermostat, zone valve, and relay in the external circuit one at a time and check the voltmeter reading across the incoming wires.
3. There should NEVER be a voltage reading.
4. If a voltage does occur under any condition, check and correct the external wiring. (This is a common problem when using 3-wire zone valves.)
5. Once the external boiler enable wiring is checked and corrected if necessary, reconnect the external thermostat circuit wires to the connection board. Allow the boiler to cycle.

Inspect condensate system

Inspect/check condensate lines and fittings

1. Inspect the condensate drain line, condensate PVC fittings and condensate trap.

9 Start-up *(continued)*

Final checks before starting the boiler

- ❑ Read the Crest Service Manual to familiarize yourself with SMART TOUCH control module operation. Read this manual, page 50 for proper steps to start boiler.
- ❑ Verify the boiler and system are full of water and all system components are correctly set for operation.
- ❑ Verify the preparation procedures of Section 9, pages 46 - 48 have been completed.
- ❑ Verify electrical connections are correct and securely attached.
- ❑ Inspect vent piping and air piping for signs of deterioration from corrosion, physical damage or sagging. Verify air piping and vent piping are intact and correctly installed per this manual.

Start the boiler

1. Read and follow the Operating instructions in FIG. 9-2, page 50.

If boiler does not start correctly

1. Check for loose connections, blown fuse or service switch off?
2. Is external limit control (if used) open? Is boiler water temperature above 200°F (93°C)?
3. Is the boiler receiving a call for heat?
4. Is gas turned on at meter and boiler?
5. Is incoming gas pressure less than 4 inches w.c. (.99 kPa)?
6. Ignition problems are especially noticeable in new LP installations and also in empty tank situations. This can also occur when a utility company shuts off service to an area to provide maintenance to their lines.

If none of the above corrects the problem, refer to the Troubleshooting Section of the Crest Service Manual.

Check system and boiler

❑ Check water piping

1. Check system piping for leaks. If found, shut down the boiler and repair immediately. (See WARNINGS on pages 46 - 48 (startup) regarding failure to repair leaks.)
2. Vent any remaining air from the system using manual vents. Air in the system will interfere with circulation and cause heat distribution problems and noise.

❑ Check vent piping and air piping

1. Check for gastight seal at every connection, seam of air piping, and vent piping.

⚠WARNING Venting system must be sealed gastight to prevent flue gas spillage and carbon monoxide emissions, which will result in severe personal injury or death.

❑ Check gas piping

1. Check around the boiler for gas odor following the procedure on page 37 of this manual (connecting gas supply piping).

⚠WARNING If you discover evidence of any gas leak, shut down the boiler at once. Find the leak source with a bubble test and repair immediately. Do not start the boiler again until corrected. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check flame and combustion

NOTICE For dual fuel models, reference the Crest Dual Fuel Supplemental Manual.

1. Turn the main power off to the boiler by placing the "On/Off" switch in the OFF position.
2. Remove the fitting from the flue collector. Note: Combustion measurements will be made at this point.
3. Insert the probe from a combustion analyzer into the hole left by the removal of the fitting.
4. Turn the main power on to the boiler by placing the "On/Off" switch in the ON position.

9 Start-up

Figure 9-2 *Operating Instructions*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

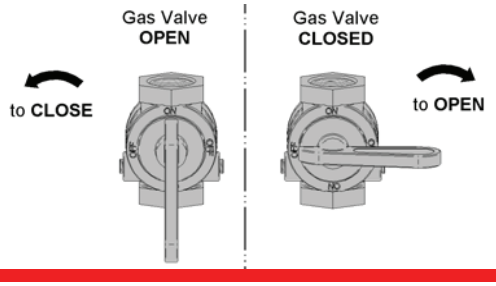
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control knob. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove front door.
6. Turn gas shutoff valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Turn gas shutoff valve clockwise to "ON". Handle will be parallel to pipe.
9. Install front door.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove front door.
4. Turn gas shut off valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force.
5. Install front door.

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9 Start-up *(continued)*

Check flame and combustion *(continued)*

5. Navigate to the Setup Screen from the Home Screen by pressing the SETUP button along the left side of the screen. Enter the installer password.
6. Select the Service Maintenance Screen. The tabs will scroll (up and down) to reveal more options. See the Crest Service Manual for more detailed information.
7. Once the boiler has modulated up to rate, measure the combustion. The values should be in the range listed in Table 9B (this page). CO levels should be less than 200 ppm for a properly installed unit. If the combustion is not within range reference the *Troubleshooting* Section in the Crest Service Manual for possible causes and corrective actions.
8. Once the heater analysis is complete, test the safety shutoff device by turning the manual shutoff valve to the OFF position and ensuring the heater shuts down and registers an alarm. Open the manual shutoff valve and reset the control.
9. Turn the main power off to the boiler and replace the fitting into the flue pipe connection.
10. Ensure the boiler is placed back into normal operation.

***Table 9B** Flue Products Chart*

Flue Products	Natural Gas			
Units	751-2001		2501-6001	
Gas Valve	CO_2 (%)	O_2 (%)	CO_2 (%)	O_2 (%)
Valve 1 High	9.2	4.6	9.2	4.6
Valve 1 Low	9.0	4.9	8.5	5.7
Valve 2 High	9.3	4.4	9.5	4.2
Valve 2 Low	8.7	5.5	8.8	5.4
Propane				
Units	751-2001		2501-6001	
Gas Valve	CO_2 (%	O_2 (%)	CO_2 (%	O_2 (%)
Valve 1 High	11.0	4.1	11	4.1
Valve 1 Low	10.0	5.6	9.9	5.7
Valve 2 High	11.1	4.0	11.1	4
Valve 2 Low	10.7	4.6	10.1	5.5
All set points should be within +/- 0.2%				

⚠WARNING You must replace the fitting to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

***Figure 9-3** Service Maintenance Screen*

9 Start-up

Set space heating operation

Verify space heat circulator mode

The system pump output can be programmed to never run (OFF), run only when a space heating demand is present (ON), or run continuously except during warm weather shutdown (WWSD). If the boiler is not heating an indirect HW (Hot Water Generator) tank, it also turns on the boiler pump. After the space heating call for heat ends, and the system pump is programmed as ON, the system pump continues to run for a short period of time. If the boiler pump was running, it continues to run for a short period of time as well. These pump delays are factory set to 30 seconds. If different delays are desired, the appropriate parameters in the control must be changed. See the Crest Service Manual for a detailed explanation of this procedure.

Set space heating set point temperature

During normal operation, set point temperatures can be adjusted from the Home Screen by pressing the DETAILS button on the bottom of the screen (see FIG. 9-4).

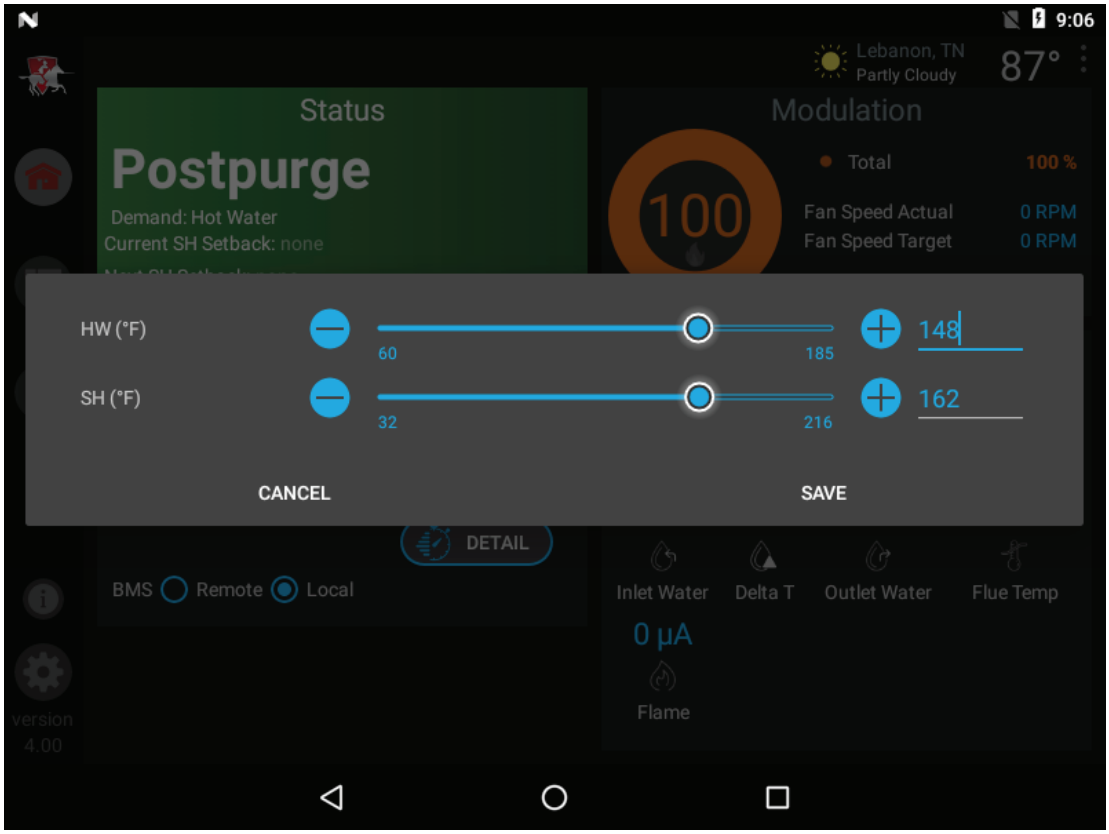
1. To change a set point, use the set point slider feature or the PLUS (+) and MINUS (-) buttons to adjust the set points as shown in FIG. 9-4.

2. Once the set point has been adjusted to the desired setting, press the Door Menu slider (top left) or the SETUP button.

3. Press the APPLY CHANGES button on the top of the screen.

NOTE: The APPLY CHANGES button must be pressed to complete programming of the controls. Failure to press the APPLY CHANGES button will result in an unprogrammed control. The Door Menu button will become highlighted when there are changes that can be applied.

Figure 9-4 *User Set Point Screen*



9 Start-up *(continued)*

Set Hot Water Generator (HW) operation

Note: For more detailed instructions, please refer to the Crest Service Manual.

Verify HW mode

There are two (2) modes of operation for HW. In Normal Mode, when a HW demand begins, the control will start the HW pump, turn off the boiler pump (if running), and modulate to bring the outlet temperature to the HW boiler set point. The maximum firing rate may be limited in this mode if desired.

In Zone Mode it is assumed that the indirect HW tank is piped as a zone on the primary loop. When a HW demand begins, the control will turn on the HW pump output, and raise the system temperature set point to the HW boiler set point (if higher). The boiler pump will be turned on. The system pump may be forced on, forced off, or not changed, depending on the System Pump Mode selected (reference the Crest Service Manual for details). In this mode, any low temperature zones (such as radiant heating) may need additional controls to limit the water temperature sent to those zones.

Set HW boiler target temperature

When in the HW Mode, the control will modulate to maintain the boiler outlet temperature or system supply temperature to a set point. This set point is set at the factory to 180°F. If a different set point is desired, the appropriate parameter in the control must be changed. See the Crest Service Manual for a detailed explanation of this procedure.

Set maximum HW fan speed

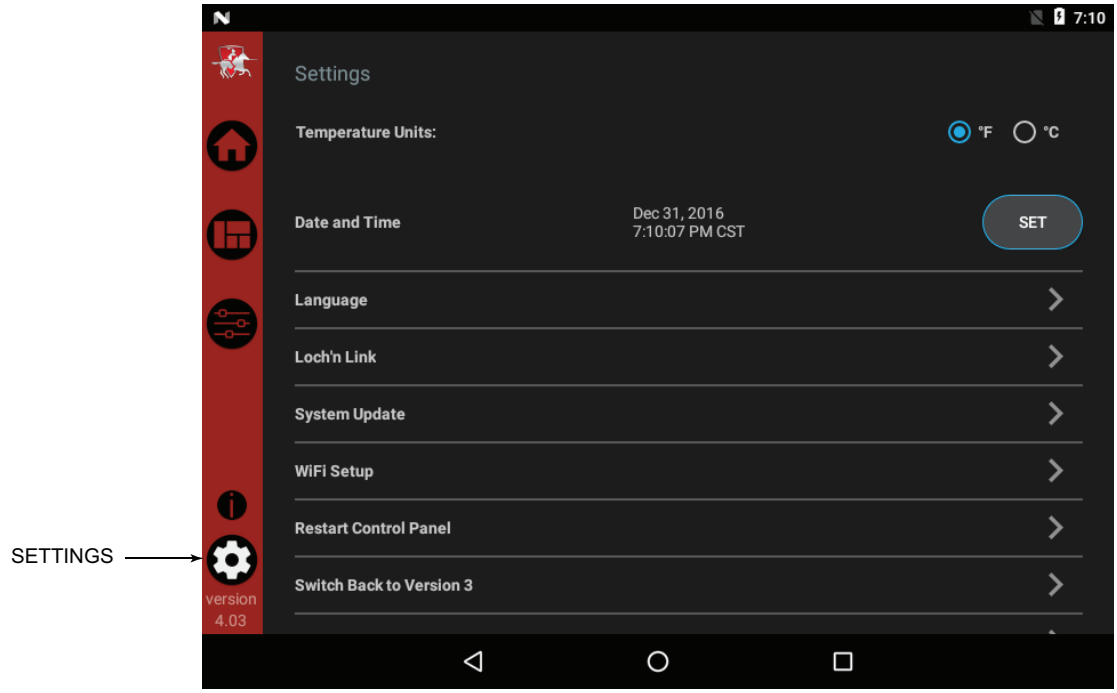
If the rated input of the indirect tank is less than the maximum output of the boiler, change the maximum HW fan speed setting to limit the boiler output accordingly, see the Crest Service Manual for a detailed explanation of this procedure.

Set clock

The SMART TOUCH control has a built-in clock that it uses for its night setback feature and for logging events. This clock must be set when the boiler is installed, and anytime the boiler has been powered off for more than one day. Use the following procedure to set the clock:

1. Press the SETTINGS button under the Lochinvar logo (see FIG. 9-5).
2. Press the SET button across from the date and time.
3. Proceed to set the date, time, and time zone. **NOTE:** Automatic Time Zone will not work.
4. Temperature units and WiFi may also be set here. These items may be used to automatically sync the time.
5. Press the Home, View, or Back button to exit.

Figure 9-5 *Settings Screen*



9 Start-up

Configuration of the cascade

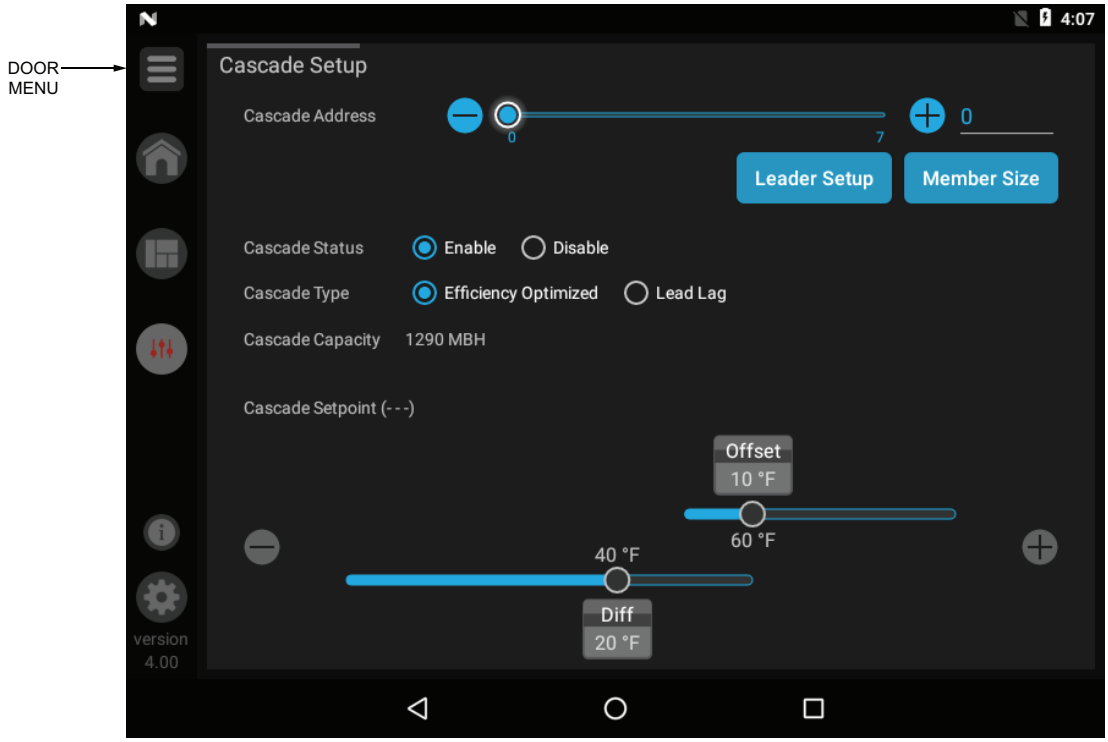
Note: For more detailed instructions, please refer to the Crest Service Manual.

When installing a Cascade system, all units must be programmed for Cascade to operate. Access the Cascade Setup options as follows:

1. Press the SETUP button on the left side of the display screen.
2. Enter the installer password.
3. Select the Cascade option as shown in FIG. 9-6.
4. Each unit must have a unique address set. The leader has more options which are described in the Crest Service Manual.
5. Once all the updates are complete, press the Door Menu slider (top left) or the SETUP button.
6. Press the APPLY CHANGES button on the top of the screen.

NOTE: The APPLY CHANGES button must be pressed to complete programming of the controls. Failure to press the APPLY CHANGES button will result in an unprogrammed control. The Door Menu button will become highlighted when there are changes that can be applied.

Figure 9-6 Cascade Screen



10 Operating information

General

How the boiler operates

The Crest uses an advanced stainless steel heat exchanger and electronic control module that allows fully condensing operation. The blower pulls in air and pushes flue products out of the boiler through the heat exchanger and flue piping. The control module regulates blower speed to control the boiler firing rate. The gas valves sense the amount of air flowing into the boiler and allow only the right amount of gas to flow.

How the control modules operate

The Crest boiler is equipped with a SMART TOUCH control module. The SMART TOUCH control module receives inputs from boiler sensors and external devices. The control module activates and controls the blower and gas valves to regulate heat input and switches the boiler, Hot Water Generator (HW), and system pumps on and off as needed. The user programs the control module to meet system needs by adjusting control parameters. These parameters set operating temperatures and boiler operating modes.

Control inputs and outputs

Enable

This input tells the boiler to provide water for space heating.

Hot Water Generator (HW) tank thermostat

This input tells the boiler to provide water for heating an indirect HW tank.

0 - 10V BMS input (set point or power)

The Crest can be controlled by a Building Management System (BMS) using a 0 - 10 VDC signal. The control can be configured by the installer to use this signal to either control set point or firing rate.

0 - 10V System Pump speed input

When a variable speed system pump is used, and there is a 0 - 10V signal available from the pump speed control, this signal may be connected to the boiler. Doing so will allow the boiler to anticipate changes in the BTU's needed by the system as the system flow changes, and therefore, help the boiler to maintain the desired system temperature. Connect the - input terminal to the COM or - output terminal on the pump speed control, and the + input terminal to the 0 - 10V or + output terminal on the pump speed control. Note that the voltage on these inputs must never go below ground.

HW priority

The SMART TOUCH control allows the connection of a HW thermostat or tank sensor to the low voltage connection board. When a tank sensor is connected, the HW thermostat input is ignored. When a boiler is programmed for HW Normal Mode, the maximum firing rate can be limited to match the input rating of the indirect tank coil.

HW / space heating (SH) cycling

If a HW call for heat is received while a space heating call is in progress, and the HW is in Normal Mode, the control will start the HW pump and shut the boiler pump off. The system pump will remain on. For stand-alone boilers, if the space heating call is still active while the HW call is in operation, the control will wait for 30 minutes (time adjustable by installer) then it will switch back to the space heating demand. There is a timer to switch from space heating to HW and a timer to switch from HW to space heating. The control will switch back and forth until one of the heat demands end. This function does not apply to cascade systems.

Controlling sensor

The control module is programmed to use the outlet sensor as the control sensor by default. If a system supply sensor is connected, the control automatically uses it as the control sensor. The control module may be programmed to use the inlet sensor as the control sensor instead. In this case, the control will use the system return sensor if it is connected.

Anti-cycling

After a space heating demand has been satisfied, the control will delay the next space heating call for a set time period (time is adjustable by the installer). The time delay will be bypassed if the inlet water temperature drops too far during the delay.

Boiler, system, and HW pump control

When a space heating call for heat starts and no HW call is on, the boiler pump is turned on. The system pump will turn on also if it is programmed to do so. If a HW call for heat is on, the boiler pump will wait to turn on until just before the HW pump turns off. After the space heating call for heat ends, the boiler pump will run for an additional period of time.

When a HW call for heat starts, the HW pump is turned on. If a space heating call for heat is on, the boiler pump will turn off a few seconds after the HW pump turns on.

Louver

When the boiler needs to control combustion air louvers, connect a 24 VAC louver relay to the two (2) Louver Relay terminals. Connect the Louver End Switch to the Louver Proving Switch input on the Low Voltage Connection Board.

Temperature control

Modulation

The Crest is capable of modulating its firing rate from a minimum of 4-6% (depending on model) to a maximum of 100%. The firing rate is dictated by the call for heat (i.e., space heating or hot water generation), the heating load, ramp delay (if enabled), and various other temperature limitations.

10 Operating information

Gradient limiting

If during operation of the boiler the outlet water temperature is rising too quickly, the control will reduce the firing rate to its lowest setting.

Outdoor air reset

If an outdoor air sensor is connected, the control module will calculate the set point based on the programmed reset curve. The installer can change the slope of the reset curve by several adjustable parameters. The user can limit the maximum set point for the system using the space heating set point.

Boost function

If outdoor air reset is active, the boost temperature is not 0, a space heating demand has been active continuously for a set period of time (time adjustable by installer) and there has been no HW demands, the control will increase the set point by a fixed number of degrees (adjustable by installer). This process will continue until the space heating demand ends, the set point reaches the programmed set point or a maximum of 20 increases has occurred. Once the system heat demand is satisfied, the set point will revert to the value determined by the reset curve.

Night setback

The controller may be programmed to reduce the space heating set point and/or Hot Water Generator set point for each demand during a certain time each day. A start and stop time for each demand can be programmed for each day of the week. The controller can be programmed to reduce the tank set point as well. A different set of start and stop times can be programmed each day of the week.

Flame current support

To prevent nuisance shutdowns when the boiler is firing at minimum rates, the control will increase the firing rate when the flame signal drops too low.

ModBus / BACnet

The Crest boiler can be connected to and controlled by a Building Automation System through a ModBus or BACnet interface. Connect the A and B wires to the A and B terminals. If connecting another cable (in a daisy chain), connect the shield wire of the first cable to one of the shield terminals, and the shield wire of the second cable to the other shield terminal. If it is desired to ground the cable shield at the heater, connect the shield wire to one of the shield terminals, and install a jumper across the two (2) terminals in connector X5 on the ModBus / BACnet interface board.

0-10V Rate output

A 0-10V signal which indicates the firing rate of the heater is available. This output may be connected to a Building Management System (BMS) to allow it to monitor the actual firing rate. Connect the - terminal to the COM or - terminal on the BMS, and connect the + terminal to the 0 - 10V or + terminal on the BMS.

Ramp Delay

For systems with lower flow, the SMART TOUCH can limit the firing rate (when enabled) when a space heating call for heat starts, or when switching from a DHW call for heat to a space heating call for heat. There are six (6) limits that can be programmed, as well as six (6) time intervals corresponding to each limit. The sixth limit will also limit the firing rate for the rest of the call for heat.

Protection features

Outlet temperature, flue temperature, and temperature rise limiting

The outlet water temperature is monitored by the boiler outlet temperature sensor. When the outlet temperature exceeds 185°F, the unit will reduce the fan speed. If the outlet water temperature exceeds 195°F (90°C) the control will shut the unit down until the minimum off time has expired and the outlet drops 10°F (5.5°C).

The control module monitors the flue temperature by a sensor located in the flue exhaust. If the flue temperature exceeds 215°F (101°C) the control will reduce the maximum fan speed. If the flue temperature exceeds 225°F (107°C) the control will shut the unit down. The unit will restart automatically once the flue temperature drops 10°F (6°C) and the minimum off time has expired.

The control monitors the temperature difference between the inlet and the outlet sensor. If this difference exceeds 70°F (21°C) the control will reduce the fan speed. If the temperature difference exceeds 80°F (27°C) the control will shut the unit down. The unit will restart automatically once the temperature difference has dropped below 50°F (28°C) and the minimum off time has expired.

Freeze protection

DO NOT install the boiler in a room likely to freeze.

The following integral feature of the SMART TOUCH control module provides some protection for the boiler only -- not for the system.

- The SMART TOUCH control module provides freeze-up protection as follows when the boiler water temperature drops below 45°F (7°C):
- Below 45°F (7°C), the boiler and system pumps (if enabled) operate constantly.
- Below 37°F (3°C), the boiler turns on.
- Boiler and pumps turn off if boiler water temperature rises above 43°F (6°C).

⚠ CAUTION This feature of the SMART TOUCH control module does not eliminate the possibility of freezing. The installation must still use recognized design, installation and maintenance practice to prevent freeze potential for the boiler and system.

10 Operating information *(continued)*

Monitor external limits

Connections are provided on the connection board for external limits such as an additional high limit. The SMART TOUCH control will shut off the burner and inhibit relighting whenever any of these external limits open.

Run-time and alarm outputs

The boiler provides dry contacts for indicating when the boiler is running, and when it is unable to operate.

Run-time and cycle counting

The control uses four timers to monitor the total hours of burner operation:
75 - 100% 50 - 75%
25 - 50% <25%

The control uses four (4) ignition counters to monitor the amount of boiler cycles. The first counter counts all ignitions of the control. The second counter counts only ignition attempts that have failed. The third and fourth counters are the same as the first and second respectively, but can be reset by the installer.

Service reminder

The control can be programmed for service reminder notification. This notification will become active when either a set amount of time has expired, or a set amount of running hours or cycles has expired (all adjustable by the installer). The service reminder notification can be reset by the installer. The service company's name and phone number can be programmed to display when service is due.

Error logging

The control will hold in memory the last 10 blocking faults as well as the last 10 lockout faults. The date and time of the occurrence will be recorded as well. Only the 10 most recent occurrences will be held in memory.

Boiler temperature regulation

Operating temperature (target)

The SMART TOUCH control module senses water temperature and regulates boiler firing and firing rate to achieve a target temperature. The target temperature can be set between 32°F (0°C) and 185°F (85°C).

- Target temperature is fixed when the outdoor sensor is not installed.
- Target temperature is calculated as described under "Outdoor Reset Operation" and "Target Temperature Boost" when the outdoor sensor is connected.

High limit operations

The Crest SMART TOUCH control has two (2) integral limits, one auto reset and one manual reset. The Crest also has one auxiliary manual reset high limit. The integral and auxiliary high limits are UL353 certified.

When the outlet temperature exceeds 195°F (90.6°C) (Installer Adjustable Parameter), integral auto reset high limit action occurs. The boiler will shut down until the outlet water cools down and the timer expires.

If the outlet temperature exceeds 200°F (93.3°C) (User Adjustable Dial), auxiliary manual reset high limit action occurs. The boiler will shut down until the outlet water cools down and the boiler is reset through the user interface.

If the outlet temperature exceeds 205°F (93.3°C) (Installer Adjustable Parameter), integral manual reset high limit action occurs. The boiler will shut down until the outlet water cools down and the boiler is reset through the user interface.

Low water cutoff protection

A low water cutoff device with test and reset functionality is provided in the boiler as standard equipment.

Flow sensing device

The SMART TOUCH control module uses temperature sensing of both supply and return temperatures of the heat exchanger. If the flow rate is too low or the outlet temperatures too high, the control module modulates down and will shut the boiler off. This ensures boiler shutdown in the event of low flow conditions.

NOTICE If a mechanical flow switch is required to meet local code requirements the Crest boiler can be equipped with a field supplied outlet flow switch. Please wire to the Louver Proving Switch terminals.

Outdoor reset operation, if used

Target temperature with outdoor reset

This feature improves the system's efficiency as the outdoor temperature warms up.

See the Crest Service Manual to change the settings.

Reset curve

The reset curve looks at outdoor air temperature and adjusts the set point.

10 Operating information

Cascade

When multiple boilers are installed, they can be wired together in a cascade sequence. A maximum of eight boilers can be controlled from a single control. In this application one boiler would be designated as the Leader control and all others would be designated as Member controls.

Once the Leader boiler receives a call for heat from the Enable input, the 0 - 10 VDC input, ModBus or BACnet, the control will determine what the set point will be. If outdoor air reset is desired, connect the outdoor air sensor to the terminals on the Low Voltage Connection Board on the Leader boiler. The set point will be calculated based on the programmed reset curve parameters. See the Crest Service Manual to program the reset curve. If outdoor air reset is not desired, do not connect the outdoor air sensor. A fixed temperature set point can be programmed into the control, or provided through the ModBus or BACnet interface.

If the water temperature at the controlling sensor is less than the set point + the turn-off offset - the off-on differential, the control will initiate a call for heat on the Cascade (see the Crest Service Manual for an explanation of the offset and differential). The Leader will energize the lead boiler on the Cascade. For a new startup this will be the Leader boiler.

The two (2) types of Cascade control are listed below:

Efficiency optimization

Efficiency optimization is chosen when the application is such that overall heating efficiency is most important. The Cascade will fire the boilers in a way that is the most efficient. This allows more boilers to fire at one time, at a lower rate, thus more efficient. This Cascade is **NOT** allowed in a common vent application.

Lead/Lag

The Lead/Lag method is chosen when the application requires firing as few boilers at a time as possible. This method will not bring on another boiler until the current number of boilers cannot meet the demand. This Cascade is also ***required*** when cascading boilers in a common vent application.

The parameters for both types of Cascade are adjustable. Reference the Crest Service Manual for a more detailed description of these adjustments.

Sequence of the cascade

To equalize the run time of all boilers on the Cascade, the firing sequence will automatically be changed at set intervals.

For the first 24 hours after initializing the Cascade, the sequence will be changed every hour. After that the sequence will be changed once every 24 hours.

HW operation with cascade

For normal mode HW operation any boiler(s) in the Cascade can be selected to provide heat for a HW call. Select a boiler to be designated as the HW boiler. Connect the HW thermostat or sensor to the terminals on the Low Voltage Connection Board marked for the corresponding device. When the boiler receives a HW call, the Leader control will take that boiler out of the Cascade sequence. If another boiler is available, the Leader will start it up to take its place.

The HW boiler will adjust its set point to the programmed HW boiler set point and will adjust its firing rate to maintain this. Once the HW call has been satisfied, the Leader control will place that boiler back into the Cascade sequence.

Switching of the boiler between HW operation and SH operation when there is a call for both does not occur in Cascade Mode.

When HW is programmed for Zone Mode, connect the HW thermostat or tank sensor to the Leader boiler. When a HW call is received, the Leader will modulate the entire Cascade to bring the system supply temperature up to the HW boiler set point (if higher).

Night Setback and Ramp Delay operations with cascade

Night Setback and Ramp Delay operation of the boilers within the Cascade are available. Programming will be done through the Leader boiler. Refer to the Crest Service Manual for information regarding Night Setback and Ramp Delay.

10 Operating information *(continued)*

Sequence of operation

Note: This unit is equipped with two (2) gas train systems. Gas Train 1 will fire first. If the demand cannot be met by the first gas train, the second gas train (Gas Train 2) will fire.

1.	Upon a call for heat, the control turns on the appropriate pumps (system and boiler pumps for a space heating call, HW pump for a hot water generator call).
2.	The control confirms that the low water cutoff contacts are closed and energizes the louvers (optional) and damper (optional) relays.
3.	The control confirms that the proof of closure switch (Model FB 6001 only), gas pressure switch, blocked drain switch, limits, louver proving switch (optional) and damper proving switch (optional) contacts close. The proof of closure valve (FB 6001 only) opens and the Pre-Purge cycle begins.
4.	The control confirms the blower is up to the desired speed, and the air pressure switch is closed.
5.	Once the Pre-Purge cycle is complete, the control lowers the blower speed, initiates sparking of the ignition electrode, and opens gas valve 1.
6.	After a short wait, the control stops sparking and checks for the presence of flame current through the flame sense electrode.
7.	If the control does not detect flame current: Models FB0751-2001 - The control will repeat the ignition cycle after the required post purge and pre-purge cycles. Models FB2501-6001 - Loss of flame will result in safety shutdown and lockout, requiring manual reset.
8.	If the control detects flame current, the control will hold the blower speed constant for a few seconds to allow the flame to stabilize, then begin modulating the firing rate in order to maintain the controlling sensor to the desired set point temperature.
9.	If the current call for heat is for space heating and a HW call for heat becomes active, the control will turn on the HW pump relay output, then turn off the boiler pump. It will then modulate the blower speed in order to maintain the outlet temperature to the desired HW outlet set point temperature.
10.	If the boiler is unable to maintain the desired set point using gas valve 1, control will transition to the larger gas valve 2. The blower will modulate to a fixed speed and the air metering valve will start to open. As it opens, gas valve 2 will be turned on and gas valve 1 will be turned off. If the flame should be lost at any time during this process, the control will immediately try to reignite the burner. Once the air metering valve is fully open and the flame is confirmed to be present, the control will hold the fan speed constant for a few seconds in order to allow the flame to stabilize. The fan speed will then modulate as needed to maintain the set point. If the flame is not present when the air metering valve is fully open, the boiler will go through a complete shutdown and restart of the burner. If the heat load should decrease sufficiently, a similar process is used to transition from gas valve 2 to gas valve 1.
11.	Once both the space heating and HW calls for heat are satisfied, the control will turn off the gas valve and begin the Post-Purge cycle. Any pumps that are running will begin their respective Pump Delay cycles.
12.	At the end of the Post-Purge cycle, the louver relay contacts will de-energize.
13.	The control verifies that the blowers stop running and the blower proving switches open.
14.	At the end of the Pump Delay cycle(s), the pump(s) will be turned off.

10 Operating information

SMART TOUCH™ w/Crest CON•X•US Interface (CCI)

The Home Screen displays the available basic system information divided into the following sections: Status, Demand, Modulation, Sensors, and Navigation.

Figure 10-1 *Home Screen*

- The **Status** Section is located on the top left of the screen and displays how the unit is currently running (i.e. Off, Stand-by, Blocking, and Lockout) including: current driving demand, the next Hot Water Setback scheduled, the reason for any blocking or lockout, and a power button.
- The **Demand** Section is located on the bottom left of the screen and displays information about the targets and limits of the current demand being serviced.
- The **Modulation** Section is located on the top right of the screen and displays the target modulation of the unit. This section also includes target and actual fan speeds.
- The **Sensor** Section is located on the bottom right of the screen and displays both factory installed and field installed sensor including: Outdoor Air, Hot Water Temperature, System Supply, System Return, Inlet Water, Delta T, Outlet Water, Flue Temperature, and Flame Current.
- The **Navigation** Section is located down the left side of the screen. There are five (5) sections located below the Lochinvar icon: Home, View, Setup, Information (About), and Settings. The Home Section is the screen shown above. The View Section provides more detailed information including subsections for: History, Cascade, Graphing, and a complete list of current Sensor Values. The Setup Section has several screens to aid in setting up the appliance. The Setup Section includes screens for adjusting: Set Points, Pump Settings, Cascade, BMS, Ramp Delay, and Night Setback. The Information Section provides information about the hardware and software including the current software version of the interface, the version of the boiler control, and the CON·X·US device serial number. The Setting Section enables several interface setup features including: Time Setup, Temperature Unit Select, Loch'n Link, System Update, and WiFi Setup.

11 Maintenance

Maintenance and annual startup

Table 11A *Service and Maintenance Schedules*

Service technician (see the following pages for instructions)	
ANNUAL START-UP	**General:** • Address reported problems, if any • Inspect interior; clean and vacuum if necessary; • Clean condensate trap and fill with fresh water • Check for leaks (water, gas, flue, condensate) • Verify flue and air lines in good condition and sealed tight • Check system water pressure/system piping/expansion tank • Check fill water meter • Test boiler water. When test indicates, clean system water with approved system restorer following manufacturer's information. • Check control settings • Check the ignition and both flame sense electrodes (sand off any deposits; clean and reposition) • Check wiring and connections • Perform start-up checkout and performance verification per Section 9. • Flame inspection (stable, uniform) • Check both flame signals (at least 10 microamps at high fire) • Clean the heat exchanger • Test low water cutoff (reference the Crest Service Manual). **If combustion or performance indicate need:** • Clean heat exchanger • Remove and clean burner using compressed air only • Clean the blower wheels

Owner maintenance (see the Crest User's Information Manual for instructions)	
Daily	• Check boiler area • Check pressure/temperature gauge
Monthly	• Check vent piping • Check air piping • Check air and vent termination screens • Check relief valve • Check condensate drain system
Every 6 months	• Test low water cutoff • Reset button (low water cutoff) • Check boiler piping (gas and water) for leaks • Operate relief valve
End of season months	• Shut boiler down (unless boiler used for domestic hot water)

11 Maintenance

⚠WARNING Follow the service and maintenance procedures given throughout this manual and in component literature shipped with the boiler. Failure to perform the service and maintenance could result in damage to the boiler or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.

⚠WARNING The boiler should be inspected annually only by a qualified service technician. In addition, the maintenance and care of the boiler designated in Table 11A and explained on the following pages must be performed to assure maximum boiler efficiency and reliability. Failure to service and maintain the boiler and system could result in equipment failure.

⚠WARNING Electrical shock hazard – Turn off power to the boiler before any service operation on the boiler except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

Address reported problems

1. Inspect any problems reported by the owner and correct before proceeding.

Inspect boiler area

1. Verify that boiler area is free of any combustible materials, gasoline and other flammable vapors and liquids.
2. Verify that air intake area is free of any of the contaminants listed in Section 1 of this manual. If any of these are present in the boiler intake air vicinity, they must be removed. If they cannot be removed, reinstall the air and vent lines per this manual.

Inspect boiler interior

1. Remove the front access covers and inspect the interior of the boiler.
2. Vacuum any sediment from inside the boiler and components. Remove any obstructions.

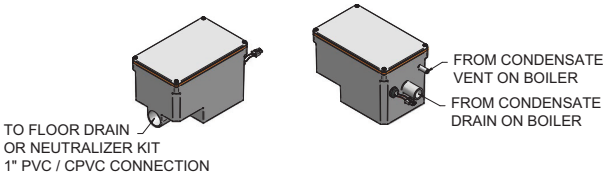
Clean condensate trap

1. Inspect the condensate drain line, vent line, condensate PVC fittings, and condensate trap.

Flush condensate trap with water

1. Remove the four (4) screws securing the top cover to the condensate trap and remove the cover (FIG. 11-1).
2. Locate the plastic ball inside the float tube. Verify there is nothing under the ball causing it to not seat properly.
3. Fill with fresh water until the water begins to pour out of the drain.
4. Replace the top cover and the screws removed in Step 1.

Figure 11-1 *Condensate Trap*



Check all piping for leaks

⚠WARNING Eliminate all system or boiler leaks. Continual fresh makeup water will reduce boiler life. Minerals can build up, reducing heat transfer, overheating heat exchanger, and causing heat exchanger failure. Leaking water may also cause severe property damage.

1. Inspect all water and gas piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check gas line using the procedure found in Section 6 - *Gas Connections*.

Flue vent system and air piping

1. Visually inspect the entire flue gas venting system and air piping for blockage, deterioration or leakage. Repair any joints that show signs of leakage. Verify that air inlet pipe is connected and properly sealed.
2. Verify that boiler vent discharge and air intake are clean and free of obstructions.

⚠WARNING Failure to inspect for the above conditions and have them repaired can result in severe personal injury or death.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 psi (82.7 kPa)).
3. Watch the system pressure as the boiler heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly press push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

11 Maintenance *(continued)*

Check expansion tank

1. Expansion tanks provide space for water to move in and out as the heating system water expands due to temperature increase or contracts as the water cools. Tanks may be open, closed or diaphragm or bladder type. See Section 5 - *Hydronic Piping* for suggested best location of expansion tanks and air eliminators.

Check fill water meter

1. Check fill water meter for water usage. If the amount exceeds 5% of your system volume, you could have a leak. Have the system checked for leaks and fixed by a qualified service technician.

Test boiler water

1. Test boiler water. Reference the Crest Installation and Operation Manual for guidelines. When test indicates, clean system water with approved system restorer following the manufacturer's information.

Check boiler relief valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read Section 5 - *Hydronic Piping* before proceeding further.

⚠WARNING Safety relief valves should be re-inspected AT LEAST ONCE EVERY THREE YEARS, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the boiler relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

2. After following the above warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

⚠WARNING Following installation, the valve lever must be operated AT LEAST ONCE A YEAR to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down the boiler until a new relief valve has been installed.

Inspect ignition and flame sense electrodes

1. Remove the ignition and both flame sense electrodes from the burner plate.
2. Remove any deposits accumulated on the ignition/flame sense electrodes using sandpaper. If the electrodes cannot be cleaned satisfactorily, replace with new ones.
3. Replace ignition/flame sense electrodes, making sure the gaskets are in good condition and correctly positioned.

Check ignition ground wiring

1. Inspect boiler ground wire from the heat exchanger access cover to ground terminal strip.
2. Verify all wiring is in good condition and securely attached.
3. Check ground continuity of wiring using continuity meter.
4. Replace ground wires if ground continuity is not satisfactory.

Check all boiler wiring

1. Inspect all boiler wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Navigate to the Setup Screen and check all settings. See Section 1 of the Crest Service Manual. Adjust settings if necessary. See Section 1 of the Crest Service Manual for adjustment procedures.
2. Check settings of external limit controls (if any) and adjust if necessary.

Perform start-up and checks

1. Start boiler and perform checks and tests specified in Section 9 - *Start-up*.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.

11 Maintenance

Check burner flame

1. Inspect flame through observation windows.
2. If the flame is unsatisfactory at either high fire or low fire, remove and clean the burner. Clean the burner thoroughly using a vacuum cleaner or compressed air. Do not use compressed air to clean the burner if cleaning is performed inside a building.

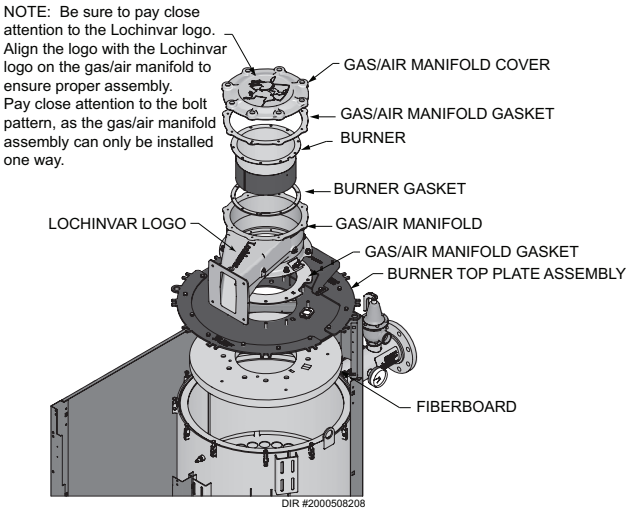
   • Shut down the boiler:
   - Follow the "To Turn Off Gas to Appliance" instructions for the boiler in Section 9 - Startup of the Crest Installation and Operation Manual.
   - Do not drain the boiler unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain.
3. Allow time for the boiler to cool to room temperature if it has been firing.
4. Remove the top access panel(s) to gain access to the gas/air manifold assembly.
5. Remove the gas/air manifold burner access cover (FIG. 11-2).
6. Remove the nuts/washers holding the burner to the gas/air manifold assembly.
7. Remove the burner from the gas/air manifold assembly.

NOTICE The burner gasket, burner, burner baffle, and gas/air manifold access cover can only be installed in one orientation. All of these parts will have to be re-installed correctly. To ensure all of these parts are re-installed correctly, align the logo on top of the gas/air manifold cover with the logo on the gas/air manifold as shown in FIG. 11-2. Be certain to pay close attention to the bolt pattern when re-installing the above parts.

8. When replacing the burner, ensure gaskets are in good condition and positioned correctly (FIG. 11-2).
9. When securing the burner and manifold, be sure to tighten the nuts as follows:
   a. Tighten the nuts in a star pattern sequence.
   b. Tighten the 7/16" nuts, securing burner to the cast manifold to a torque of 25 ft.-lbs.
10. Re-install the gas/air manifold burner access cover. Tighten 3/8" nuts to 8 ft.-lbs. using the star pattern sequence.
11. After firing the unit, re-tighten the nuts to the torque specifications.

⚠WARNING Failure to follow the torquing specifications listed in this manual could result in severe personal injury or death.

Figure 11-2 *Burner Assembly*



Check flame signal

1. At high fire of each combustion system, the flame signal shown on the display should be at least 10 microamps.
2. A lower flame signal may indicate a fouled or damaged flame sense electrode. If cleaning the flame sense electrodes does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the flame sense electrode.
3. See Section 3 - *Troubleshooting* in the Crest Service Manual for other procedures to deal with low flame signal.

11 Maintenance *(continued)*

Review with owner

1. Review the Crest User's Information Manual with the owner.
2. Emphasize the need to perform the maintenance schedule specified in the Crest User's Information Manual (and in this manual as well).
3. Remind the owner of the need to call a licensed contractor should the boiler or system exhibit any unusual behavior.
4. Remind the owner to follow the proper shutdown procedure and to schedule an annual start-up at the beginning of the next heating season.

Cleaning boiler heat exchanger

1. Shut down boiler:
   - Follow the "To Turn Off Gas to Appliance" instructions for the boiler in Section 9 - Startup.
   - Do not drain the boiler unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain.
2. Allow time for the boiler to cool to room temperature if it has been firing.
3. Remove the top access panel to remove the gas/air manifold assembly.
4. Remove the nuts securing the burner to the burner mounting plate. Remove the burner (reference FIG. 11-2 and follow the steps in *Check Burner Flame* on page 64).
5. Remove the nuts securing the burner mounting plate from the heat exchanger and set aside. Remove the entire burner mounting plate assembly.

⚠WARNING The boiler contains ceramic fiber materials. Use care when handling these materials per instructions on this page. Failure to comply could result in severe personal injury.

6. Use a vacuum cleaner to remove any accumulation on the tube sheet surfaces. Do not use any solvent.
7. Brush the heat exchanger (tube sheet, combustion chamber walls, and tube entry) while dry using a nylon bristle brush. **Caution:** DO NOT use a metal brush. Re-vacuum the heat exchanger.
8. Finish cleaning using a clean cloth dampened with warm water.
9. Temporarily remove the condensate drain line from the condensate trap and route directly to a drain.
10. Rinse out debris with a low pressure water supply. The water will drain through the condensate connection.
11. Allow the heat exchanger to thoroughly dry.
12. Reconnect the condensate drain line to the condensate trap.
13. Close isolation valves on piping to isolate boiler from system. Attach a hose to the boiler drain and flush boiler thoroughly with clean water by using purging valves to allow water to flow through the water makeup line to the boiler.
14. When securing the burner, be sure to tighten the nuts, but DO NOT over-tighten. Tighten the nuts to a torque setting of no more than 6.2 ft.-lbs. When securing the burner mounting plate be sure to tighten the nuts, but DO NOT over-tighten. Tighten the nuts to a torque setting of no more than 15.5 ft.-lbs.
15. Replace the burner mounting plate assembly and gas/air manifold assembly. Ensure gaskets are in good condition and positioned properly. Restore boiler to operation.
16. Perform start-up and check-out procedures in the Check Flame and Combustion - Section 9 - Startup on pages 49 and 51 of this manual.

Handling ceramic fiber materials

REMOVAL OF COMBUSTION CHAMBER LINING

⚠WARNING The combustion chamber insulation in this appliance contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)." Normal operating temperatures in this appliance are below the level to convert ceramic fibers to cristobalite. Abnormal operating conditions would have to be created to convert the ceramic fibers in this appliance to cristobalite.

The ceramic fiber material used in this appliance is an irritant; when handling or replacing the ceramic materials it is advisable that the installer follow these safety guidelines.

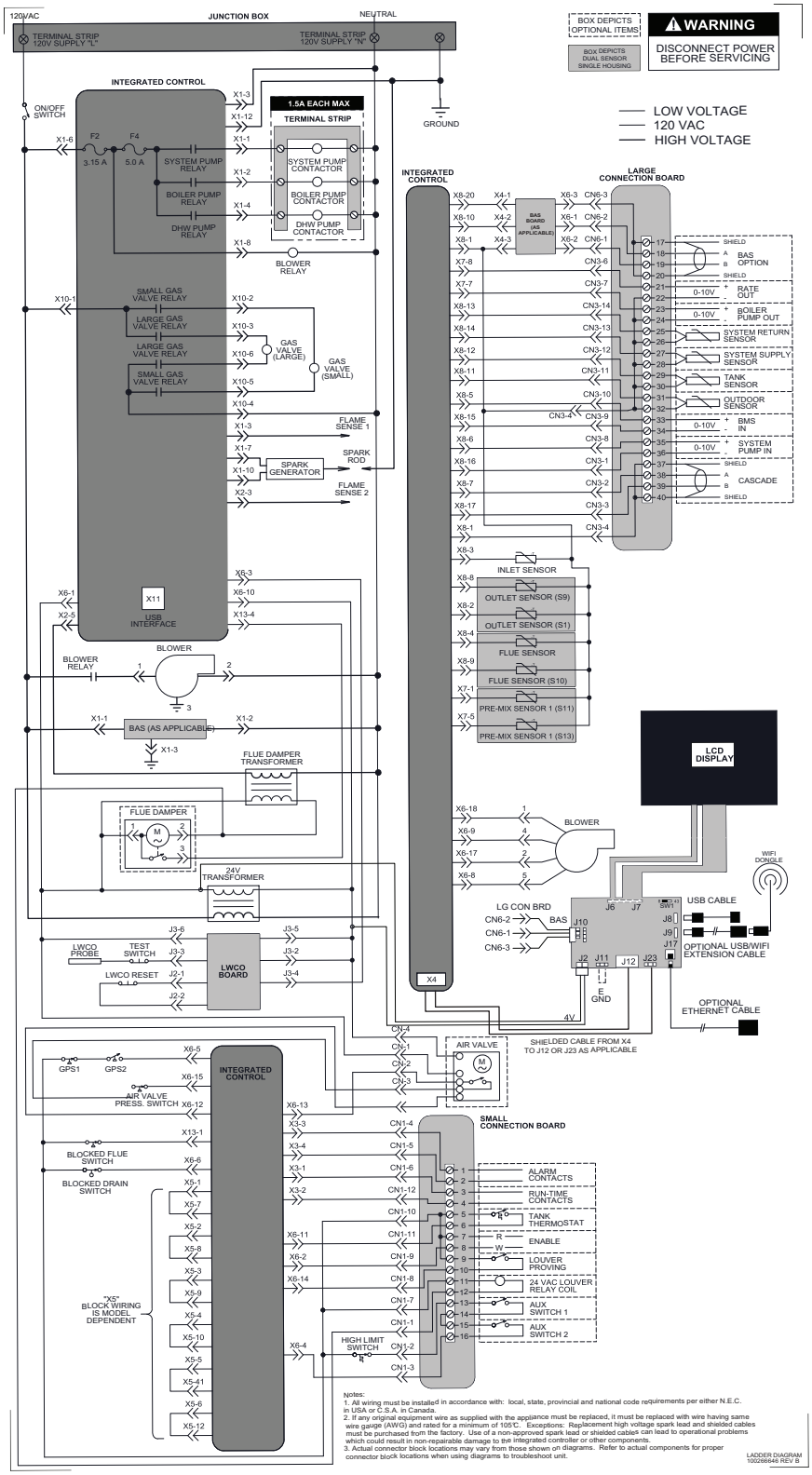
- Avoid breathing dust and contact with skin and eyes.
  - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH website at http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
  - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent airborne dust.
- Remove the combustion chamber lining from the boiler and place it in a plastic bag for disposal.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

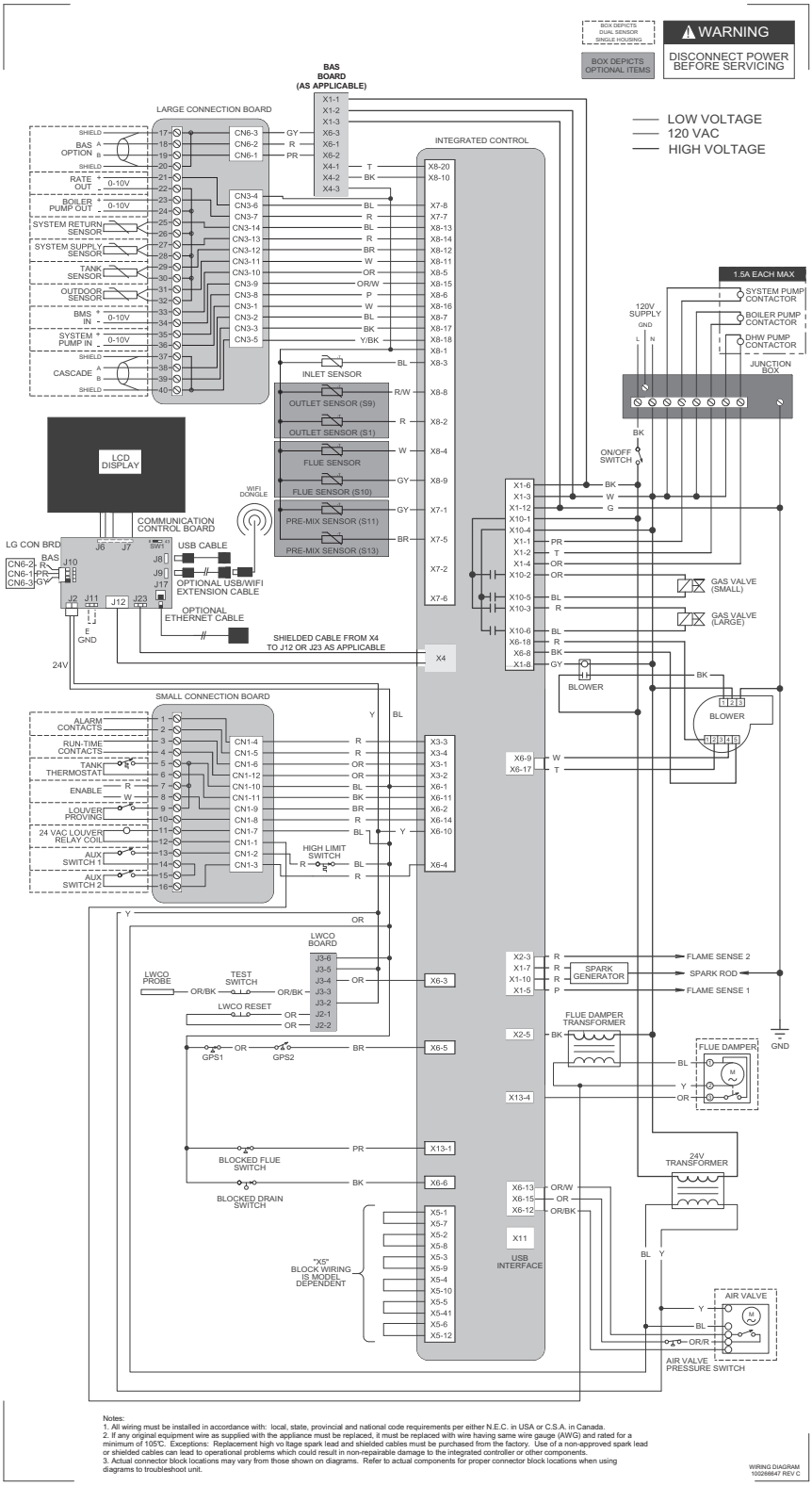
12 Diagrams

Figure 12-1 *Ladder Diagram_751 - 2001 Models*



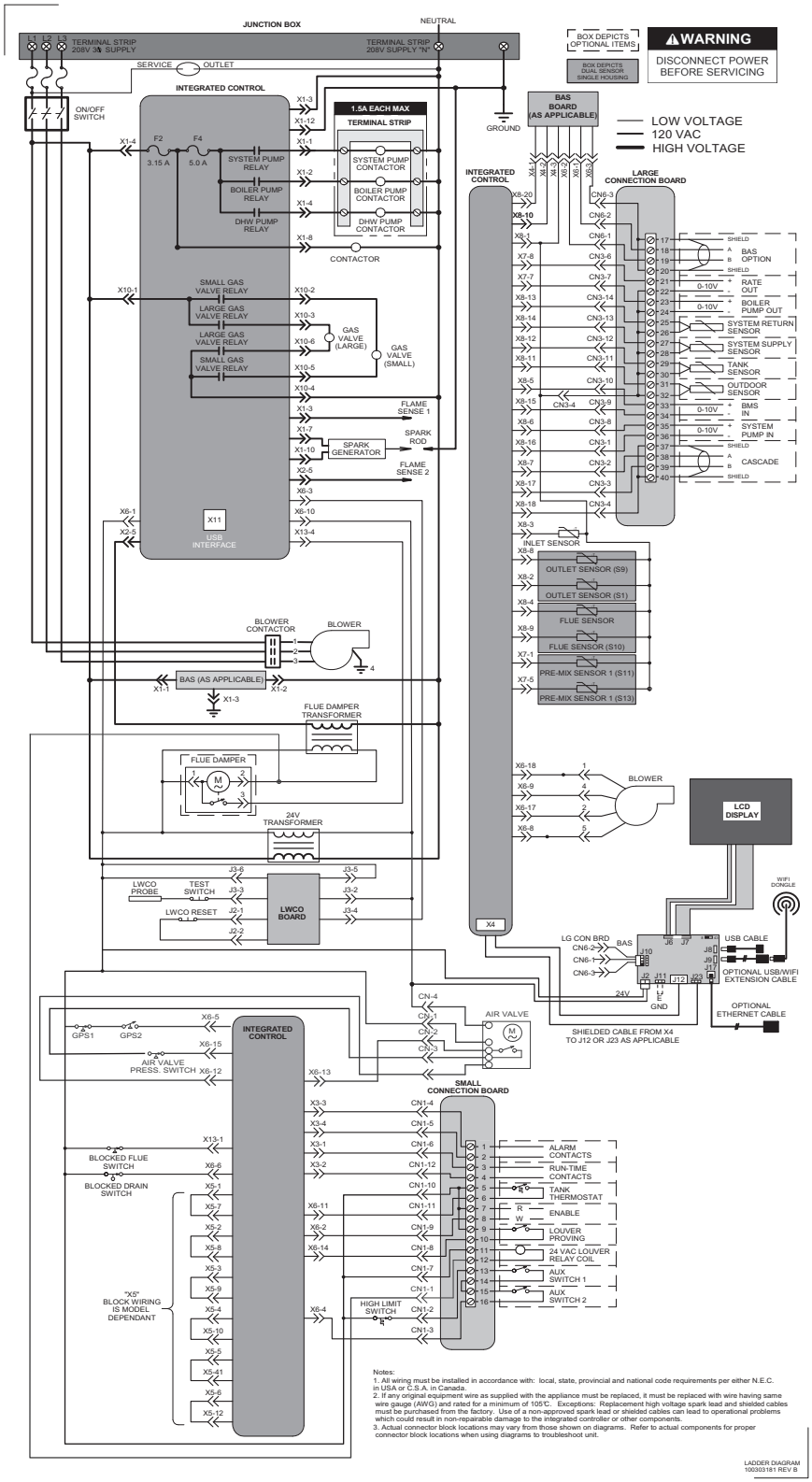
12 Diagrams *(continued)*

Figure 12-2 *Wiring Diagram_751 - 2001 Models*



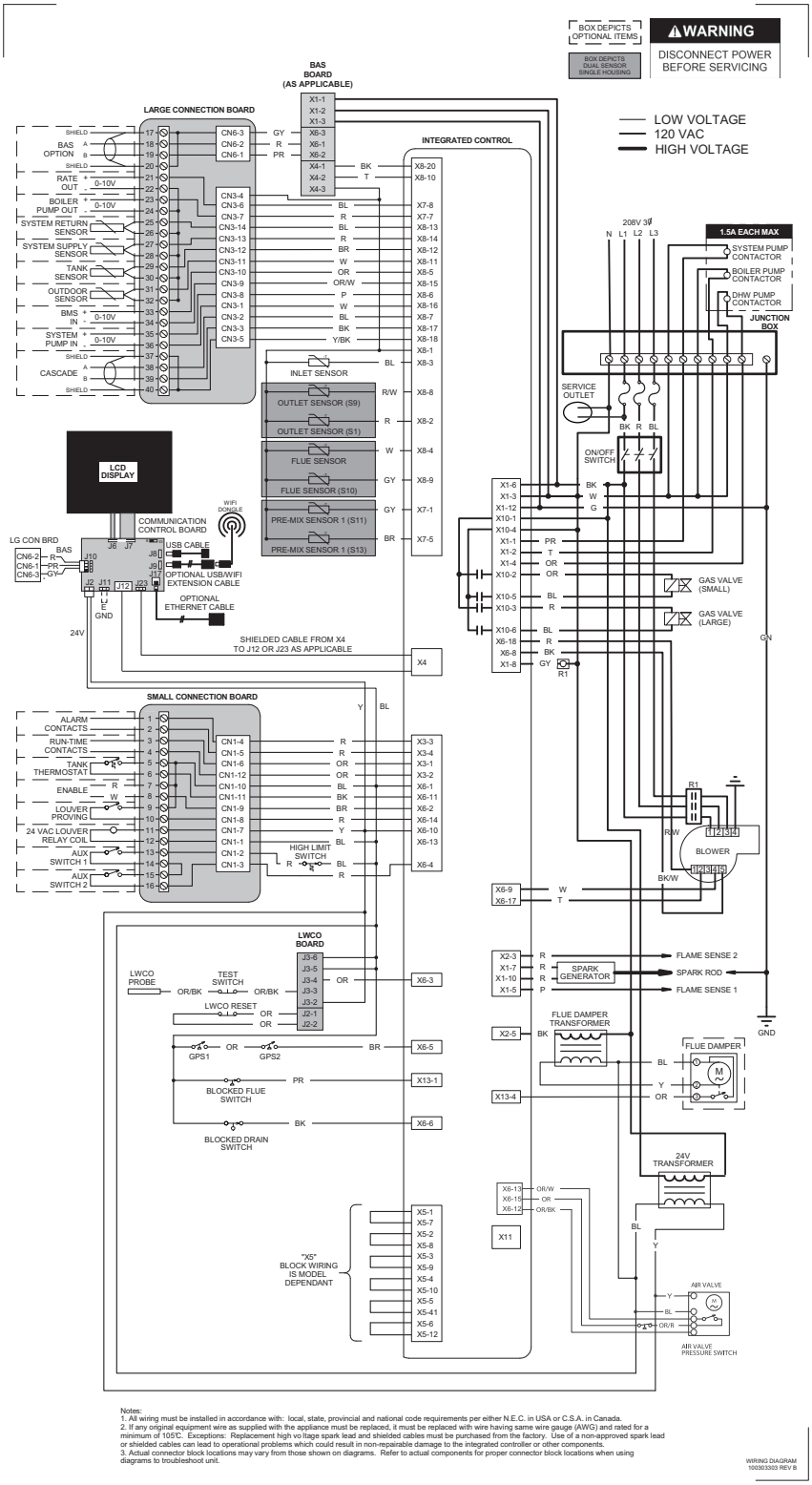
12 Diagrams

Figure 12-3 *Ladder Diagram_2501 - 3501 Models*



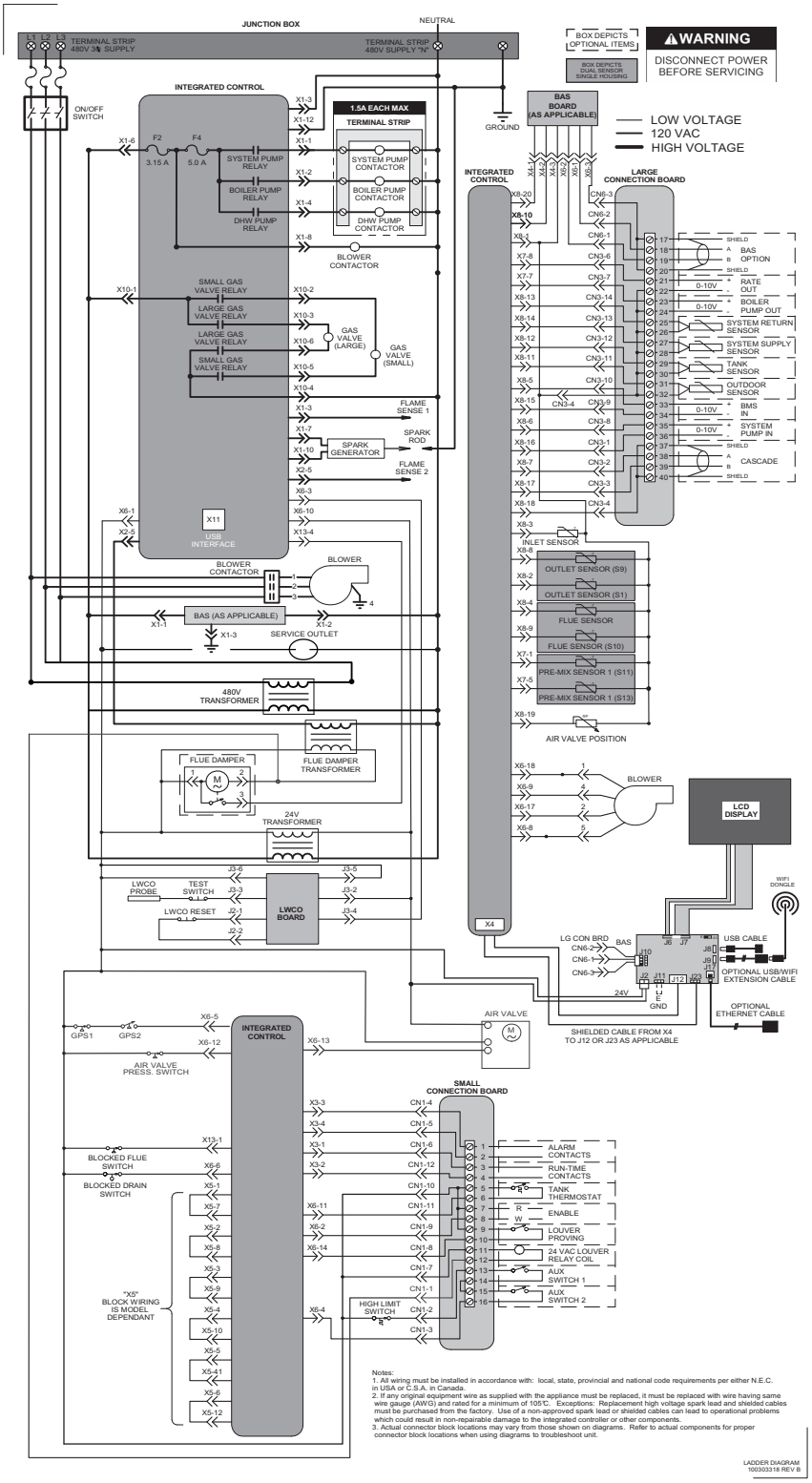
12 Diagrams *(continued)*

Figure 12-4 *Wiring Diagram_2501 - 3501 Models*



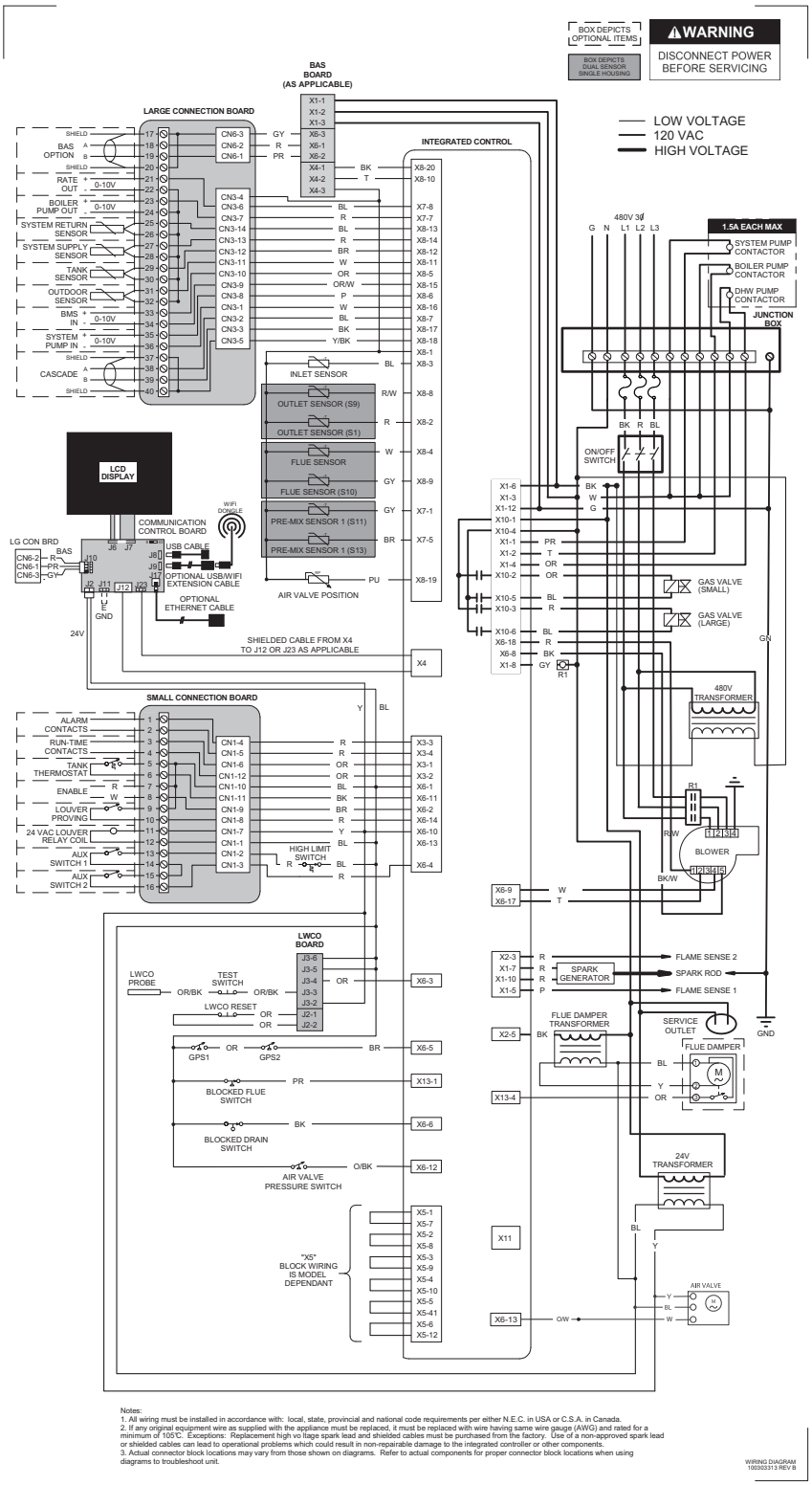
12 Diagrams

Figure 12-5 *Ladder Diagram_4001 - 5001 Models*



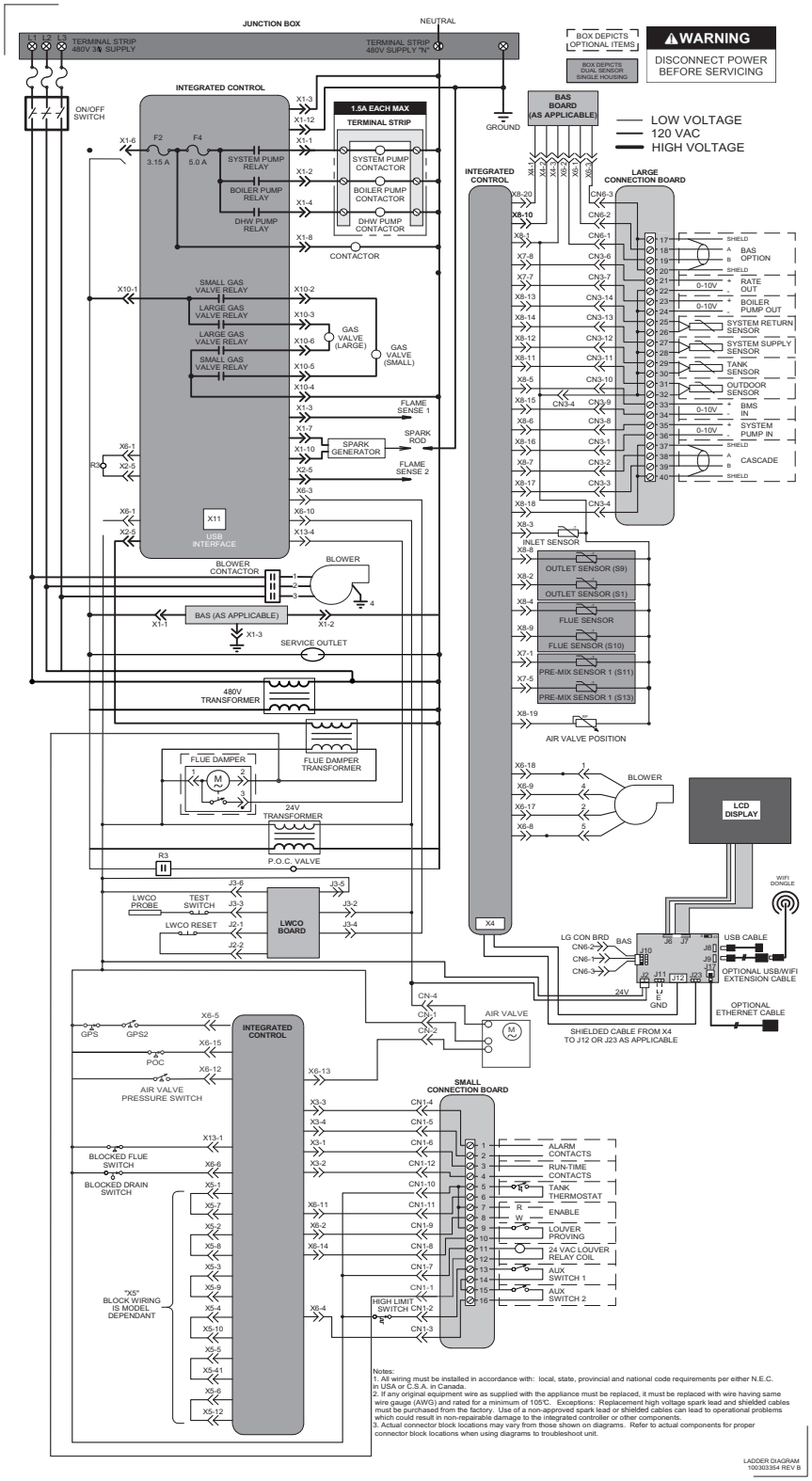
12 Diagrams *(continued)*

Figure 12-6 *Wiring Diagram_4001 - 5001 Models*



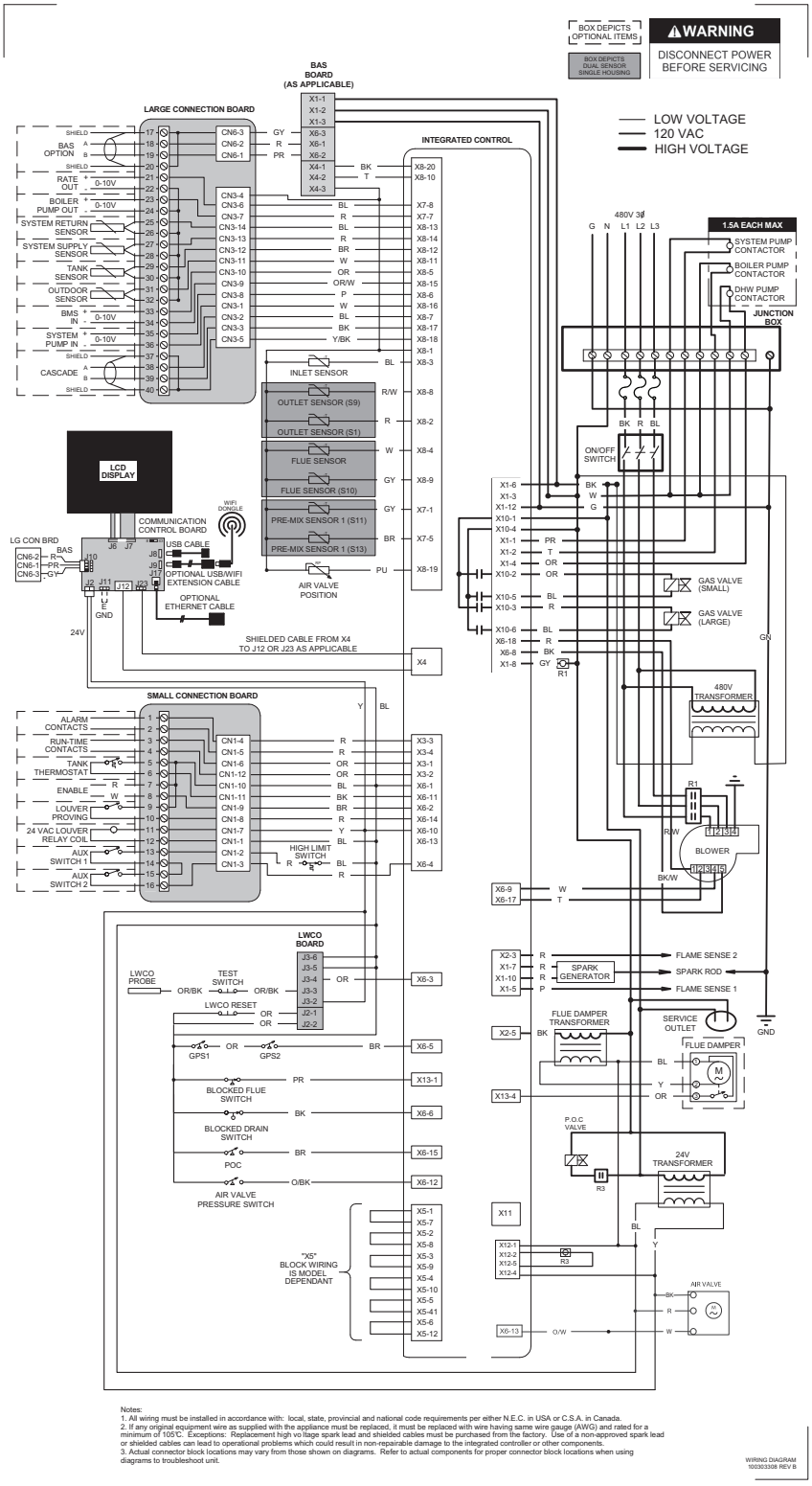
12 Diagrams *(continued)*

Figure 12-7 *Ladder Diagram_6001 Model*



12 Diagrams

Figure 12-8 *Wiring Diagram_6001 Model*



Notes

Notes

Revision Notes: *Revision A (ECO #C17106) initial release.*

Revision B (ECO C17419) reflects the addition of the large Crest models (1501 - 2001).

Revision C (Change #500000695) reflects the addition of ICC venting options on page 17 (R06799), add PVC to SS adapter and 6" starter piece on page 20 (R08066), along with edits made to the Gas Connections Section, and the addition of the California contaminant warning on page 3 (R07228).

Revision D (Change #500000938) reflects the removal of the balancing valves notice on page 34.

Revision E (Change #500001029) reflects the addition of the Crest CON•X•US Interface, along with the addition of the re-spark ignition option.

Revision F (PCP# 3000002544 / CN# 500002701) reflects an update to step 10 in Sequence of Operation on page 57.

Revision G (PCP# 3000001665 / CN# 500001821) reflects the addition of Step 4 under the Common Venting section on page 19. SAP part numbers have been updated.

Revision H (PCP# 3000003037 / CN# 500003264) reflects an update to Figures 5-4 & 5-5 on pages 33 & 34.

Revision J (PCP# 3000005648 / CN# 500006460) reflects an update to Figures 3-3 and 3-4 on page 23 and Figure 4-5 on page 27.

Revision K (PCP# 3000004438 / CN# 500005574) reflects an update to the flue temperatures on page 54.

Revision L (PCP# 3000007531 / CN# 500007598) reflects changes made to water chemistry information on pages 3, 7, 17, 21, 28-34, 44-45, and 59.

Revision M (PCP# 3000006133 / CN# 500007549) reflects the addition of a PVC-DWV vent fitting in Table 2E on page 20.

Revision N (PCP# 3000009267 / CN# 500009031) reflects an update to the pH Level range on page 44.

Revision P (PCP# 3000009150 / CN# 500008822) reflects edits made to the vent terminations on pages 23 and 27 along with the removal of 48" MAX termination references on pages 24, 25 and 27.

Revision R (PCP #3000010423 / CN #500010150) reflects an update to the neutralizer information on page 43.

Revision T (PCP #3000021559 / CN #500011827) reflects the addition of the 6" vent option along with changes made to the Btu inputs on page 6.

Revision U (PCP# 3000025102 / CN# 500014948) reflects the addition of Models 2501 - 6001.

Revision V (PCP #3000027116 / CN #500016865) reflects the addition of the 110 and 111 series.

Revision W (PCP #3000028279 / CN #500017755) reflects an update to the user interface screens, wiring diagrams, and ladder diagrams.

Revision X (PCP #3000028854 / CN #500018329) reflects an update to Figure 5-4.

Revision Y (PCP #3000029921 / CN #500019205) reflects an update to the data in Figures 5-1A and 5-1B along with Table 5A on pages 30 and 31.

Revision AA (PCP #3000031194 / CN #500020655) reflects an update to Tables 2B, 2C, 2G, and FIG. 2-2. This also includes the addition of Table 2F.

Revision AB (PCP #3000033465 / CN #500022172) reflects the addition of the neutral wiring reference on page 41 along with the addition of the combustion measurement port on pages 4 and 5.

Revision AC (PCP #3000035711 / CN #500024133) reflects an update to the Ratings Table and Table 6A.

Revision AD (PCP #3000036331 / CN #500024646) reflects an update from 7" to 8" pipe in the hydronic piping charts.

Revision AE (PCP #3000037348 / CN #500025601) reflects an update to the ICC part numbers in Table 2A-2.

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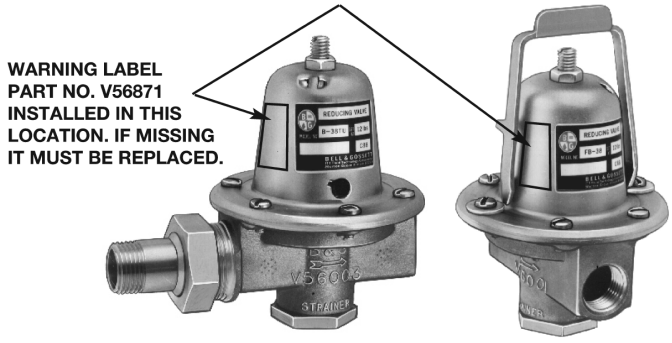
INSTRUCTION MANUAL
V55999N



Reducing Valves

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

SAFETY INSTRUCTIONS

This safety alert symbol will be used in this manual to draw attention to safety related instructions. When used, the safety alert symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED! FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN A SAFETY HAZARD.

DESCRIPTION

The Bell & Gossett Pressure Reducing Valve is designed for filling hot water boilers and associated piping systems to a properly controlled pressure after boiler installation or system servicing. **It is not a safety device and is not intended to be used as a water feed valve to control boiler water at a safe operating level.** They are factory set at specified limits although adjustment is easily made. They are equipped with a built-in strainer and low inlet pressure check valve.

SIZES & PERFORMANCE

MODEL NUMBER	SIZE INCHES		FACTORY SETTING PSIG	ADJUSTABLE RANGE PSIG
B-38	1/2	NPT	12	10-25
B 7-12	3/4	NPT		
B-38TU	1/2	UNION NPT/SWEAT		
FB-38*	1/2	NPT		
FB-38TU*	1/2	UNION NPT/SWEAT		
6	1/2	NPT	45	25-60
7	3/4	NPT		

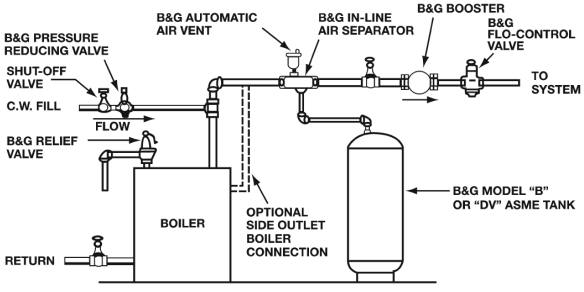
Maximum Flow 5 1/2-6 GPM at 125 PSIG inlet Pressure.

*NOTE: Fast-Fill models must be installed in upright position (i.e. flow arrow along horizontal axis).

TEMPERATURE AND PRESSURE LIMITS

Maximum Operating Temperature: 225°F.
Maximum Working Pressure: 125 PSIG

NOTE: Bell & Gossett does not recommend Reducing Valves to be used for potable water.



TYPICAL INSTALLATION

INSTALLATION INSTRUCTIONS

The Pressure Reducing Valve must be installed with the flow arrow on the body pointing in the direction of flow. A shut-off valve must be installed on the city water side of the Pressure Reducing Valve. If the Pressure Reducing Valve is not equipped with a fast fill feature, a by-pass may be used for rapid filling, but it must remain closed during normal system operation.

For safe boiler operation, installation of a low water cut off, adequate burner safety control and a properly installed float operated water feed control is recommended. Examples of these types of control devices include the McDonnell & Miller No. RB-24 and RB-120 low water cut offs and the No. 47-2 combination feeder and low water cut off.

Uncontrolled firing and overheating of boiler and boiler components may occur in a hot water heating system that is installed without adequate safety controls. The installation of a functioning air control system and thermal expansion compensation system is required for the proper operation of a hot water heating system.

WARNING: State of California Residents
This product contains a chemical known by the State of California to cause cancer. This product contains a chemical by the State of California to cause birth defects or other reproductive harm.

WARNING: Injecting cold water into a boiler that has overheated due to uncontrolled firing and/or improper water level control, can cause excessive stresses in boiler components and possible rupture of the boiler. This will be prevented by proper selection and installation of a water level control and burner safety controls. The shut-off valve at the pressure reducing valve inlet must be closed except when filling the system, after installation, or after service. Failure to follow these instructions could result in serious personal injury or death and property damage.

1. Pipe Reducing Valve into system as shown on typical installation drawing on page 1.

CAUTION: The generous use of pipe joint compound when installing Pressure Reducing Valve will foul the valve operating mechanism, preventing it from functioning properly. Pipe joint compound must be conservatively applied to male threads only. Failure to follow this instruction can result in moderate personal injury or property damage.

CAUTION: The use of PTFE impregnated pipe compound and PTFE tape on pipe threads provides lubricity which can lead to overtightening and breakage. Do not overtighten. Failure to follow this instruction can result in moderate personal injury from hot water and/or property damage.

2. When installing Reducing Valve models that include a sweat union connection feature, first sweat the tailpiece in place, then assemble union nut to Reducing Valve.

WARNING: Use of improper procedures to sweat Reducing Valve models with union connection into a system can damage the Reducing Valve. Before installing sweat union connection to Reducing Valve, the union connection must be first sweated (soldered) into place. Failure to follow these instructions could result in serious personal injury or death and property damage.

OPERATING INSTRUCTIONS

Model No's. B-38, B-38TU and B7-12 are preset at 12 PSI, and No's. 6 and 7 are preset at 45 PSI. Open the cold water fill valve to allow the system to fill until the preset pressure of the valve has been obtained.

Model No's. FB-38 and FB-38TU are preset at 12 PSI, and are equipped with a fast fill lever. When filling the system, the fast fill lever should be manually placed in the top vertical position. **This overrides the pressure regulating function of the reducing valve.** The system should be filled until the boiler pressure gauge indicates the preset pressure of the valve. The fast fill lever should then be placed in the horizontal position for the normal automatic operation.

WARNING: Improper use of fast fill feature can result in over pressurization of the boiler system. The fast fill lever must never be left in the upright position after the system has been filled. The handle must be placed in the horizontal position to avoid over pressurization and unnecessary relief valve discharge. Damage to the Reducing Valve and other system components can result. Failure to follow these instructions could result in serious personal injury or death and property damage.

WARNING: Low pressure conditions may occur during uncontrolled overfiring of the boiler. This could result in cold water being added to an extremely overheated boiler, causing excessive stress on boiler components, and possible rupture of the boiler. The shut-off valve, installed on the Reducing Valve inlet, must be kept closed except during initial system fill, or when manually adding water to the system because of a loss of pressure. This will prevent water from being added to an overheated boiler. **NEVER ADD WATER TO AN OVERHEATED BOILER.** Failure to follow these instructions could result in serious personal injury or death and property damage.

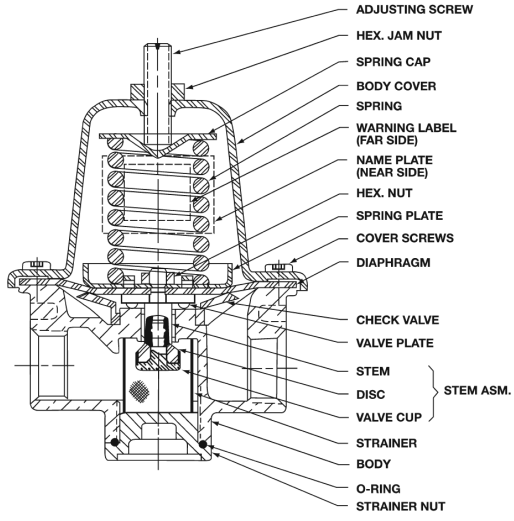
CAUTION: Corrosion and eventual failure of system components can result from the constant addition of fresh water. After the system has been filled, the cold water shut-off valve must be closed. This will prevent system leaks from being undetected by the constant replacement of lost system water. Failure to follow these instructions could result in property damage and/or moderate personal injury.

PRESSURE SETTING

The pressure setting can be changed by the following steps:

1. Allow water in heating system to cool to ambient temperatures.
2. Reducing Valve pressure setting can be adjusted by loosening the jam nut on top of the Reducing Valve and turning the slotted adjusting screw. Turn the screw clockwise to increase the set pressure, or counterclockwise to lower the set pressure. This should be done slowly until the boiler pressure gauge indicates the desired fill pressure.

   NOTE: Do not adjust pressure to less than 10 psig.
3. Hold the adjusting screw stationary with a screwdriver and tighten the jam nut.
4. Return the system to operation.
5. Close the cold water shut-off valve.



SERVICE INSTRUCTIONS

1. One way to determine if the Pressure Reducing Valve is working is to carefully place your hand on the Reducing Valve body. If the system is up to temperature but the valve body feels cold to the touch, then it is passing water. The problem may be an improper setting (see action on Pressure Setting), a leak downstream, or a faulty valve (which would need to be replaced).
2. If the relief valve discharges periodically, it is an indication that the system may have lost its air cushion in the compression or expansion tank. To determine if this is the case, initiate the following test:
   a. *Bladder or diaphragm style pre-charged tanks:* Shut off boiler and allow system to cool to ambient temperature. Isolate the tank from the system, then bleed the water from the tank. Place a tire-type pressure gauge on the air valve on the tank. If the pressure is zero, the cushion is lost. The absence of the cushion may be from a leaking air valve. To check if this is the case, add some air to the tank and place some liquid on the valve stem area. If the liquid bubbles, the valve is leaking and must be replaced (see Instruction Manual A01500 for valve replacement). If the absence of the air cushion was not caused by a leaking valve, then the bladder or diaphragm is leaking, and the bladder must either be replaced (for the "B" Series) or the tank must be replaced (for the "D" Series). See Instruction Manual A01500 for bladder replacement.
   b. *Conventional compression tanks:* Shut off the boiler for approximately 30 minutes. Record the pressure. Turn the boiler on. If, within 8-9 minutes, the pressure gauge at the boiler indicates a value within 10% of the relief valve setting, then the tank is waterlogged and needs to be drained and re-charged (see Instruction Manual S10300 for drain and air-charge procedures).
3. If the Pressure Reducing Valve fails to fill to the set COLD fill pressure, the strainer may be clogged. To service the strainer, follow the following steps:
   a. Verify that the city water or cold water shut-off valve is closed.
   b. Turn the boiler on-off switch to the "OFF" position.

WARNING: System fluid under pressure and/or at high temperatures can be very hazardous. Before servicing, reduce system pressure to zero or isolate the pressure reducing valve from the system. Leave drain valve open. Allow system to cool below 100°F. Failure to follow these instructions could result in serious personal injury or death and property damage.

   c. Remove strainer nut located on bottom of reducing valve.
   d. Remove and clean or replace the strainer.
   e. Reinstall the strainer nut with O-ring into the reducing valve and tighten to a torque of 10 in-lbs. Min. – 100 in-lbs. Max. Replace the strainer nut with O-ring if it is damaged.

WARNING: Do not use PTFE when installing the strainer nut with O-ring. The PTFE provides lubricity which can lead to overtightening and breakage. **Do not overtighten.** Failure to follow these instructions can result in moderate personal injury from hot water and/or property damage.

   f. Close the boiler drain and open cold water shut-off valve to refill system.
   g. After system has been filled and vented, turn the boiler on-off switch to the "ON" position and resume normal boiler operation. Close the cold water shut-off valve.

WARNING: Corrosion or leakage are indications that the Pressure Reducing Valve may be about to cause serious damage from leakage or rupture. It must be periodically inspected and if corrosion or leakage is noted, the pressure reducing valve must be serviced or replaced. Failure to follow these instructions could result in serious personal injury or death and property damage.

Valve Repair

To service the valve using the repair kit, follow steps 1, 2 and 3 from above and these additional steps:

   d. Remove the strainer.
   e. Using a size 25 Torx screwdriver, unfasten the six cover screws and remove the body cover. (A 1/8" Allen wrench will work in an emergency, but stripping may occur).
   f. Remove the spring cap and spring.
   g. Remove the hex nut by holding the stem assembly stationary while turning the nut counterclockwise. The stem assembly may drop once the nut has been removed.
   h. Lift off the spring plate, diaphragm and valve plate.
   i. Pull the rubber check valve from the valve body and replace.
   j. Insert new stem assembly into valve body through the strainer opening in the housing. Hold in place.
   k. Place the new valve plate, knob side down, on the stem assembly.
   l. Set new diaphragm on top of the stem, aligning holes with those in the body.
   m. Place spring plate over the diaphragm on top of the stem assembly.
   n. Thread the hex nut on the stem assembly. A dab of Loctite must be added to the hex nut before threading on the stem.

CAUTION: Any more than a dab will seize the valve.

   o. Place spring, spring cap and body cover on top.
   p. Align body cover holes with those in the body and fasten body cover screws.
   q. Reinstall the strainer nut with O-ring into the reducing valve and tighten to a torque of 10 in-lbs. Min. – 100 in-lbs. Max. Replace the strainer nut with O-ring if it is damaged.

WARNING: Do not use PTFE when installing the strainer nut with O-ring. The PTFE provides lubricity which can lead to overtightening and breakage. **Do not overtighten.** Failure to follow these instructions can result in moderate personal injury from hot water and/or property damage.

   r. Close the boiler drain and open cold water shut-off valve to refill system.
   s. After system has been filled and vented, turn the boiler on/off switch to the "ON" position and resume normal boiler operation. If pressure setting differs from previous setting, refer to section on pressure setting. Close cold water shut-off valve.

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're 12,500 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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INSTRUCTION MANUAL

P2002548 Rev E

Single Phase Pump

Three Phase Pump

ecocirc® XL

Bell & Gossett
a xylem brand

06/19/2020

Table of Contents

Table of Contents

1 Introduction and Safety

1.1 Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance

CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

1.2 Safety terminology and symbols

Hazard levels

Hazard level	Indication
DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	• A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:

Electrical Hazard:

Hot surface hazard

Hot surface hazards are indicated by a specific symbol that replaces the typical hazard level symbols:

CAUTION:

Qualified personnel

WARNING:

This product is intended to be operated by qualified personnel only.

1.3 Protecting the environment

Emissions and waste disposal

Observe the local regulations and codes regarding:

- Reporting of emissions to the appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills

Exceptional sites

CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

Recycling guidelines

Always follow local laws and regulations regarding recycling.

1.4 Spare parts

WARNING:

Only use original spare parts to replace any worn or faulty components. The use of imitation spare parts may cause malfunctions, damage, and injuries as well as void the warranty and the UL listing.

2 Transportation and Storage

2.1 Inspect the delivery

1. Inspect the package for damage or missing items upon delivery.
2. If applicable, unfasten the product by removing any screws, bolts, or straps. For your personal safety, be careful when you handle nails and straps.
3. Remove packing material from the product.
4. Dispose of all packing material in accordance with local regulations.
5. Inspect the product to determine if any parts have been damaged or are missing.

Contact your local B&G representative if there are any issues.

2.2 Transportation guidelines

Positioning and fastening

The unit should be transported in an upright position as indicated on the package. Make sure that the unit is securely fastened during transportation and cannot roll or fall over. The product can be safely transported at ambient temperature from -40°F to +158°F (-40°C to +70°C) with humidity <95% (non-condensing) and protected against dirt, heat source, and mechanical damage.

Precautions

WARNING:

- Observe accident prevention regulations in force.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.

Check the gross weight that is indicated on the package in order to select proper lifting equipment.

2.3 Storage guidelines

Storage location

NOTICE:

- Protect the product against humidity, dirt, heat sources, and mechanical damage.
- The product must be stored at an ambient temperature from -13°F to +131°F (-25°C to +55°C) and humidity < 95% (non-condensing).

3 Product Description

3.1 Pump design

- The ecocirc XL is a large wet rotor pump with energy efficient, electronically commutated permanent magnet motor.
- The pump is designed for systems with variable flow rates to optimize pump operation thus reducing energy consumption. The pump can be set to any one of the multiple operating modes available, with each designed for a specific application to achieve high performance and maximum energy savings.
- Pumps are offered in cast iron and stainless steel options to handle HVAC and potable water applications respectively. However, a single stainless steel body pump can handle heating, cooling and plumbing applications if so desired. The pumps are also suitable for a 50/50 percent water/glycol circulating fluid. The built-in electrical overload and dry run protection provide safety and protection from damage.

Intended use

WARNING:
This product can expose you to chemicals including lead, which is known to the state of California to cause cancer and birth defects or other reproductive harm. For more information go to: www.P65Warnings.ca.gov

The pump is suitable for:

- Potable water with stainless steel body models
- Hot water heating systems
- Cooling and cold water systems

The pump can also be used for:

- Solar systems
- Geothermal applications

Improper use

DANGER:
Do not use this pump to handle flammable and/or explosive liquids.

WARNING:
Unintended use of the pump may create dangerous conditions and cause personal injury and damage to property.

WARNING:
Do NOT install this pump in swimming pools or marine areas. Failure to follow these instructions could result in serious personal injury, death and/or property damage.
THIS IS A NON-SUBMERSIBLE PUMP

WARNING:
Do NOT exceed the maximum working pressure of the pump. This information is listed on the nameplate of the pump.

WARNING:
The pump user interface values are to be used for reference purposes only. Do not use the values given by the pump for system balancing. If a level of flow and accuracy is required, gauges that match the expected accuracy level must be installed independent of the pump.

NOTICE:
Do not use this pump to handle liquids containing abrasive, solid or fibrous substances, toxic or corrosive liquids, potable liquids other than water or liquids not compatible with the pump construction material. Water pH must be maintained between 7-9 and water hardness must not exceed 14 grains/ gallon, with suspended solids less than 100 PPM.

An improper use of the product leads to the loss of the warranty.

3.2 Product nomenclature

Example: ecocirc XL N 15–75	
ecocirc XL	high efficiency pump series
N	Pump type: Blank = Cast iron N = Stainless Steel pump body for potable water pumping
-15	Maximum pump head (FT)
-75	Maximum pump flow rate (GPM)

3.3 Technical data

Feature	Description
Motor model	Electronically commutated motor with permanent magnet rotor
Series	ecocirc XL
Rated voltage	1 x 115 V ±10% 1 x 208-230 V ±10% 3 x 208-230/400-460 V ± 10% 3 x 400-460 V ± 10%
Frequency	50/60 Hz
Power consumption	The maximum power consumption is indicated on the pump nameplate.
IP protection	IP 44
Insulation class	Class 155 (F)
Maximum working pressure	The maximum pressure is indicated on pump nameplate 175 PSI (12 bars)
Liquid temperature range	14°F (-10°C) to 230°F (110°C) Up to 149°F (+65°C) is recommended for domestic hot water pumps
Ambient temperature range	32°F (0°C) to 104°F (40°C)
Ambient humidity	≤ 95% non-condensing
Pumping media	Water and water/glycol mixtures[1] up to 50%.
Sound pressure	See *Sound pressure levels* on page 5.
EMC (electromagnetic compatibility)	EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-2:1997 + A1:2001 + A2:2008, EN 61000-3-2:2006 + A1:2009 + A2:2009, EN 61000-3-3:2008, 61800-3:2004+A1:2012.
Leakage current	< 3.5 mA
I/O auxiliary +15 VDC power supply	Imax < 40 mA
Fault signal relay	1 PH: • Vmax < 250 VAC • Imax < 2 A 3 PH units have two relays: • Status signal relay • Fault signal relay Vmax < 250 VAC Imax < 2 A
Run signal relay	3 PH pumps only

[1] The pump can be used with water/propylene glycol mixtures up to 50% with a maximum viscosity of 50cST at 14°F (-10°C). The pump has built-in overload and thermal protection to protect the pump from overload due to increased fluid viscosity. Pump performance is based on 77°F (25°C). Therefore pumping of glycol mixtures will affect max performance, depending on mixture concentration and temperature.

Feature	Description
CSA certification	NSF/ANSI-372 compliant (stainless steel body parts)
UL/cUL Listed	UL 778 - Motor operated water pump UL1004 - Motors UL listing UL 60730 - Inverters UL listing
BTL Certification	BacNet Smart Actuator (B-SA)

3.4 Sound pressure levels

Nominal pump HP	Sound pressure level (approximate values)
1/6	≤ 43 dB (A)
1/2	≤ 48 dB (A)
1	≤ 55 dB (A)
2	≤ 60 dB (A)
3	≤ 65 dB (A)

3.5 Scope of delivery

Inside the package you will find:

- Pump unit
- Insulating shells for pump body – for heating applications
- O-ring to be used as replacement between motor housing and pump body
- Two (2) gaskets for flanged connection
- 20 mm x ½" NPT electrical fitting
- IOM and Quick Start guide
- Two (2) M16 x 1.5 connection cable fitting
- Two (2) Absolute Pressure Sensors PN 16, rated for 175 PSI (12 bar) (with 3-phase pumps only)

3.6 Accessories

- Companion flanges
- Fastener Packs consisting of 4 bolts and 4 nuts (for 2-bolt models)
- Fastener Packs consisting of 8 bolts and 8 nuts (for 4-bolt models)
- Pressure sensor (for details see *External sensors* on page 11)
- Temperature sensor (for details see *External sensors* on page 11)
- Wireless module
- RS-485 module

4 Installation

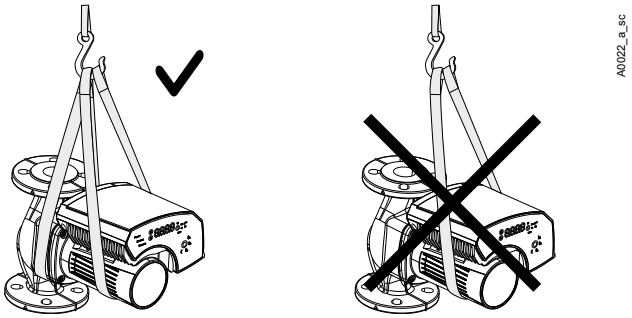
Precautions

WARNING:
- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Always refer to the local and/or national regulations, legislation, and codes in force regarding the selection of the installation site, plumbing, and power connections.

4.1 Pump handling

WARNING:
Observe local codes and regulations setting the limits for manual lifting or handling.

Always lift the pump by the motor housing or pump body. If the pump weight exceeds the manual handling limits, use lifting equipment with lifting straps.



4.2 Tools required for pump installation

- T-Handle with allen screw
- Control screw driver – with 2 mm flat blade size

Nominal HP	Allen wrench size (mm)	T-handle length (in)
1/12	5	8
1/6	5	8
1/2	6	10
1	8	12
2	8	12
3	8	12

4.3 Facility requirements

4.3.1 Pump location

DANGER:
Do not use this unit in environments that may contain flammable/explosive or chemically aggressive gases or powders.

Guidelines

Observe these guidelines regarding the location of the product:

- Make sure that the installation area is protected from any fluid leaks, or flooding.
- If possible, place the pump slightly higher than the floor level.
- Provide shut-off valves on the suction and discharge sides of the pump.
- The relative humidity of the ambient air must be less than 95% non-condensing.
- This pump is suitable for indoor use only.

CAUTION:
CAUTION: PROPERTY DAMAGE HAZARD. It is not advisable to install circulators in an attic or upper floor over finished living space. If the circulator must be installed over head, or over expensive equipment, provide adequate drainage in the event of leakage. Failure to follow these instructions could result in property damage.

4.3.2 Minimum inlet pressure at the suction port

The values in the table below are the inlet pressures above the atmospheric pressure.

Nominal Suction Diameter	Fluid temperature 77°F (25°C)	Fluid temperature 203°F (95°C)	Fluid temperature 230°F (110°C)
1½"	4.5 PSI	16 PSI	25 PSI
2"	4.5 PSI	16 PSI	25 PSI
3"	7.5 PSI	19 PSI	28 PSI

NOTICE:
- Ensure that the suction pressure is never below the values specified above, as this could cause cavitation and damage the pump.
- The inlet pressure plus the pump pressure against a closed valve must be lower than maximum admissible system pressure.

4.3.3 De-rating table

The following table indicates percent decrease in input power draw, with the increase in temperature of circulating water and the ambient.

Ambient temperature	Fluid Temperature (°C)			
	-10	60	95	110
32°F–77°F (0°C–25°C)	100%	100%	100%	100%
86°F (30°C)	100%	100%	80%	70%
104°F (40°C)	100%	100%	70%	55%

4.4 Piping requirements

Precautions

CAUTION:
- Use pipes suited to the maximum working pressure of the pump. Failure to do so can cause the system to rupture, with the risk of injury.
- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.
- Do not use a shut-off valve on the discharge side in the closed position for more than a few seconds. If the pump must operate with the discharge side closed for more than a few seconds, a bypass circuit must be installed to prevent overheating of the water inside the pump.

Piping checklist
- Pipes and valves must be correctly sized.
- Pipe work must not transmit any load or torque to pump flanges.
- Be sure to minimize any pipe-strain on the pump:
  - Support suction and discharge piping by the use of pipe hangers near the pump.
  - Line up the vertical and horizontal piping so that the bolt-holes in the pump flanges match the bolt-holes in the pipe flanges.
  - Do not attempt to spring the suction or discharge lines in position. This may result in unwanted stress in the pump body, flange connections and piping.
  - The code for pressure piping (ANSI B31.1) lists many types of supports available for various applications.

4.5 Electrical requirements

- The NEC, CEC and local codes must be followed at all times. If a branch circuit is fitted with ground fault circuit breaker, ensure that the circuit breaker is suitable for use with inverter-driven appliances.

Electrical connection checklist

Check that the following requirements are met:
- The electrical wires are protected from high temperature and vibration.
- The current type and power supply voltage connection must correspond to the specifications on the name plate on the pump.
- Use wires at least 14 AWG to supply power to the pump. Follow all local and NEC wiring codes and practices.
- High voltage conduit must connect to one 20mm to 1/2" npt adapter (factory supplied and installed).
- Low voltage conduit can be connected using 16mm to 1/2" npt fittings (field supplied).

The electrical control panel checklist

NOTICE:

The electrical supply must match the electrical rating of the pump. Improper combination could fail to guarantee protection of the unit.

Check that the following requirements are met:
- The control panel circuit breaker is sized properly to protect the pump against short-circuit.
- Both single and 3-phase pumps have built in overload and thermal protection, no additional overload protection is required.

The motor checklist

Electrical supply and grounding wires must be suitable for at least 194°F (90°C).

4.6 Pump installation

1. Install the pump according to the liquid flow direction.
   - The arrow on the pump housing shows the flow direction through the pump body.
   - The pump must be installed with the motor in a horizontal position. For more information about allowed positions, refer to the following image:

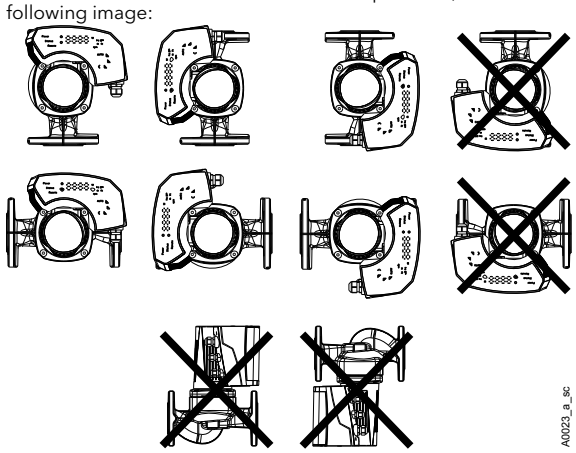


Figure 1: Allowed pump installation

2. If necessary, rotate the position of the motor for better visibility of the user interface.

   Section 4.7 below describes the procedure of changing of motor orientation.
3. If applicable, install the thermal insulation shells.
   - Only use the pump thermal shells that are included in the delivery. Do not insulate the motor housing, the electronics can overheat and cause the pump to thermally overload.
   - The thermal shells that are included with the pump must only be used in hot water circulation applications with fluid temperature above 68°F (20°C). The thermal shells are permeable to water vapor.
   - If the customer installs vapor barrier insulation for cold water application, then the pump housing must not be insulated above the motor flange. The drain opening must be kept unobstructed in order that the accumulated condensation can run out.

NOTICE:

Improper installations shown above can cause the pump to fail prematurely and create an electrical hazard and/or damage caused by water leakage.

4.7 Change the position of the motor housing

WARNING:
- Drain the system if possible or close the service valves on both sides of the pump before disassembling the pump. The pumped fluid can be pressurized and may be scalding hot.
- There is the risk of escaping vapor when the motor is separated from the pump housing.

Electrical Hazard:
Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized.

CAUTION:
Burn hazard. During operation various surfaces on the unit will become hot. To avoid burn injury, use heat protective gloves.

WARNING:
- A strong magnetic field is created when the rotor is removed from or inserted into the motor housing. This magnetic field can be harmful to pacemaker wearers and others with medical implants. In addition, the magnetic field may attract metal parts to the rotor which can cause injuries and/or damage the bearing of the pump.

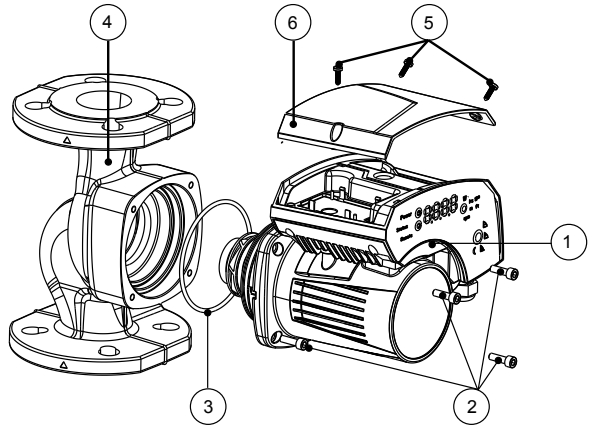


Figure 2: Change the position of the pump head for 1 PH

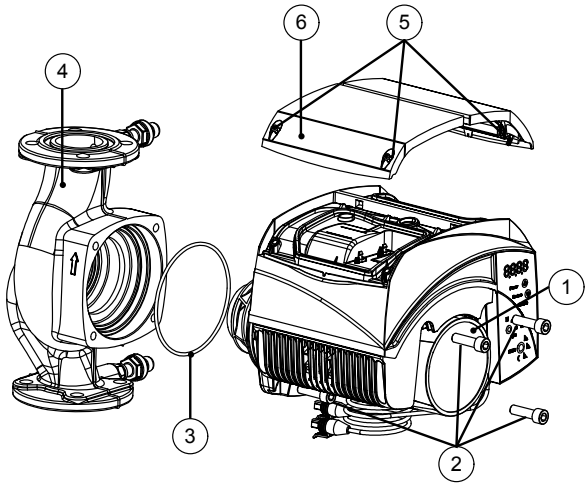


Figure 3: Change the position of the pump head for 3 PH

1. Loosen the four hex-head screws (2) that fix the motor to the pump housing (4) using the T-handle allen wrench described.
2. Rotate the motor (1) in 90° steps to the desired position.
3. In case of separation of the motor housing from the pump body (4):
   a) avoid removing the rotating assembly from motor housing;
   b) note the magnetic hazard listed above.
   A defective O-ring must be replaced. A spare O-ring is already available inside the package.
4. Properly align and tighten the four hex-head screws (2) that affix the motor to the pump body (4) according to the torque table given below in a criss cross pattern.

Nominal HP	Screw size	Torque
1/12 & 1/6	M6	90 in-lb
1/2	M8	170 in-lb
1 & 2	M10	340 in-lb
3	M10	340 in-lb

CAUTION:
Check for the presence of leaks after reassembling the pump.

4.8 Electrical installation

Precautions

WARNING:
- Make sure that all connections are performed by a qualified electrician in accordance with all applicable codes, ordinances and good practices. Failure to follow these instructions could result in serious injury, death and/or property damage.
- Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized.

Grounding (earthing)

WARNING:
Reduced risk of electric shock during operation of this pump requires the provision of acceptable grounding.

Be sure the following are adhered to. Failure to follow these instructions could result in serious personal injury, death, and/or property damage.
- If means of connection to the supply connection box (wiring compartment) is other than grounded metal conduit, ground the pump back to service using a copper conductor at least the size of the circuit conductors supplying the pump.
- Connect the ground wire to the grounding terminal in the wiring compartment.

The number of ON/OFF power cycles for the pump must be less than 3 times per hour and less than 20/24 hours. If more frequent start/stop cycles are required, the use of a dedicated start/stop input is recommended. See *External start/stop* on page 10.

4.8.1 Power supply connection

WARNING:
Do not make any connection in the pump control box unless the power supply has been switched off for at least 2 minutes.

For models with standard terminal block connection:
1. Open the terminal box cover removing the screws (5).
2. Thread the ½" NPT electrical fitting into the conduit connection of the pump.
3. Connect the cable according to the wiring diagram.
   a. Connect the ground wire, if used.
   b. Connect the power wiring.
4. Close the terminal box cover.

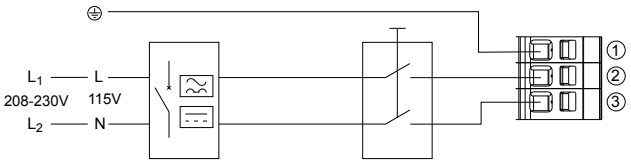


Figure 4: Wiring diagram for single phase models

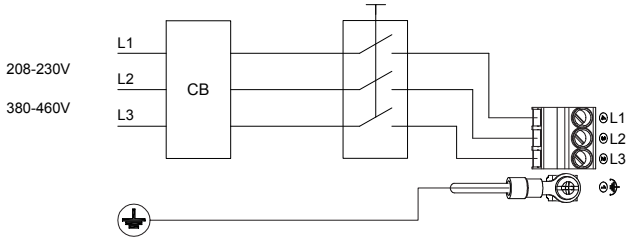


Figure 5: Wiring diagram for three phase models

CAUTION:
If stranded wire is used to connect power to the pump, make sure that all the individual strands enter the terminal block as the wire is inserted. Peeled back strands can cause a short circuit hazard at the pump terminal block connections.

1-PHASE TERMINAL BLOCK

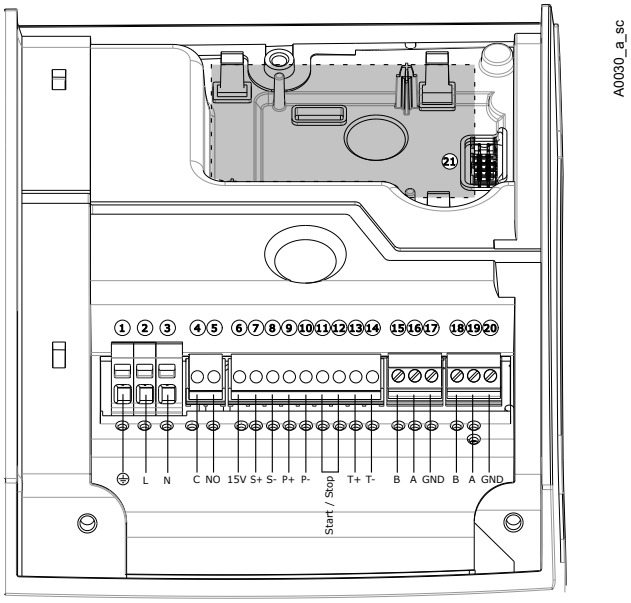


Figure 6: Connection diagram for single phase models

3-PHASE TERMINAL BLOCK

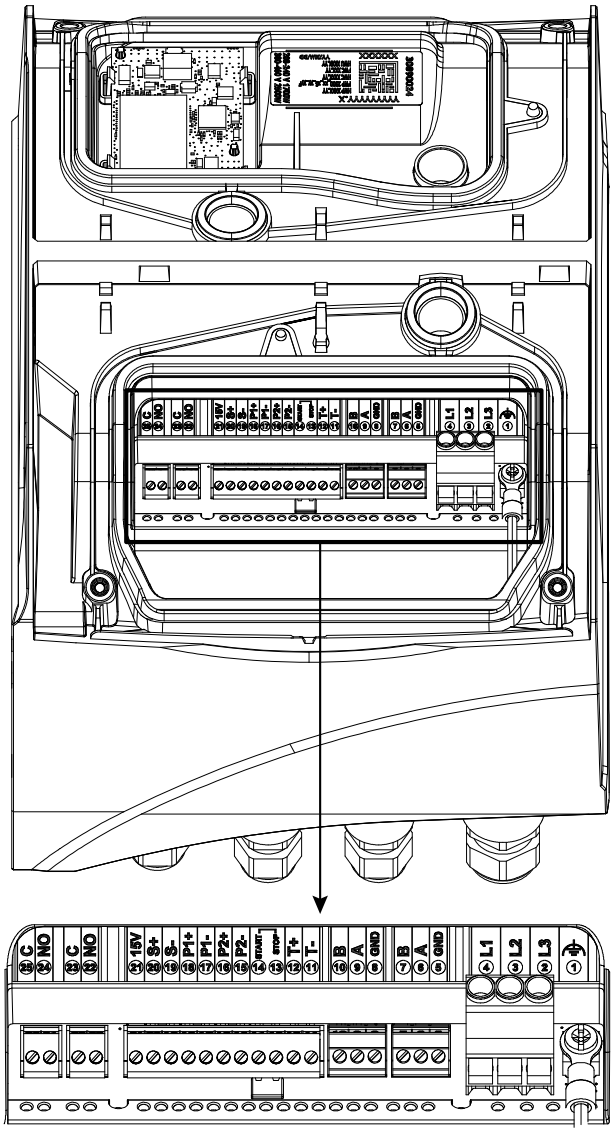


Figure 7: Connection diagram for three phase models

CAUTION:
Connect the low voltage circuits of the electronic drive only to Safety Extra Low Voltage (SELV) circuits. The circuits provided for use with external communications and control equipment are designed to provide isolation from neighboring hazardous circuits within the drive. The communications and control circuits within the ecocirc XL drive are floating from ground and are classified as SELV. They must be connected only to other SELV circuits in a manner which maintains all the circuits within the SELV limits and prevents ground loops. Physical and electrical separation of the communications and control circuits from non-SELV electrical circuits must be maintained both within the inverter and external to the inverter.

4.8.2 I/O connections

1. Open the terminal box cover removing the screws (5). Refer to figures 2 & 3 on page 7. Use control screwdriver described under section 4.2 to access terminal blocks.
2. Connect the appropriate wires according to the terminal block diagram and the requirements of section *Connection assignment* on page 9 given below in section 4.7.3.
3. Close the terminal box cover.

4.8.3 Connection assignment

- For all electrical connections, use heat resistant wires or cable that is rated for at least 194°F (90°C). Make sure that the wiring does not touch the motor housing, the pump, or the piping.
- Power and control wires must be run in separate channels.
- Metal conduit for power wiring must only be attached to 1/2" NPT conduit fitting.
- For a two pump connection, wire both pumps through a communication cable connecting the 2 RS-485 ports at the pumps to terminals 15, 16 & 17 for single phase pumps and 5–6 & 7 for three phase pumps.
- Low voltage wiring is recommended to be twisted pair and shielded. Sensor wiring is not to exceed 65 feet (19.8 m) in length.

NOTICE:
Cable glands are only available for low voltage wiring to protect against cable slippage and vapor ingress into the terminal box.

5 System Description

5.1 User interface

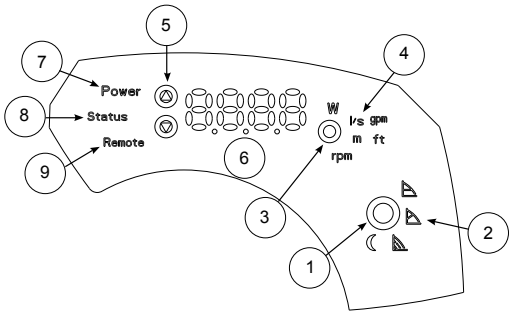


Figure 8: User interface diagram for single phase models

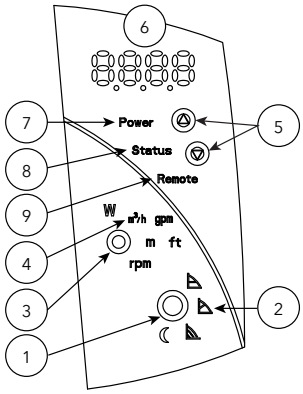


Figure 9: User interface diagram for three phase models

1. Control mode button
2. Control mode indicators
3. Parameter button
4. Parameter indicators
5. Setting buttons
6. Numeric display
7. Power indicator
8. Status / Fault indicator
9. Remote control indicator

Hot Surface:
Burn hazard. During normal operation, the pump surfaces may be so hot that only the buttons should be touched to avoid burns.

5.1.1 User interface locking/unlocking

The user interface will automatically lock if no button is pressed for ten minutes, or if the upper setting button (5) and the parameter button (3) are pressed for two seconds. See *User interface* on page 9.

If a button is pressed when the user interface is locked, the display (6) shows:

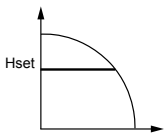
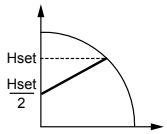
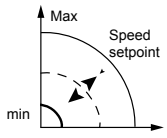
To unlock the user interface, press the upper setting button (5) and the parameter button (3) for two seconds. The display (6) will show:

Now it is possible to change the pump setting as required.

5.2 Functions

The main functions of the pump and control modes are selectable through the pump user interface and the embedded I/O. Advanced functions or communication features, can only be accessed and set via communication bus protocol or the optional Wireless module. See the electronic drive manual at www.bellgossett.com, for details.

5.2.1 Control Modes

Mode	Description
Constant pressure 	The pump maintains a constant pressure at any flow demand. The desired head of the pump can be set via user interface. See *Change the set point* on page 12.
Proportional pressure 	The pump pressure is continuously increased/decreased depending on the increased/decreased flow demand. The maximum head of the pump can be set via user interface. See *Change the set point* on page 12.
Fixed speed control 	The pump maintains a fixed speed at any flow demand. The speed of the pump can be set via user interface. See *Change the set point* on page 12.

All the above control modes can be combined with the night mode function.

5.2.2 Temperature dependent control modes

For details refer to the electronic drive manual on www.bellgossett.com.

5.2.2.1 Δp-T control

This function adjusts the nominal differential pressure set point according to the temperature of the pumped media.

For details refer to the electronic drive manual on www.bellgossett.com

5.2.2.2 T-Constant temperature control

This function adjusts the nominal differential pressure set point according to the temperature of the pumped media.

For details refer to the electronic drive manual on www.bellgossett.

5.2.2.3 ΔT constant

This function alters the speed of the pump in order to maintain a constant differential temperature of the pumped media.

For details, refer to the electronic drive manual on www.bellgossett.com.

5.2.3 Night mode

The night mode cannot be used in cooling systems.

Pre-requisites:

- The pump is installed between boiler outlet and system supply.
- The night mode feature is initiated when the pump recognizes a water temperature change that is brought about by the boiler or high-level control system.

The night mode is active only with:

- Proportional pressure
- Constant pressure
- Fixed speed / Constant curve

This function decreases power consumption of the pump to the minimum when heating system is not running. An algorithm detects the water temperature change and automatically adjusts the speed of the pump.

The pump returns to the original setpoint when the system restarts.

5.2.4 External start/stop

The pump can be started or stopped via an external dry contact or a relay that is connected to terminals 11 and 12 on single phase pump models. The pump unit is provided by default, with the terminals 11 and 12 jumpered. See *Figure 6: Connection diagram for single phase models* on page 8.

Start/stop terminals for three phase models are 13 and 14. See *Figure 7: Connection diagram for three phase models* on page 8.

NOTICE:

- The pump provides 5 VDC through the start / stop terminals.
- No external voltage must be provided to start / stop terminals.
- The cables connected to terminals 11 and 12 on single phase or to terminals 13 and 14 on three phase pumps shall not exceed 65 feet in length

5.2.5 Analog Input

The pump integrates a 0-10 V analog input at terminals 7 and 8 for single phase and 19 and 20 for three phase units. See *Figure 6: Connection diagram for single phase models* on page 8 and *Figure 7: Connection diagram for three phase models* on page 8.

When a voltage input is detected, the pump switches to fixed speed control mode automatically and starts to run according to the following diagram:

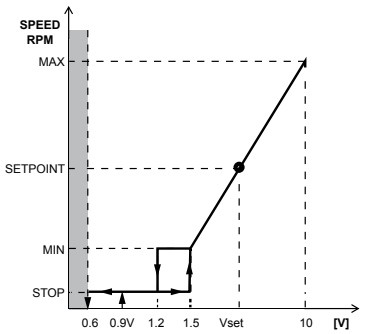


Figure 10: Voltage input detected

0–0.6V	Voltage control – unrecognized	
0.6–0.9V	Control recognized – fixed speed icon begins blinking. Pump off.	
0.9–1.5V	Pump operates at minimum speed	
1.5–10V	Pump accelerates at controlled speed	

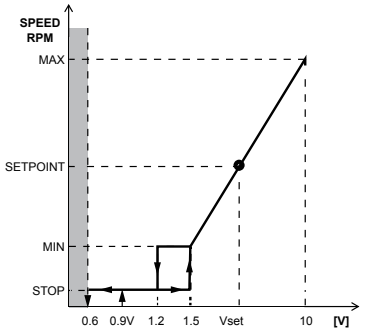


Figure 11: Voltage input detected

10–1.5V	Pump decelerates at controlled speed	
1.5–1.2V	Pump runs at minimum speed	
1.2–0.6V	Control recognized – fixed speed icon remains blinking. Pump off.	
0.6–0V	Voltage control – unrecognized	

5.2.6 Signal relay

Dry relay contacts are available at terminal 4 and 5 for single phase pumps, and at terminals 22, 23 and 24, 25 for three phase pumps.

Relay ratings

1. Vmax < 250 VAC
2. Imax < 2 A

5.2.6.1 Signal relay for single phase pumps only

A dry contact relay is provided at terminals 4 and 5. See connection diagrams *Figure 6: Connection diagram for single phase models* on page

8 and *Figure 7: Connection diagram for three phase models* on page 8 for location. If there is a fault, the relay contact closes to display a red status light and the error code on the user interface display. See *User interface* on page 9. The relay contact closure can also be used to energize a remote fault display.

5.2.6.2 Signal relay for 3–phase pumps only

Two normally open relay contacts are available at terminals 22, 23 and 24, 25. If an error causes the pump to stop operating, the relay contact closes and terminals 24–25 are closed. Terminals 23–24 indicate pump stop/run status.

Table 1: Relay status

	Motor running	Motor stopped
No fault	Relay 1 Open (24-25 open circuit) Relay 2 Closed (22-23 short circuit)	Relay 1 Open (24-25 open circuit) Relay 2 Open (22-23 open circuit)
Fault present	Not possible	Relay 1 Closed (24-25 short circuit) Relay 2 Open (22-23 open circuit)

5.2.7 External sensors

Single phase pumps can be equipped with an optional differential pressure sensor and a remote optional temperature sensor. The three phase pumps are equipped with two absolute pressure sensors and an optional external temperature sensor. Refer to the following table for more information.

Sensor description	Type	Terminals	
		1–Phase Pump	3–Phase Pump
Differential pressure sensor 4-20 mA	15 psi 30 psi	9–10	–
Absolute pressure sensors 4-20 mA	–	–	17–18 15–16
Temperature sensor	KTY82	13–14	11–12

Differential pressure sensor setup — single phase pumps only

1. Install differential pressure sensor on the pipe
2. Connect wires at terminals 9 and 10. See *Figure 6: Connection diagram for single phase models* on page 8.
3. Turn on the pump.
4. Upon startup, the pump detects the sensor and displays the setup menu.
5. Select the right sensor model and confirm the selection by using the parameter button (3). See *User interface* on page 9.
6. The pump runs through the startup sequence and automatically starts working in constant pressure mode (factory default). The sensor must be wired to terminals 9 & 10.
7. The setpoint can be changed by using the settings button (5). See *User interface* on page 9.

Pressure sensor setup — three phase pumps only

Two absolute pressure sensors are factory provided to be installed on the pump flanges pressure ports and wired to terminals 15, 16 and 17, 18. The sensors must be installed to allow for precise pump operation in constant and proportional pressure modes. In case of sensor failure, the pump will display the corresponding alarm code (see par. 8.2) and will continue to operate with limited precision using pressure estimation.

External temperature sensor setup

The optional external temperature sensor setup and related control modes are available only through RS-485 or wireless module connection.

For details refer to the electronic drive manual on www.bellgossett.com

NOTICE:

The differential sensor cables shall not exceed 65 ft.

5.2.8 Communication bus

The pumps have two built-in RS-485 communication channels.

Single phase pumps – The standard channel is available on terminals (15-16-17), while the second one is enabled only with optional RS-485 or wireless module on terminals (18–19–20). See *Figure 6: Connection diagram for single phase models* on page 8.

Three phase pumps – The standard channel is available on terminals (5-6-7), while the second one is enabled only with optional RS-485 or wireless module on terminals (8-9-10). See *Figure 7: Connection diagram for three phase models* on page 8.

The pump can communicate with external BMS systems via Modbus or BACnet protocol. For a complete description of the protocols, refer to the electronic drive manual, in addition to Modbus and BACnet instruction manuals at www.bellgossett.com.

NOTICE:

When remote control is active, the set points and control modes are managed only through communication channels and cannot be changed via the user interface. The displayed quantity and unit of measurement remain active on the user interface.

5.2.9 Wireless module

The wireless module is an optional module, to be coupled with the ecocircXL circulators. When correctly configured, it generates a wireless network accessible by a mobile device, tablet or a personal computer. See wireless module instructions manual for details at www.bellgossett.com.

5.2.10 Automatic two pumps in parallel operation

Backup operation (bcup)

Only the lead pump runs. The second pump starts in case of failure of the lead pump.

Alternate operation (alte)

Only one pump runs at a time. The working time is switched every 24 hours so that workload is balanced between both pumps. The second pump is started immediately in case of failure of the lead pump.

Automatic parallel operation (para)

Both pumps run simultaneously at the same set point. Only when the constant pressure mode is selected (for details see *Control Modes* on page 9), the lead pump determines the behavior of the full system and is able to optimize the performance. To guarantee the required performance with the minimum power consumption, the lead pump starts or stops the lag (second) pump to satisfy system requirement of flow and head.

NOTE: The automatic optimization works correctly on most installations. In the case of unstable running, switch the pump operation to “forced parallel operation” (forc).

Forced parallel operation (forc)

Both pumps run simultaneously with the same set point. The master pump determines the behavior of the full system.

6 System Setup and Operation

CAUTION:

Always wear protective gloves when handling the pumps and motor. When pumping hot liquids, the pump and its parts may exceed 40°C (104°F).

NOTICE:

The pump must not run dry as this can damage the bearings. Fill the system correctly with liquid and vent the air before first start-up.

NOTICE:

- Never operate the pump with discharge valve closed for longer than a few seconds.
- Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.
- The suction plus shut-off discharge pressure must not exceed the pump pressure rating.
- Do not use the pump if cavitation occurs. Cavitation can damage the internal components.

  Do not use the pump if cavitation occurs. Cavitation can damage the internal components and cause reduced life of the pump.

6.1 Configure the pump settings

Change the pump settings using one of the following methods:

- User interface
- Bus communication
- Wireless communication

6.1.1 Change the communication parameters

Change pump communication parameters. See *User interface* on page 9.

1. Switch off the pump.

   Wait until the power indicator light turns off.
2. Turn on the pump.
3. When the display shows **COMM**, press the parameter button (3) to access the communication menu.
4. Select one of the four below parameters using the settings button (5).
   - **BAUD** = baud rate setup (available values 4.8 - 9.6 - 14.4 - 19.2 - 38.4 - 56.0 - 57.6 kbps)
   - **PROT** = communication protocol (available protocols “mod” = Modbus; “bac” = BACnet
   - **ADDR** = address setup (available address 1-247 for Modbus 0-127 for BACnet)
   - **MODU** = optional module setup (“none” = no module; “wifi” = Wireless module; “485” = RS-485 module)
5. Press the parameter button to enter the submenu
6. Edit the values using setting buttons.
7. Press the parameter button to confirm and store the new values.
8. Press mode button to exit the submenu.
9. Repeat above procedure for each of the three parameters.

If no buttons are pressed for 10 seconds, then the pump exits the current menu and continues start-up procedure. All the parameters that are changed but not confirmed restore back to previous state.

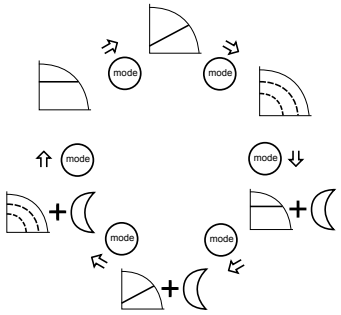
NOTE: The communication setup menu is available only on display and not through communication bus.

6.1.2 Change the control mode

The pump can be controlled by a BMS (Building management system) or other devices through the RS-485 communication port via Modbus or BACnet protocol.

The following instructions are used when making the change on the user interface. See *User interface* on page 9.

- Press the operating mode button (1).
- The operating modes are cyclically changed by the pressed button.



6.1.3 Change the set point

See *User interface* on page 9.

1. Press one of the arrow setting buttons (5).

   The display starts to blink.
2. Change the value using the buttons (5).
3. Wait 3 seconds to store and activate the new set point.

   The display will stop blinking to confirm the change.

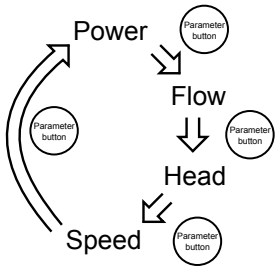
NOTICE:

If a check valve is installed in the system, ensure that the pump head is sufficient to allow flow through the system.

6.1.4 Change the displayed unit of measurement

Power, Flow, Head and Speed parameters cyclically change by pressing the parameter button (3). In order to change the unit of measurement, follow these steps:

1. Press the button (3) to change the unit of measurement. See *User interface* on page 9.



2. When flow and head are displayed, by pressing the button (3) for more than one second at each of these parameters, the unit of measurement automatically changes as below:
   - Flow: m3/h ↔ gpm (US)
   - Head: m ↔ ft

6.2 Start or stop the pump

CAUTION:

- The pump must not run dry as this can result in premature failure of the bearings in a very short time. Fill and vent the system correctly before first start-up. The pump rotor chamber will be vented after the pump is powered on with an automatic air venting procedure. "deg" will be displayed indicating degassing process.

NOTICE:

The system cannot be vented through the pump.

- Start the pump in one of the following ways:

- Switch on power to supply the pump.
- Close the start/stop contact by jumpering terminals 11 and 12 on single phase pumps and terminals 13 and 14 for three phase pumps, or through a remote dry contact..
- Send start command through the communication bus.

The pump starts pumping in constant pressure mode with the following default set points:

Default set points	Pump models
7.5 ft	15–XX (Max head 15 ft)
10 ft	20–XX (Max head 20 ft)
13.5 ft	27-XX (Max head 27 ft)
18 ft	36–XX (Max head 36 ft)
20 ft	40–XX (Max head 40 ft)
22.5 ft	45-XX (Max head 45 ft)
27.5 ft	55–XX (Max head 55 ft)
32.5 ft	65–XX (Max head 65 ft)
35 ft	70-XX (Max head 70 ft)
47.5 ft	95–XX (Max head 95 ft)
55 ft	110–XX (Max head 110 ft)

For more information about how to change setting, see *Configure the pump settings* on page 12.

- Stop the pump in one of the following ways:
  - Switch off power supply to the pump.
  - Open the start/stop contact.
  - Send stop command through the communication bus.

6.2.1 Automatic air venting procedure

At each power-on of the pump unit, an automatic air venting procedure is executed. During this phase, the user interface displays "deg" (degassing) and a count-down begins until the completion of the procedure.

The air venting procedure can be recalled or skipped:

- Manually by pressing simultaneously the two buttons (5). See *User interface* on page 9. The feature will remain disabled until power to pump is disconnected.

The procedure can be permanently enabled or disabled by:

- Manually by pressing simultaneously the two buttons (5) for at least 10 seconds. See *User interface* on page 9. Or
- Via communication bus. See the electronic drive manual on www.bellgossett.com.

6.2.2 Two pumps in parallel configuration setup

The circulators are configured as single units by factory default. To activate the two pump parallel functions, follow the procedure below only on one of the two pumps. The second pump will be automatically configured. The working modes are described in *Automatic two pumps in parallel operation* on page 11.

6.2.3 Set automatic operation mode on two pumps in parallel

Once the communication cable is connected, configure only the “lead” pump. The two pump submenu for this configuration is available at each power-on. When the drive is displaying **SING** (which stands for “Single Pump) short press one of the settings button (5) to display two pumps in parallel menu.

The following procedure must be executed during the start-up phase of the pump.

1. Enter the two-pump sub menu when the display is showing **TWMA (two-pump master)** or **TWSL (two-pump slave)**.
2. Select the applicable two-pump operation.
   - **bcup** = backup operation
   - **alte** = alternative operation
   - **para** = automatic parallel operation
   - **forc** = forced parallel operation
3. Push the parameter button (3) to accept the new setting.

The second pump is configured automatically by the lead pump. Refer to Electronic Drive Manual for further details.

7 Maintenance

Precaution

Electrical Hazard:

Disconnect and lock out electrical power before installing or servicing the unit.

Wait 2 minutes before opening the conduit box.

WARNING:

- Always wear protective gloves when handling the pumps and motor. When pumping hot liquids, the pump and its parts may exceed 40°C (104°F).
- Maintenance and service must be performed by skilled and qualified personnel only.
- Observe accident prevention regulations in force.
- Use suitable equipment and apply personal protection.
- Risk of property damage, serious personal injury or death. You must repair or replace the pump if corrosion or leakage is found.

8 Troubleshooting

8.1 Introduction

See *User interface* on page 9.

- In case of any alarm that allows the pump to continue running, the display shows a blinking alarm code and the last quantity selected, while the status indicator (8) becomes orange.
- In case of a failure that stops the pump, the display shows the error code permanently lit and the status indicator (8) becomes red

8.2 Periodic inspection

Bell & Gossett ecocircXL circulators are designed to provide years of trouble-free service. It is recommended that periodic inspections be made to check for potential problems with the pump. If any leakage or evidence of leakage is present, repair or replace the unit.

8.3 Display messages

Table 2: Default

Operating LEDs / Display	Cause
Power On	Pump powered
All LEDs and display On	Start-up of the pump
Status Green light	Pump is working properly
Remote On	Remote communication is activated

Table 3: Fault messages

Operating LEDs / Display	Cause	Solution
Power Off	Pump is not connected or is incorrectly connected	Check power connection
	Power failure	Check power supply and circuit breaker
Status light Orange	Alarm for system problem	Check the displayed alarm code and find cause from table 8.4.
Status light Red	Pump failure	Check the displayed error code and find the cause from table 8.3.

Operating LEDs / Display	Cause	Solution
Remote Off	Remote communication is deactivated	If the communication does not work, check the connection and the configuration parameters for communication on the external controller.
Display shows "ALOC"	Rotor unlocking function is in progress	Wait for the result of this procedure (about 30 seconds). If procedure fails, error code E04 will appear. Note: during the execution of this procedure, vibration and noise may occur. Wait for the procedure to complete.

8.4 Fault and error codes (Red LED)

Error code	Cause	Solution
E01	Internal communication lost	Restart the pump[2]
E02	High motor current	Restart the pump[2]
E03	DC Bus overvoltage	Indicates excessive power through the pump. Confirm system setup, verify correct position and operation of check valves.
E04	Motor stall	Restart the pump[2]
E05	Data memory corrupted	Restart the pump[2]
E06	Voltage supply out of operating range	Check the electrical system voltage and wiring connection.
E07	Motor thermal protection trip	Check the presence of foreign material around impeller and rotor that cause overload. Check installation conditions and temperature of the water and ambient air. Wait until the motor is cooled. If the error persists try to restart the pump[2].
E08	Inverter thermal protection trip	Check installation conditions and ambient air temperature.
E09	Hardware error	Restart the pump.
E10*	Dry run	Check for system leakage or fill the system.
E11**	Loss of phase	Check power supply
E12	Internal communication error	Switch off the pump for 5 minutes and then power on. If problem persists, contact factory.

8.5 Alarm codes (Orange LED)

Alarm code	Cause	Solution
A01	Fluid sensor malfunction	Switch off the pump for 5 minutes and then power on. If the problem persists, contact local B&G representative.
A02	High temperature of the fluid	Check water temperature value
A03	Automatic speed reduction to prevent inverter overheating	Check installation conditions and rectify status of the system
A05	Data memory corrupted	Switch off the pump for 5 minutes and then power on. If the problem persists, contact local B&G representative.
A06	External temperature probe malfunction	Check the probe and the connection to the pump
A07	External pressure sensor malfunction	Check the sensor and the connection to the pump
A08	Cooling fan failure (Only on 2 HP and larger models)	Check for the presence of foreign bodies which could lock the fan rotation. Switch off the pump for 5 minutes and then power on. If the problem persists, contact service.
A12	2-pump communication lost	If both pumps show the A12 alarm, check the connection between the pumps. If one of the pump is switched off or shows another error code, check the section 8.1 and 8.2 to find the problem
A20	Internal alarm	Switch off the pump for 5 minutes and then power on. If the problem persists, contact local B&G representative.
A31**	Sensor P1 failure	Check pressure sensor installation and wiring connections
A32**	Sensor P2 failure	Check pressure sensor installation and wiring connections
A33**	Sensors P1 and P2 failure	Check pressure sensor installation and wiring connections

* For very low motor RPM, dry run condition cannot be properly detected.
** Applies to 3-Phase pumps only

8.6 Faults, causes, and remedies

The pump does not start

Cause	Solution
No power.	Check the power supply and ensure that it is properly terminated to the pump power.

[2] Switch off the pump for 5 minutes and then power on. If the problem persists, contact service.

Cause	Solution
Tripped circuit breaker or ground-fault protection device or the circuit breaker.	Reset power supply circuit breaker and determine cause for overload.
If display shows "ALOC", the rotor unlocking function is in progress.	The procedure, in the attempt to unlock the rotor can produce noise and vibration. Wait for the procedure to finish (approximately 30 seconds).

The pump starts but the thermal protection is triggered after a short time

Cause	Remedy
Incorrect wiring size or circuit breaker rating not suitable for motor current.	Check and replace the components as necessary.
Thermal overload protection due to excessive input.	Check the pump working conditions.
Missing a phase in the power supply.	Verify continuity and ensure proper wiring connections.

The pump is noisy

Cause	Remedy
Not thoroughly vented.	Switch off the pump and after 30 seconds switch on again to restart the automatic air-venting procedure.
Cavitation due to insufficient suction pressure.	Increase the system suction pressure within the admissible range.
Foreign objects in pump.	Clean the system.
Worn out bearing	Replace pump.

9 Other Relevant Documentation or Manuals

9.1 Embedded Software and Driver Software License Agreement

With the purchase of the product, the terms and conditions of the license for the software embedded on the product are considered accepted. For more information see license condition on www.bellgossett.com

FCC Statement — USA only (Federal Communications Commission)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference and
2. this device must accept any interference received, including interference that may cause undesirable operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment.

10 Product warranty

Commercial warranty

Warranty. For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of eighteen (18) months from the date of installation or thirty-six (36) months from the date of shipment (which date of shipment shall not be greater than after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE GOODS PROVIDED HEREUNDER, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Limited consumer warranty

Warranty. For goods sold for personal, family or household purposes, Seller warrants the goods purchased hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be free from defects in material and workmanship for a period of eighteen (18) months from the date of installation or thirty-six (36) months from the product

date code, whichever shall occur first, unless a longer period is provided by law or is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render this Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. The Warranty is conditioned on Buyer giving written notice to Seller of any defects in material or workmanship of warranted goods within ten (10) days of the date when any defects are first manifest.

Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS PROVIDED IN PLACE OF ALL OTHER EXPRESS WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO EIGHTEEN (18) MONTHS FROM THE DATE OF INSTALLATION OR THIRTY-SIX (36) MONTHS FROM THE PRODUCT DATE CODE , WHICHEVER SHALL OCCUR FIRST. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To make a warranty claim, check first with the dealer from whom you purchased the product or visit www.xyleminc.com for the name and location of the nearest dealer providing warranty service.

Xylem |’zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We’re a global team unified in a common purpose: creating advanced technology solutions to the world’s water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com

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www.bellgossett.com

Visit our Web site for the latest version of this document and more information

The original instruction is in English. All non-English instructions are translations of the original instruction.

P2002548_Rev. E_en-US_ecocirc® XL

BoilerMag XT

Ultimate Heating System Protection

Installation and Servicing Instructions

ECLIPSE MAGNETICS

Innovative Magnetic Solutions

ECLIPSE TOOLS NORTH AMERICA INC

06/19/2020

BoilerMagXT Heating & Cooling System Filter

Thank you for choosing BoilerMagXT, please follow the instructions carefully to ensure that this BoilerMagXT magnetic filtration system is fitted and maintained correctly.

By completing and returning the guarantee card in the pack you qualify for a 10 year warranty against manufacturing defects. Failure to follow these instructions will invalidate the warranty.

BoilerMagXT is a magnetic filtration system for heating systems in larger premises such as industrial, commercial and municipal buildings. For other applications always consult the manufacturer before installing.

This product contains strong magnets. Care and attention should be taken at all times during installation and servicing. Do not place the magnetic cores on any ferrous surfaces or near ferrous objects.

Suitable personal protective equipment should be used during all installation and servicing.

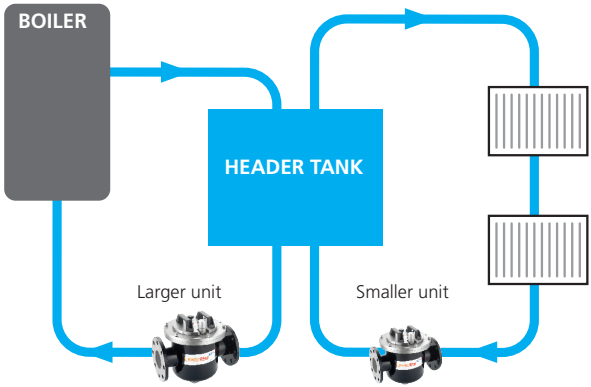
PPE

BoilerMagXT must be installed by a qualified person in accordance with all relevant current regulations.

Guide to Installation

Ensure the heating system is isolated prior to carrying out installation or maintenance work.

Where to Install



BoilerMagXT is typically installed on the return circuit as close to the boiler as possible. On larger systems, such as the one shown, smaller BoilerMagXT units may be installed elsewhere to give extra protection for radiators and pipework.

Please also ensure that the BoilerMagXT is located in a position which gives adequate access above to lift out the magnets during servicing and maintenance. Also access is required to the underneath of the unit to connect a hose or hold a bucket during draining.

Venting Options

The BoilerMagXT unit is fitted with a manual vent, however, an additional Automatic Air Vent has been packaged along with unit separately. The auto-vent will automatically release the trapped air maintaining heating efficiency.

Please note: If using the Automatic Air Vent, operating pressure is reduced to 145 psi / 10 bar and maximum temperature to 212˚F / 110˚C respectively.

Please find enclosed the installation instructions for the Automatic Air Vent.

Installing BoilerMagXT

1. Identify a suitable location (see 'Where to Install' p3).
2. Ensure enough clearance to carry out cleaning as the rods must be lifted out of the unit to clean. See dimensions in column B in the table below.
3. Mark and then cut out the correct length of pipe section to be removed to accommodate the BoilerMagXT unit and isolation valves. Ensure the cut is level and burr free. (Isolation valves are not included in the BoilerMagXT pack.)
4. Install appropriate isolation valves to the pipework and fit the valves to the two ANSI flanges (see below for flange dimensions).
5. Position the BoilerMagXT in place then align and secure the fittings to connect the unit to the valves.
6. Open the isolation valves and turn on the heating system
7. Complete the BoilerMagXT warranty card and return to Eclipse Magnetics.
8. Run the heating system at normal operating temperature and check installation integrity.

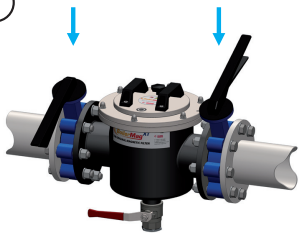
Servicing & Maintenance Instructions

Cleaning and servicing must only be carried out by a qualified person in accordance with all relevant current regulations.

To maintain optimum efficiency we recommend cleaning annually. However when a BoilerMagXT is fitted to an existing heating system we recommend more regular checks as it is likely there will be a large build-up of ferrous oxide (black sludge) to clear out.

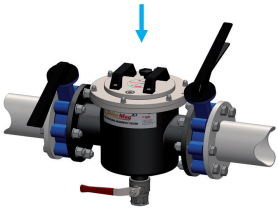
To service and maintain BoilerMagXT follow the instructions below:

1



Isolate the heating system and close the isolation valves on either side of the BoilerMagXT unit.

2

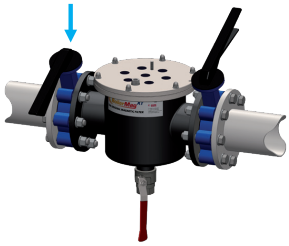


Remove the black tricone positioned on the lid.

3

Lift out the magnetic cores using the handle on top of the unit. *Warning see below*. Be careful not to place the cores on or near ferrous items.

4

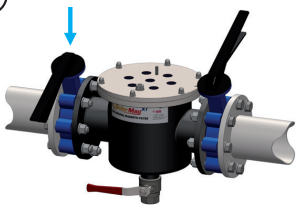


Either place a bucket underneath or connect a hose to the 1¼" drain valve on the underside of the BoilerMagXT. Remove the drain plug and open the drain valve. Partially open the inlet isolation valve and allow the contents to drain through the drain valve.

⚠ For larger BMXT units, the weight may exceed safe single person lifting limits. Please check and if required do as 2 persons or alternatively as a mechanical lift.

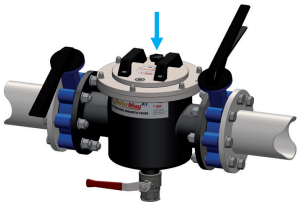
Servicing & Maintenance Instructions

5



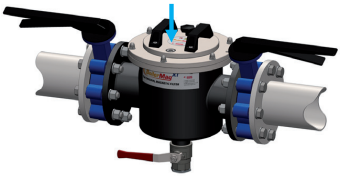
When the draining water runs clear turn off the inlet isolation valve and allow the remaining contents to drain. Close the drain valve and replace the plug.

6



Replace the magnetic core and hand tighten the black tricone to retain. Re-open both isolation valves.

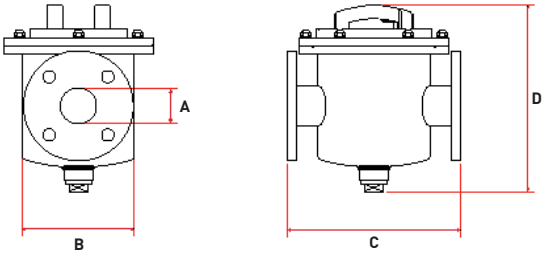
7



If required open the vent shown on the top of the unit to release any trapped air*.

*Automatic Air Vent option also available

Product data



Item Code	Part No.	Inlet / Outlet Dia. A	Filter Dia. B	Flange spacing C	Height D	No. magnetic rods	** Flow rate gallons/ minute (m³/hour)	Weight lbs/kgs
BMXT/1.5	BMXT100/ANSI	1.5" / 38mm	4" / 100mm	10" / 250mm	11" / 280mm	3	40 (9)	20 / 9
BMXT/2	BMXT150/ANSI	2" / 50mm	6 ¾" / 170mm	11 ⅛" / 280mm	11" / 280mm	5	79 (18)	42 / 19
BMXT/3	BMXT200/3/ANSI	3" / 75mm	8 ⅝" / 220mm	14 ⅛" / 360mm	13 ¼" / 335mm	7	229 (52)	82 / 37
BMXT/4	BMXT200/ANSI	4" / 100mm	8 ⅝" / 220mm	14 ⅛" / 380mm	13 ¼" / 335mm	7	308 (70)	82 / 37
BMXT/6	BMXT300HF/ANSI	6" / 150mm	12 ¾" / 325mm	19 ¼" / 490mm	16 ½" / 420mm	9	440 (100)	133 / 60
BMXT/8	BMXT300HF/8/ANSI	8" / 200mm	12 ¾" / 325mm	20 ⅝" / 525mm	18 ⅛" / 460mm	9	950 (215)	140 / 64
BMXT/10*	BMXT400/10/ANSI*	10" / 250mm	16" / 406mm	30" / 760mm	29 ¾" / 754mm	16	968 (220)	190 / 86
BMXT/12*	BMXT400/12/ANSI*	12" / 300mm	16" / 406mm	30" / 760mm	29 ¾" / 754mm	16	1364 (310)	195 / 88

* Made to order sizes
** Based on flow velocity of 6-8 ft/sec.

Performance

Magnetic performance	9,000 Gauss high strength
Performance reading	On tube surface
Magnetic material	Rare Earth Neodymium Iron Boron N42SH
Temperature	41° to 302°F / 5° to 150°C (212°F / 110°C if using automatic air vent)
Operating pressure	+/- 174psi / 12 bar (145psi / 10 bar if using automatic air vent)
Drain valve	¾" NPT BMXT/1.5 (BMXT100/ANSI), all others 1 ¼"NPT

Materials

Housing	304 grade stainless steel
Tube cartridge	316 grade stainless steel – aerospace quality
Other parts	304 grade stainless steel
Surface finish	Internal - bead blast External - powder coated, black
Sealing	Viton o-ring, brown

Includes Optional automatic air vent

Options High temperature Samarium Cobalt magnetic material +482°F / 250°C

Warranty Industry leading 10 years

See our full range of products

BoilerMag® Ultimate Heating System Protection

(1" & 1¼" connections)

BoilerMag XL® Ultimate Heating System Protection

(1½" connections)

System Treatment Chemicals
BM1 Inhibitor & BM3 Cleaner

www.boilermag.com/na

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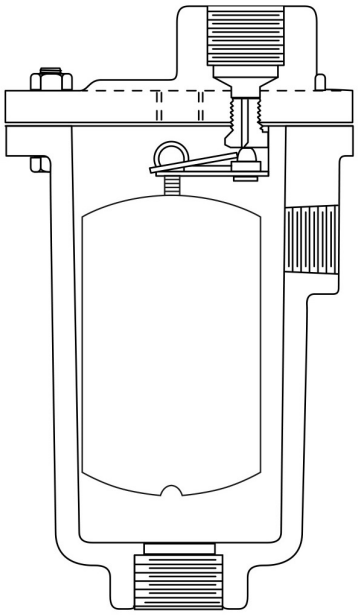
INSTRUCTION MANUAL
HS-112E

512725

Hoffman Specialty®
Model 792
High Pressure Water Vent Valve



⚠ CAUTION

Excessive use of pipe joint compound when installing air vent will foul the vent's operating mechanism allowing water to escape. Pipe joint compound must be conservatively applied to male threads only. Failure to follow this instruction can result in personal injury from hot water and/or property damage.

⚠ CAUTION

The use of PTFE impregnated pipe compound and PTFE tape on pipe threads provide lubricity which can lead to overtightening and breakage. Do not overtighten. Failure to follow this instruction can result in personal injury from hot water and/or property damage.

⚠ CAUTION

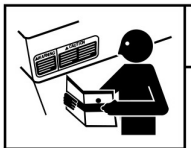
When the vent discharges air or if foreign material from the system fouls the vent's operating mechanism, it is possible for water to also be discharged. Vent must be piped to a drain. Failure to follow this instruction can result in personal injury from hot water and/or property damage.

IMPORTANT: To prevent system damage from water hammer or sudden shock, open supply valves slowly.

If you are uncertain about the product's adaptability for your application, please call the factory or authorized representative before using the product.

The vent pressure rating must be equal or greater than the maximum system pressure.

The vent discharge must be connected to a drain or fluid recovery unit to prevent damage to the equipment or structures in the event of leakage.



⚠ CAUTION

- **Before using product, read and understand instructions.**
- **Save these instructions for future reference.**
- **All work must be performed by qualified personnel trained in the proper application, installation, and maintenance of systems in accordance with all applicable codes and ordinances.**
- **To prevent serious burns, wear heat resistant gloves when opening and closing supply valves, or handling hot equipment.**
- **To prevent serious burns, the internal pressure of the system must be 0 psi (0 bar) before servicing.**

Failure to follow these cautions will cause personal injury.

INSTALLATION

An equalizing line is recommended for continuous operation applications as with water storage tanks. See Figure 1.

The Hoffman No. 792 Water Vent should always be installed with a safety drain from the discharge port to a suitable waste. At high rates of discharge at pressure, a fine mist will be discharged with the air. If dirt lodges between valve pin and seat, the valve will not close properly and water will be discharged at system pressure until problem is corrected.

Temperature and Pressure Limits

Maximum Temperature: 300˚F (149˚C)
Maximum Operating Pressure: 250 psig (17.3 bar)
Maximum Hydrostatic Pressure: 350 psig (24.2 bar)

Model 792 Capacity	
Water Pressure psig (bar)	Air Discharge to Atmosphere CFM (M^3/min.)
100 (6.9)	10 (.28)
150 (10.3)	15 (.42)
200 (13.8)	20 (.57)
250 (17.3)	25 (.70)

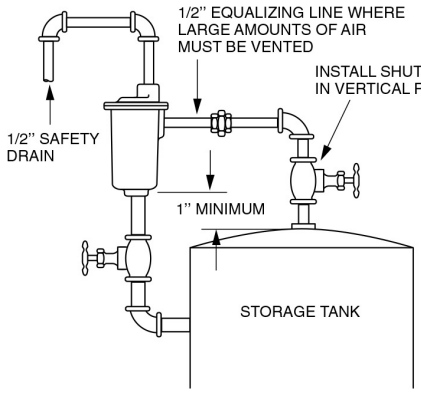


FIGURE 1

NOTE

Note: Leave shut-off valves open for proper installation. Close only to service unit.

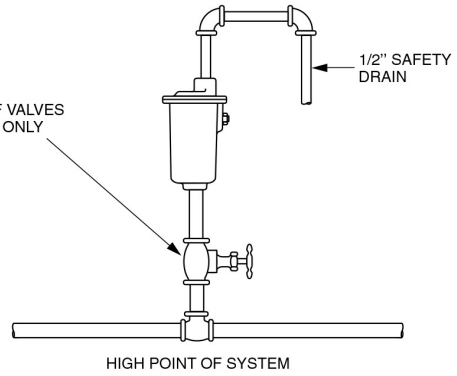


FIGURE 2

⚠ WARNING

The air vent will discharge air and possibly some liquid during its normal functioning. Avoid eye, face or skin contact with top area of air vent. We recommend the vent connection be piped to a drain to prevent accidental contact with discharging fluids. Failure to follow this instruction can result in serious personal injury and/or property damage.

⚠ WARNING

Corrosion or leakage are indications that the air vent may be about to cause serious damage from leakage or rupture. It should be periodically inspected and if noted, air vent must be replaced or serviced. Failure to follow this instruction can result in serious personal injury and/or property damage.

⚠ WARNING

System fluid under pressure and/or at high temperatures can be very hazardous. Before servicing, reduce system pressure to zero or isolate the air vent from the system. Allow system to cool below 100˚F. Failure to follow this instruction can result in serious personal injury and/or property damage.

Model 792
High Pressure Water
Vent Valve (complete unit) 401494
Service Parts Available

Cover Gasket Part No. 601273
Internal Parts Kit Part No. 600204
(includes cover gasket, pin, seat, lever arm, yoke, cotter pin and integral connecting hardware)
Float 600247

COMMERCIAL WARRANTY

Warranty. For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of one (1) year from the date of installation or two (2) years from the date of manufacture, whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE GOODS PROVIDED HEREUNDER, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

LIMITED CONSUMER WARRANTY

Warranty. For goods sold for personal, family or household purposes, Seller warrants the goods purchased hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be free from defects in material and workmanship for a period of one (1) year from the date of installation or two (2) years from the product date code, whichever shall occur first, unless a longer period is provided by law or is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render this Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. The Warranty is conditioned on Buyer giving written notice to Seller of any defects in material or workmanship of warranted goods within ten (10) days of the date when any defects are first manifest.

Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS PROVIDED IN PLACE OF ALL OTHER EXPRESS WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE (1) YEAR FROM THE DATE OF INSTALLATION OR TWO (2) YEARS FROM THE PRODUCT DATE CODE, WHICHEVER SHALL OCCUR FIRST. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To make a warranty claim, check first with the dealer from whom you purchased the product or call +1-847-966-3700 for the name and location of the nearest dealer providing warranty service.

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Morton Grove, Illinois 60053
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INSTRUCTION MANUAL
A01500I

Series "B" Series "D" Series "B-LA"

Pressurized Expansion Tanks (ASME)

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

SAFETY INSTRUCTIONS

This safety alert symbol will be used in this manual to draw attention to safety related instructions. When used, the safety alert symbol means **ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED! FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN A SAFETY HAZARD.**

WARNING: Explosion Hazard
Failure to follow instructions in the accompanying product manual can cause rupture or explosion, possibly causing serious or fatal injury, leaking or flooding and/or property damage.

DESCRIPTION

Precharged Expansion Tanks contain either a bladder or a diaphragm to separate the air charge from the system water. Tanks are designed to absorb the expansion forces of heating/cooling system water while maintaining proper system pressurization under varying operating conditions.

NOT FOR USE IN DOMESTIC (POTABLE) WATER SYSTEMS

DANGER: Series "B", "D", & "B-LA" are for use in closed loop systems only. Domestic, potable or fresh water can cause serious corrosion in a tank. This can result in leakage and a potential explosion. Do not use for domestic, potable or fresh water. Failure to follow this instruction will result in serious personal injury or death and property damage.

OPERATIONAL LIMITS

Maximum Operating Pressure: 125 psi (or as stamped on nameplate)
Maximum Operating Temperature: 240°F
Minimum Operating Temperature: 35°F (non-glycol application)
18°F (glycol application)

WARNING: Carefully read the Instruction Manual to avoid serious personal injury and property hazards and to ensure safe use and proper care of this product.

POINT OF CONNECTION

A. General

The Series B and Series D tanks work equally well when installed in the vertical or horizontal position. When Series B tank is installed horizontally, the system connection must be located below the centerline of the tank. The Series B-LA tanks must be installed in vertical position. They cannot be installed in the horizontal position.

The pressurized expansion tank-to-system piping differs from the "standard" compression tank piping in several major aspects:

1. Air from the system must be purged to the atmosphere and not allowed to enter the tank.
2. Tank-to-system piping must not be pitched-up to the tank.
3. Shut-off and drain valves or tank purge valve B&G TPV must be installed in the tank-to-system piping in order to properly check and recharge the tank air after the system has been filled with water.
4. Airtrol Tank Fitting (ATF or ATFL) is not required.

WARNING: This product must be installed by a qualified professional. Failure to follow the instruction in accompanying manual may cause a rupture or explosion which may result in serious injury or death and property damage.

WARNING: CALIFORNIA PROPOSITION 65 WARNING! This product contains a chemical known by the State of California to cause cancer and to cause birth defects or other reproductive harm. (California Installer/Contractor – California law requires that this notice be given to consumer/end user of this product.

B. Piping

Typical tank-to-system and air vent piping are illustrated by Figures 1 thru 6. Some general notes regarding this piping are listed below:

1. The connection point from tank-to-system represents the point of no pressure change. This means that the expansion tank must be connected as close as possible to the suction side of the system circulating pump for proper system operation.

CAUTION: Pump cavitation and unbalanced circuits can result from improper tank location. Connect tank as close to suction side of system circulating pump as possible. Failure to follow this instruction could result in property damage and/or moderate personal injury.

2. The branch piping to the tank must be attached to the main to minimize the possibility of air and debris entering the tank piping. If connected to the horizontal main, do not use top (12 o'clock) and bottom (6 o'clock) positions. Side connections are the proper positions. If connection must be made at the bottom, a dirt trap leg with a flushing drain valve, such as shown in Figure 4, should be installed.

CAUTION: A blocked connection to the expansion tank will cause system to become overpressurized resulting in periodic discharge of system relief valve. This periodic discharge will require that fresh water be added to the system to maintain pressure. The resulting addition of fresh water will cause corrosion in system components. The use of a bottom connection to the main requires the use of dirt trap leg with a flushing drain valve. Failure to follow these instructions could result in property damage and/or moderate personal injury.

3. Table A shows the recommended pipe sizes. Note that the MBH column represents the output of the heat generator (firing rate, etc.). The pipe sizes are selected for very low pressure loss in the tank-to-system piping to accommodate system operating pressures within 10% of the relief valve setting. However, if the actual system operating pressure is less than 80% of the relief valve setting, the tabulated pipe size above 1" may be reduced by one size.

   Pipe sizes 1" or less must not be changed due to the greater possibility of fouling in the smaller pipes.

4. In order to change the tank air charge pressure it is necessary to isolate the tank circuit from the main system piping. A high quality, gate type or TPV, lock-shield valve must be used for this purpose. The lock-shield for the valve stem will eliminate tampering of this normally open valve during normal system operation.

WARNING: System overpressurization will result if expansion tank isolation valve is not kept open during normal operation. Provisions must be made to lock this valve open during normal system operation. Failure to follow these instructions could result in serious personal injury or death and property damage.

WARNING: Do not locate this product where leaking or flood could cause damage to the surrounding property. A drip pan connected to an adequate drain must be installed if leaking or flooding could cause property damage. Failure to follow this instruction could result in property damage.

5. In addition to the lock-shield valve above TPV or a drain valve, automatic air vent and a pressure gauge must be installed in the piping. The drain valve is used for flushing (item 2 above) and to drain the water out of the tank for proper air charging.
6. Tank sizing calculations are based on minimum temperature rise of the air in the tank. For this reason, an anti-thermosyphon loop must be formed in the tank-to-system piping to minimize the effects of gravity (thermal) circulation into the tank. A drop leg from 12" to 20" long is usually sufficient. It is also suggested that this piping and tank not be insulated (heating systems only).

CAUTION: Lack of or improperly sized air vent will cause system circulation problems. An automatic air vent must be installed in the line to the expansion tank and at air separating devices as shown in Figures 1 thru 6. These must be sized to vent off any accumulated air. Failure to follow these instructions could result in property damage and/or moderate personal injury.

7. Allow an overhead clearance for the Series B of at least 36" to remove the bladder through the flanged opening in case replacement is required. For bladder replacement of the Series B-LA tanks, the tank must be removed from the system.

INSTALLATION

1. Note location of system connection, air charge valve and drain connection on tank.
2. Remove the plug or pipe cap from the system connection.
3. Remove the 1½" NPT plug covering the air charge valve.
4. Before making any connection to the tank, check the tank and air charge (use an accurate pressure gauge). The air pressure must be equal to the minimum system pressure at the tank location.
5. After making sure the air charge is correct, replace the 1½" plug over the air valve.
6. The tank may now be piped to the system (use the suggested tank piping diagram on page 4 and 5).
7. Using table A, select appropriate pipe size. Connection to each tank must have a lock shield gate valve or TPV and union to allow isolation and removal if required. Make up and fill valves, whether manual or automatic, should be tied into the connecting line. This will ensure that pump operation will not affect valve operation.

OPERATING INSTRUCTIONS

1. Check the expansion tank pre-charge before the system is filled with water. The charge is 12 psig unless noted otherwise on the tank label. Check to make sure this is the correct precharge pressure specified for the system. Precharge should match system fill pressure at point of tank installation. If increasing precharge, the tank must be connected immediately to the system. The tank should not be isolated at this condition. Failure to do so could result in damage to the bladder and void all warranties.
2. If the tank pre-charge pressure needs to be changed on a dry system follow the following procedure:
   a. Check the expansion tank air pressures at the precharge connection with an accurate tire type pressure gauge. The pre-charge connection is the same kind of connection found on automobile tires.
   b. If the pressure is low, charge the tank with nitrogen gas or with oil-free compressed air. Check the pressure frequently during this process as you would when filling a tire with air.

> **DANGER:** Excessive pressure can cause tank to explode. Exercise care when filling a tank with air so the pressure does not exceed that required or does not exceed the working pressure of the tank as stamped on the nameplate. Failure to follow these instructions will result in serious personal injury or death and property damage.

3. If, after the system has been filled with water and operating, it is found that the expansion tank pre-charge must be changed use the following procedure:
   a. Turn off the heat source and allow the system water to cool to ambient temperature.

> **IMPORTANT:** Expansion tank cannot be properly air charged other than at ambient temperature.

   b. Close the lock-shield valve in the tank-to-system piping.
   c. Open the drain valve or TPV to empty the water from the tank.
   d. Check the tank air pressure at the pre-charge connection with an accurate tire type air gauge.
   e. Refer to 2b above.
   f. Close the drain valve, open the lock-shield valve and turn on the heat source.
   g. Relock the lock-shield valve.

SERVICE INSTRUCTIONS

1. Check the expansion tank periodically for signs of external leakage or corrosion, If found, the tank must be replaced.

> **DANGER:** Signs of leakage or corrosion are indications the tank may explode. Periodically check the expansion tank for signs of external leakage or corrosion. If found, the tank must be replaced. Failure to follow these instructions will result in serious personal injury or death and property damage.

2. If the tank fails to hold the pre-charge pressure it could be the result of one of the following.
   a. Leakage of air valve. Do not depend on the valve cap to seal leak.
      1. Refer to items 3a thru 3d under operating instructions to prepare the tank so that the air valve core can be changed.

> **WARNING:** Improper use of air charging valve during venting of air pressure from tank will create a hazardous condition due to the escape of high velocity gas and/or liquid. Depress the center valve core stem, as with a tire valve, to slowly vent off gas pressure. Do not remove the valve core until pressure in the expansion tank has reached zero. Failure to follow these instructions could result in serious personal injury or death and property damage.

      2. If only gas escapes, unscrew the air valve core and replace with a tire type/Schrader valve core. If liquid escaped refer to 2b below.
      3. Refer to 3e thru 3g under operating instruction to complete the service procedure.
   b. The bladder or diaphragm is leaking as indicated by liquid on the gas side or the inability of the tank to maintain its gas cushion. If the tank is a diaphragm type, the tank must be replaced. Diaphragm tanks can be identified by the model numbers beginning with a “D” and the absence of a large flanged opening to remove the bladder. If the tank is a bladder type, the bladder can be replaced as follows:
      1. Refer to items 3a thru 3c under operating instructions to prepare the system for replacement of the bladder.

> **WARNING:** Residual system pressure is a serious hazard when attempting to replace tank bladder. Make sure that all fluid has stopped draining from the drain valve and the system pressure is zero. If leaking continues from the drain valve, the lock-shield isolation valve must be replaced before proceeding. Failure to follow these instructions could result in serious personal injury or death and property damage.

      2. Depress the center valve core stem on the air side of the tank, as with a tire valve, to slowly vent off the air or gas charge.

> **WARNING:** Removing the bladder housing cover with an air charge or pressure still in the tank can cause the cover to be blown off. Make sure that all gas charge pressure and system pressure is removed from the tank before loosening or removing cover bolts. Failure to follow these instructions could result in serious personal injury or death and property damage.

      3. Remove the bolts from the flanged cover to gain access to the bladder. Series B-LA tanks must be disconnected from the system. Remove the bottom drain plug to drain fluid.
      4. Pull the bladder from the tank through the flanged opening.
      5. Make sure all flange surfaces are clean and free of corrosion so that the new bladder will seal properly. If corroded, the tank must be replaced.
      6. Install the new bladder in the tank by stuffing through the flange opening in the reverse manner that the old bladder was removed. The Partial Acceptance tank has a support pipe, which the bladder will fit around. Insert the new bladder into bottom of the tank. To make system connection, align elbow with hole in skirt.
      7. Replace the flanged cover and tighten the bolts in a crisscross pattern. Take care not to exceed the allowable torque of the bolts. Screw in drain plug.
      8. Refer to item 3e thru 3g under operating instructions to place the system back in operation.
      9. Check for gas leaks around the flange connection. If leaks are found, lightly tighten bolts in a criss-cross pattern, again being careful not to exceed the allowable torque of the bolts. If leaking continues, the expansion tank will have to be replaced.

FIGURE NOTES

1. Tank connection locations may vary depending on the type of tank to be installed.
2. Provide an anti-thermosyphon loop with a minimum drop of 12" to prevent gravity heating of the tank.
3. Figures 1 and 2 show where a tee would be located if multiple expansion tanks are installed.

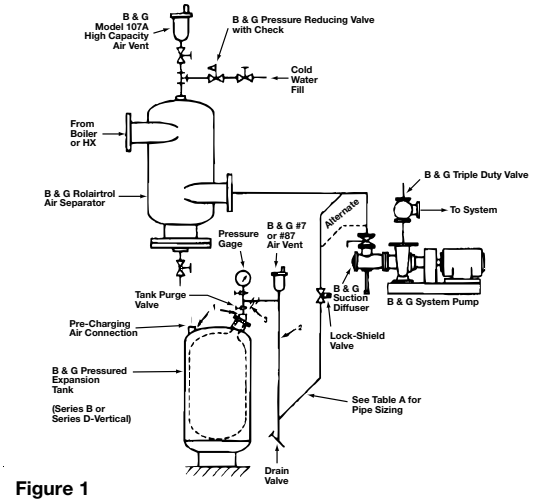

Figure 1
Vertical Tank Installation with Rolairtrol Air Separator

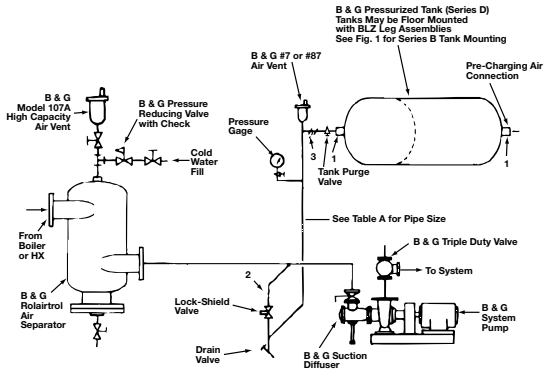

Figure 2
Horizontal Tank Installation with Rolairtrol Air Separator

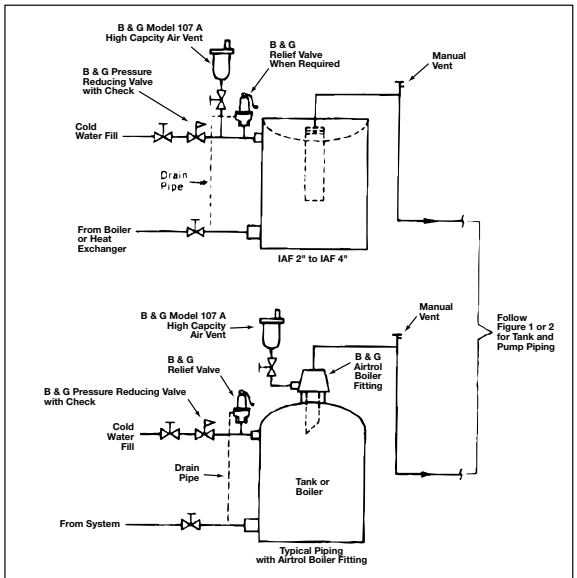

Figure 3 - Typical Piping with IAF In-Line Air Separator and Airtrol Boiler Fitting

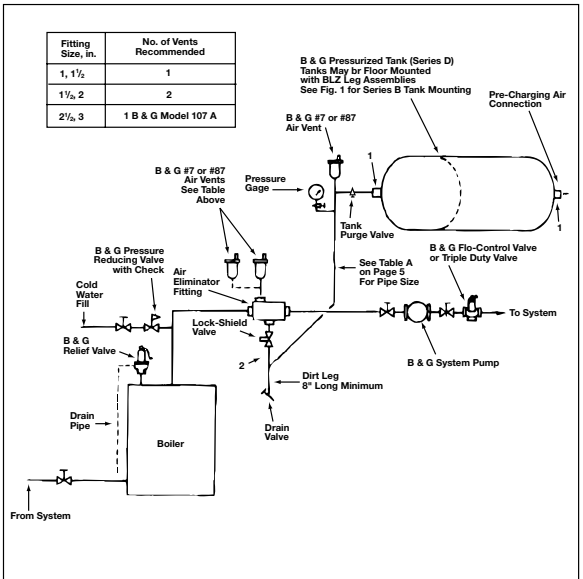

Figure 4 - Tank Installation with IAS In-Line Air Separator

PIPING DIAGRAMS

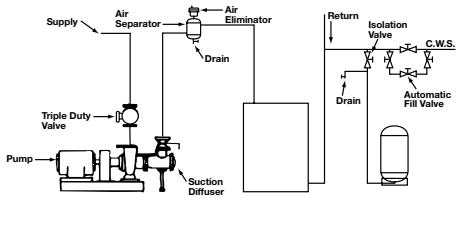

Figure 5: Suggested Piping Diagram Tank with Bottom System Connection

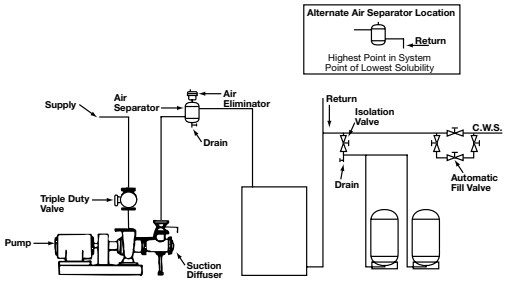

Figure 6: Alternate Piping Diagram Tank with Bottom System Connection

TABLE A - MINIMUM PIPE SIZE FROM TANK TO SYSTEM (IN INCHES)

	EQUIVALENT LENGTH UP TO 10'					EQUIVALENT LENGTH 11' TO 30'					EQUIVALENT LENGTH 31' TO 100'				
	MAX. AVERAGE DESIGN TEMP. °F.					MAX. AVERAGE DESIGN TEMP. °F.					MAX. AVERAGE DESIGN TEMP. °F.				
MBH	100	150	200	250	300	100	150	200	250	300	100	150	200	250	300
1,000	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	3/4	3/4	1/2	3/4	3/4	3/4	1
2,000	1/2	1/2	1/2	1/2	3/4	1/2	3/4	3/4	3/4	1	3/4	3/4	1	1	1 1/4
3,000	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1	1	3/4	1	1	1 1/4	1 1/4
4,000	1/2	3/4	3/4	3/4	1	3/4	1	1	1	1 1/4	1	1	1 1/4	1 1/4	1 1/4
5,000	1/2	3/4	3/4	1	1	3/4	1	1	1 1/4	1 1/4	1	1 1/4	1 1/4	1 1/4	1 1/4
6,000	1/2	3/4	1	1	1	3/4	1	1 1/4	1 1/4	1 1/4	1	1 1/4	1 1/4	1 1/2	1 1/2
7,000	3/4	1	1	1	1 1/4	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	2
8,000	3/4	1	1	1	1 1/4	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/4	1 1/4	1 1/2	1 1/2	2
9,000	3/4	1	1	1 1/4	1 1/4	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/4	1 1/4	1 1/2	2	2
10,000	3/4	1	1	1 1/4	1 1/4	1	1 1/4	1 1/4	1 1/2	1 1/2	1 1/4	1 1/2	2	2	2
12,000	1	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	2	1 1/4	1 1/2	2	2	2
14,000	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/4	1 1/4	1 1/2	2	2	1 1/4	2	2	2	2 1/2
16,000	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/4	1 1/2	1 1/2	2	2	1 1/2	2	2	2 1/2	2 1/2
18,000	1	1 1/4	1 1/4	1 1/2	1 1/2	1 1/4	1 1/2	2	2	2	1 1/2	2	2	2 1/2	2 1/2
20,000	1	1 1/4	1 1/4	1 1/2	1 1/2	1 1/4	1 1/2	2	2	2	1 1/2	2	2 1/2	2 1/2	2 1/2

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1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

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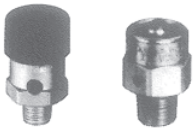
INSTRUCTION MANUAL
A90602C

Miscellaneous Accessories

No. 26 Vacuum Breaker

Nos. 87, 67 and 7 Automatic Air Vents



Nos. 17 Sr. and 17 Jr. Automatic Air Valves

No. 4V Coin-Operated Air Vent

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

SAFETY INSTRUCTION

This safety alert symbol will be used in this manual to draw attention to safety related instructions. When used, the safety alert symbol means **ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED! FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN A SAFETY HAZARD.**

DESCRIPTION

Air vents are designed to vent the accumulation of troublesome air whenever it can be trapped.

The No. 87, 67 and 7 models are automatic air vents of float type while the No. 17 Sr. and 17 Jr. automatic models are hygroscopic in operation.

The No. 4V air vent is a manual type vent specially designed for radiators.

The No. 26 vacuum breaker is designed to protect closed vessels and piping systems against collapse when induced vacuum exceeds design conditions. When used on steam systems the vacuum breaker permits the normal return of condensate to the boiler.

INSTALLATIONS INSTRUCTIONS

1. Install air vent in hydronic piping system or in hydronic system components where air is expected to accumulate and must be removed for proper hydronic system operation.

   Vacuum breakers are installed in steam systems or other systems where vacuum from condensing steam or from other sources must be controlled.

2. #7, #67 and #87 air vents are float type and must be installed in the vertical position with vent connection pointing up.

3. The #87 air vent can be installed on ½" nipple or into a ¾" NPT female connection.

4. The #17 Sr and #17 Jr air vents will function better if installed on a ½" or ¾ X 5" to 6" long NPT nipple.

CAUTION: Uncontrolled venting of water can occur with automatic air vents if foreign material prevents vent from closing. A No. 113023 overflow connector and ¼" OD copper tube should be used to direct unwanted flow to a drain. Failure to follow these instructions could result in property damage and/or moderate personal injury.

CAUTION: Pipe compound can foul the air vent or vacuum breaker operating mechanism. Use pipe joint compound sparingly on male pipe threads only. Failure to follow these instructions could result in property damage and/or moderate personal injury.

CAUTION: Overtightening and breakage can occur with the use of teflon pipe joint compounds. Teflon provides lubricity so that care must be exercised not to overtighten joints. Failure to follow these instructions could result in property damage and/or moderate personal injury.

CAUTION: Venting hot water or steam can cause injury. When working near any air vent or vacuum breaker be careful not to get inline with vent connection. Failure to follow these instructions could result in property damage and/or moderate personal injury.

OPERATIONAL LIMITS

Model No.	Pressure psig (Bar)	Temperature °F (°C)
87	150 (10.3)	240 (116)
67	35 (2.4)	240 (116)
7	75 (5.1)	240 (116)
17Sr	30 (2.1)	225 (107)
17Jr	30 (2.1)	225 (107)
4V	150 (10.3)	250 (121)
26	2" Hg Vacuum to 150 (10.3)	240 (116)

OPERATING INSTRUCTIONS

CAUTION: Dirt and scale from the system can foul the automatic air vent operating mechanism. On #7, #67 and #87 air vents keep vent cap closed tight during system filling to prevent dirt from running into valve vent mechanism. Failure to follow these instructions could result in property damage and/or moderate personal injury.

1. Automatic air vents can be used for automatically or manually venting hydronic systems. To manually operate the #7, #67 and #87 vents press down on the vent stem (tire type valve).

CAUTION: Hot venting water can be hazardous. Avoid contact with venting fluid and only manually vent when system temperature is below 100°F (38°C). Failure to follow these instructions could result in property damage and/or personal injury.

To shutoff #7, #67 and #87 vents so they can not vent automatically, (only those without overflow connector installed), screw cap on top of vent down tight. For normal automatic venting open cap only about one full turn so that there is a slow release of air. A fast release of air will allow dirt or scale to foul the vent mechanism. The small hole in the side of the cap allows air to escape with cap in place. When an overflow connector and tube to a safe drain is used, continuous automatic venting is provided.

2. The #4V coin operated air vent is a manual vent and is opened by the use of a coin or screwdriver inserted and turned in the slotted screw on top of the vent. The vent is opened and air bled off until water appears. Vent is then closed by securely tightening the vent screw.

3. The #17 Sr and #17 Jr automatic air vents are not float types and operate hygroscopically. Air is allowed to escape but water is not. Both vents have a manual venting feature which is operated by screwing the black plastic cap halfway up on the #17 Sr or by opening the screw in the center of the #17 Jr two turns maximum.

CAUTION: Hot venting water can be hazardous. Avoid contact with venting fluid and only manually vent when system temperature is below 100°F (38°C). Failure to follow these instructions could result in property damage and/or personal injury.

Screwing the black plastic cap on the #17 Sr all the way up cuts off manual venting but allows venting to continue. Turning the black plastic cap all the way down on the #17 Sr closes the vent to both automatic and manual venting. The automatic venting of the #17 Jr can not be shutoff. Manual venting is stopped by screwing down the center vent screw tightly.

4. The #26 vacuum breaker can be adjusted to open at any vacuum between ¼" Hg and 20" Hg. This is accomplished by pulling off the brass cover and adjusting the position of the brass nuts. The top nut is a jam nut used for locking the set position. Threading the nuts down will increase the vacuum at which the vent opens and threading the nuts up will decrease the vacuum at which the vent opens. After adjustments are made make sure the jam nut is tightened against the spring nut so that it is locking the set position. Replace the protective cover.

SERVICE INSTRUCTIONS

There is no service required for any of the air vents or vacuum breaker.

CAUTION: Corrosion or leakage of vents or vacuum breaker can cause damage or injury. Periodically inspect the air vents or vacuum breaker for signs of leakage or corrosion. If noted the vent or vacuum breaker must be replaced. Failure to follow these instructions could result in property damage and/or moderate personal injury.

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INSTRUCTION MANUAL
A85524C

2", 2½", 14" THROUGH 24"
R AND RL MODELS

Rolairtrol® Air Separator

3" THROUGH 12"
R AND RL MODELS

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

SAFETY INSTRUCTION

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WARNING: Carefully read the Instruction Manual to avoid serious personal injury and property hazards and to ensure safe use and proper care of this product.

DESCRIPTION

The Rolairtrol Air Separator is an ASME vessel designed with tangential openings to create a low velocity vortex where air is separated and removed from the circulating water. The Rolairtrol is designed and constructed per ASME Section VIII, Division I. This product is intended for hot and chilled water systems.

NOT FOR USE IN DOMESTIC (POTABLE) WATER SYSTEMS
DANGER: Rolairtrol Air Separator is for use in closed loop systems only. Domestic, potable or fresh water can cause serious corrosion in a tank. This can result in leakage and property damage. Do not use for domestic, potable or fresh water. Failure to follow this instruction will result in serious personal injury and property damage.

OPERATIONAL LIMITS

Maximum Operating Temperature: 350°F
Maximum Operating Pressure: 125 PSIG

CAUTION: Hot uninsulated surfaces can cause burns to the skin. Do not touch hot surfaces. Failure to follow these instructions could result in moderate personal injury.

INSTALLATION INSTRUCTIONS

1. Refer to Figures 1 and 2 for the proper installation of the Rolairtrol.

CAUTION: Use unit lifting lugs only to lift unit as shipped from factory. Unit must be empty and disconnected from pipe, and other restraints. Use proper rigging procedures. Failure to follow these instructions could result in injury or property damage.

WARNING: Wet weight of Rolairtrols can exceed strength of supports. Make sure the provisions are made to support the wet weight and not just the dry weight (see Table 1). Failure to follow these instructions could result in serious personal injury or death and property damage.

WARNING: This product must be installed by a qualified professional. Failure to follow the instruction in accompanying manual may cause a leakage or explosion which may result in serious injury or death and property damage.

WARNING: The use of improper mating flanges, connectors, gaskets or bolting can cause flange or connector failure resulting in the loss of hot or cold system fluid. Use only companion cast iron ANSI flanges or connectors with appropriate gaskets and properly tightened bolts. Failure to follow this instruction can result in serious personal injury and/or property damage.

2. Rolairtrol sizes through an "R-8" or "RL-8" can be supported in the piping system as long as pipe hangers are attached to the tangential nozzles as close to the Rolairtrol shell as possible. Sizes larger than an "R-8" or "RL-8" will need to have additional supports, such as a cradle under the Rolairtrol acting on a diameter as close to the Rolairtrol outside diameter as possible or factory installed support brackets.

   Note: Welding to the pressure vessel boundary will void the ASME stamp.

3. Model "R" Rolairtrol Air Separators have strainers which must be removed and cleaned after 24 hours of operation, 30 days of operation and as required to maintain proper system air separation. Before installing the model "R" Rolairtrol refer to Table 2 for minimum distances to be maintained between the blowdown connection or end of the pipe plug and the floor or other equipment for strainer removal.
4. A manual blowdown valve (MBV-1) can be added to the blowdown connection. The function of the MBV-1 is to facilitate the purging of sediment from the vessel.
5. A manual blowdown valve (MBV-1) can be added to the 3" through 12" tanks of the R models, by removing the 3" pipe plug and replacing with the proper sized reducer.

WARNING: CALIFORNIA PROPOSITION 65 WARNING!
This product contains a chemical known by the State of California to cause cancer and to cause birth defects or other reproductive harm.

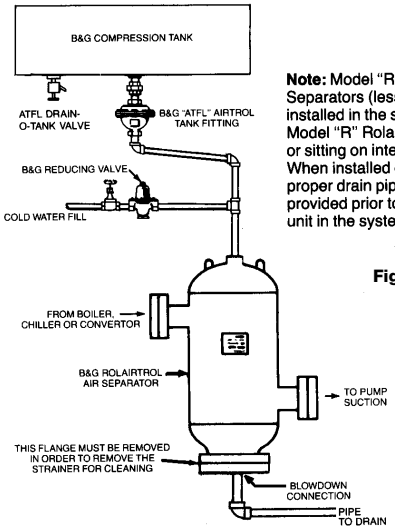
Cv, APPROXIMATE VOLUME AND WEIGHT (Table 1)

size (inches)	2	2½	3	4	5	6	8	10	12	14	16	18	20	22	24
R vol. (gal)	2	3	7	13	25	34	90	150	291	472	723	1149	1577	1958	2463
R Cv	44	64	119	257	398	632	1020	1789	2665	1445	1885	2340	2945	3725	4325
R dry wt. (lbs)	55	90	130	170	220	295	460	845	1165	1780	2425	3410	5310	6400	7500
R wet wt. (lbs)	70	115	188	278	429	579	1211	2097	3588	5719	8458	12998	18470	22740	28054
RL vol. (gal)	2	3	7	13	25	34	90	150	291	472	723	1149	1577	1958	2463
RL dry wt. (lbs)	50	85	115	155	205	280	420	800	1110	1780	2425	3410	5310	6400	7500
RL wet wt. (lbs)	65	110	173	263	414	564	1171	2052	3538	5719	8458	12998	18470	22740	28054
RL Cv	55	80	215	370	580	850	1445	2340	3300	3900	5100	6410	8000	10000	11700

DISTANCE IN INCHES REQUIRED TO REMOVE STRAINER (Table 2)

size (inches)	2	2½	3	4	5	6	8	10	12	14	16	18	20	22	24
distance	8.5	8.5	12	14	16	19	23	28	31	37	42	52	56	60	64

TYPICAL HYDRONIC HEATING/COOLING APPLICATIONS



Note: Model "RL" Rolairtrol Air Separators (less strainer) can be installed in the same manner as Model "R" Rolairtrol Air Separators or sitting on integral support skirt. When installed on the support skirt, proper drain piping should be provided prior to installing the unit in the system piping.

Fig. 1 Air Control

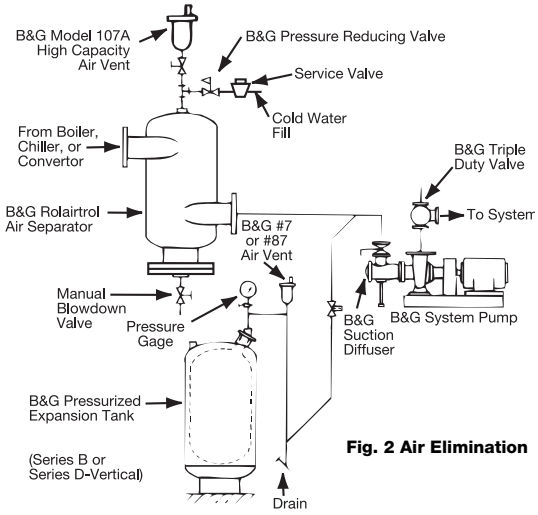


Fig. 2 Air Elimination

SERVICE INSTRUCTIONS

WARNING: Leakage, corrosion or indications of damage are signs of an impending serious failure of the Rolairtrol. Periodically inspect for damage and if noted the Rolairtrol must be serviced or replaced. Failure to follow these instructions could result in serious personal injury or death and property damage.

The strainer in the R series Rolairtrol may need to be cleaned periodically. This is particularly true during the initial start-up period. The need to clean the strainer will be evidenced by a high pressure drop across the Rolairtrol or by pump cavitation problems. To clean the strainer:

a) Allow the system water temperature to cool below 100°F.

WARNING: Water at temperatures above 100°F can be very hazardous. Allow system water temperature to cool down below 100°F before blowing down Rolairtrol. Failure to follow these instructions could result in serious personal injury or death and property damage.

b) Open the blowdown drain valve for a few seconds. This should dislodge accumulated dirt from the strainer. If it does not then the strainer must be removed from the Rolairtrol for cleaning. This can be accomplished by closing the isolation valves to isolate the Rolairtrol from the system. Make sure the water temperature in the Rolairtrol is below 100°F. Open the blowdown valve on the bottom of the Rolairtrol to drain the unit. Make sure that all flow from the blowdown valve has stopped. If water continues to flow, the isolation valves must be repaired or replaced before proceeding.

WARNING: System fluid under pressure and/or high temperature can be very hazardous. Before proceeding to service strainer, reduce system pressure to zero or isolate the Rolairtrol from the system. Allow the system to cool below 100°F. Failure to follow these instructions could result in serious personal injury or death and property damage.

c) For 2", 2½" and 14" through 24" models, remove the flange bolts that hold the strainer housing cover in place on the bottom of the Rolairtrol. Remove the cover and strainer. Clean the strainer and reinstall in the Rolairtrol. Replace the cover gasket with a new one and reinstall the cover making sure that the flange bolts are tightened in a criss-cross pattern to the proper torque. Close the blowdown valve and open the isolation valves to return the Rolairtrol to normal operation. Check the gasket for signs of leakage. If found, additional slight tightening of bolts may be required.

WARNING: The use of improper mating flanges, connectors, gaskets or bolting can cause flange or connector failure resulting in the loss of hot or cold system fluid. Use only companion cast iron ANSI flanges or connectors with appropriate gaskets and properly tightened bolts. Failure to follow this instruction can result in serious personal injury and/or property damage.

d) For 3" through 12" of the R models, remove the 3" pipe plug that holds the strainer in place on the bottom of the Rolairtrol. Remove and clean the strainer, reinstall them making sure that the strainer goes through the strainer guide and the pipe plug is tightened. Close the blowdown valve and open the isolations to return the Rolairtrol to normal operation. Check the pipe plug for signs of leakage. If found, additional slight tightening of pipe plug may be required.

CAUTION: The use of Teflon®* impregnated pipe compound and Teflon® tape on pipe threads provides lubricity which can lead to overtightening and breakage. Do not overtighten. Failure to follow this instruction can result in moderate personal injury from hot water and/or property damage.

e) Do not use any open flame devices (torches, solder guns, etc.) which may thermally degrade the painted or galvanized surfaces and cause the release of harmful decomposition products, which may be harmful if breathed.

WARNING: Failure to follow these instructions could result in serious personal injury or death.

*Teflon is a registered trademark of E.I. DuPont de Nemours and Company.

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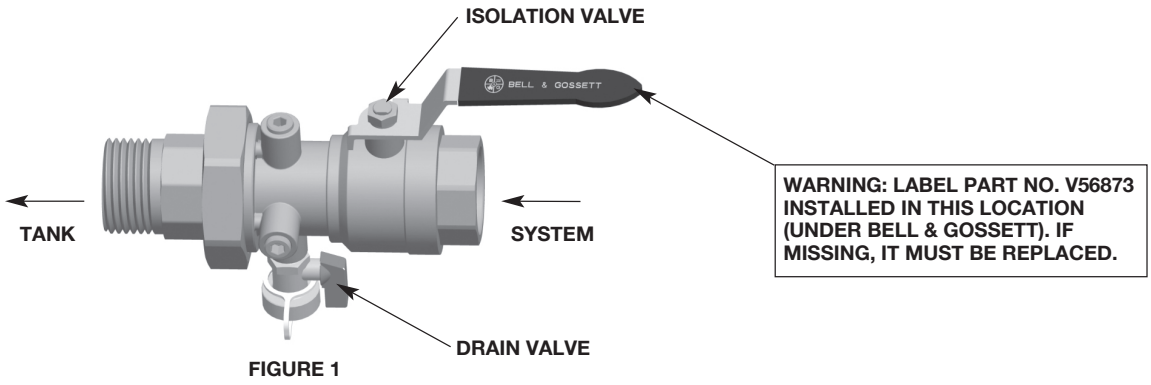

FIGURE 1

Tank Purge Valve – TPV

INSTALLLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

NOTE: This product is not intended for use in potable water applications.

WARNING: California Proposition 65 Warning! This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

SAFETY INSTRUCTION

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WARNING: Isolation valve must be in the open position with the handle inline with the valve body when the system is in operation. Failure to follow these instructions may cause system to over pressurize and can result in serious personal injury, death and property damage.

WARNING: Drain valve must be in the closed position with the handle perpendicular to the valve body when the system is in operation. Failure to follow these instructions can cause property damage due to leakage through the drain valve.

OPERATIONAL LIMITS

WORKING PRESSURE & TEMPERATURE LIMITS (SOLDER TYPE LIMITS FOR ANSI STD. B.16.18)

TYPE OF SOLDER	MAXIMUM LIMITATIONS 1/2" – 1"		MAXIMUM LIMITATIONS 1 1/4" – 2"	
	PRESSURE PSI (kPa)	TEMP °F (°C)	PRESSURE PSI (kPa)	TEMP °F (°C)
95-5	300 (2069)	200 (93)	300 (2069)	175 (79)
TIN-	250 (1724)	225 (107)	250 (1724)	200 (93)
ANTIMONY	200 (1379)	250 (121)	175 (1207)	250 (121)

WARNING: Damage to the Tank Purge Valve or failure of solder sealing joints may occur if these operational limits are exceeded. This can result in water leakage. Failure to follow this instruction can cause serious personal injury and/or property damage.

NPT

Maximum Operating Pressure 400 psig (2758 kPa)
Maximum Operating Temperature 250°F (121°C)

DESCRIPTION

The Bell & Gossett Tank Purge Valve (TPV) is a combination full port ball type isolation valve and drain valve used to connect the system to the expansion tank. This valve allows the tank to be drained for easy servicing or tank replacement without having to drain the system. These valves are furnished standard with a drain valve with standard 5/8" hose connection.

INSTALLATION INSTRUCTIONS

1. Install Tank Purge Valve between the expansion tank and the system so that the drain valve is between the expansion tank and the isolation valve. (The union connection is installed on the tank). The Tank Purge Valve should be installed so that both the drain valve handle and the isolation valve handles are easy accessible. Refer to Figure 1. For typical installation drawings refer to Figure 2 and 3.
2. **For installing Sweat Connections:**
   a) Clean tube ends and valve connections thoroughly per good piping practices with a fine grade emery cloth or fine grit sandpaper.
   b) For soldering, use 95-5 (Tin-Antimony) solder and a good grade of flux.
   c) Use a torch with a sharp pointed flame.
   d) When sweating the joints, first adjust the valve in the full open position, then wrap the valve with a cool wet rag and then direct the flame with care to avoid subjecting the valve to excessive heat. Allow the valve to cool before touching or operating.
   e) Check the soldered connection for leaks.

WARNING: Use of improper procedures to sweat valve model with union connection into system can damage valve. Before sweating valve connection, remove the union nut and O-ring from the valve body. Failure to follow this instruction could result in property damage and/or moderate personal injury.

CAUTION: Heat associated with the use of silver solder may damage a Tank Purge Valve and voids the product warranty. Do not use silver solder. Failure to follow these instructions could result in property damage and/or moderate personal injury.

3. **For installing NPT connections:**

Apply pipe compound conservatively to male connecting fittings only.

CAUTION: The use of PTFE impregnated pipe compound and PTFE tape on pipe threads provides lubricity. Care should be taken to prevent overtightening which may damage the valve body. Failure to follow these instructions can result in moderate personal injury and/or property damage.

After installation check all joints for leakage and retighten where necessary.

OPERATION INSTRUCTIONS

1. To drain the tank first close the isolation valve by moving the handle one quarter of a turn until the handle is perpendicular to the valve and piping. Allow the tank to cool to 100°F (38°C).

WARNING: Hot fluids and/or fluids under pressure are safety hazard. Do not drain while it is hot or under pressure. Failure to follow these instructions could result in serious personal injury or death and property damage.

2. Remove the cap from the 5/8" drain on the drain valve and connect a 5/8" garden hose onto the drain valve.
3. Move the handle of drain valve one quarter of a turn until it is inline with the valve body and system piping.

WARNING: It is possible, depending on the age or condition of the drain valve stem seal, for some liquid to escape when closing the valve. Do not have eyes or face directly underneath the valve. Failure to follow these instructions could result in serious personal injury.

To return the Tank Purge Valve to the operating position turn the drain valve handle until it is perpendicular to the valve body and replace the cap onto the drain. Move the handle of the isolation valve one quarter of a turn until it is inline with the valve body and system piping.

SERVICE INSTRUCTIONS

Periodically inspect the Tank Purge Valves for signs of corrosion or leakage. If steam leakage is observed the brass hex packing nut should be tightened slightly until leak stops. If tightening the packing nut does not stop the leak or signs of leakage are noted elsewhere, the Tank Purge Valve must be replaced.

WARNING: Corrosion or leakage are indications that the shutoff valve may be about to cause serious damage. The Union ended valve must be replaced. Failure to follow these instructions could result in serious personal injury or death and property damage.

FIGURE NOTES

1. Tank connection locations may vary depending on the type of tank to be installed.
2. Provide an anti-thermosyphon loop with a minimum drop of 12" to prevent gravity heating of the tank.
3. Figures 2 and 3 show where a tee would be located if multiple expansion tanks are installed.

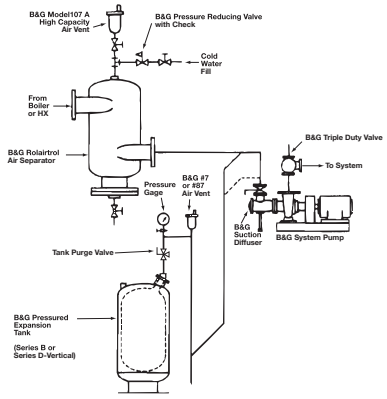

Figure 2 – Vertical Tank Installation with Rolairtrol Air Separator

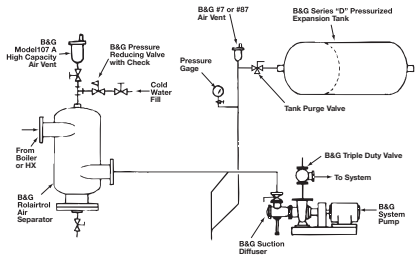

Figure 3 – Horizontal Tank Installation with Rolairtrol Air Separator

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INS70146_100161229_2000007565_Rev G

INSTALLATION INSTRUCTIONS
FOR MOTORIZED 2-WAY ISOLATION VALVES (100266962, 100157681, 100312760, 100312791, & 100280019) FOR MODELS FB/OF 751 - 6001

⚠ WARNING

Electrical Shock Hazard-- For your safety, turn OFF electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

CAUTION

Kits 100266962 and 100157681 are for INDOOR use only.

Kit components

Kit Number	Model Number	Indoor/Outdoor Rating	Part Number	Component Description
100266962	FB 751 - 1251	Indoor Only	100266791	3" Motorized Valve
			100167635	120V 60Hz Relay
			100134850	Self Tapping Screws (6)
			100150117	High Voltage J-Box
			100150118	High Voltage J-Box Cover
			100159617	.25 Female Quick Connect (6)
			100159633	.188 Female Quick Connect (4)
100312760	FB/OF 751 - 1251	NEMA 4 / Outdoor	100312502	3" Motorized Valve
			100167635	120V 60Hz Relay
			100134850	Self Tapping Screws (6)
			100150117	High Voltage J-Box
			100150118	High Voltage J-Box Cover
			100159617	.25 Female Quick Connect (6)
			100159633	.188 Female Quick Connect (4)
100157681	FB 1501 - 4001	Indoor Only	100171685	4" Motorized Valve
			100167635	120V 60Hz Relay
			100134850	Self Tapping Screws (6)
			100150117	High Voltage J-Box
			100150118	High Voltage J-Box Cover
			100159617	.25 Female Quick Connect (6)
			100159633	.188 Female Quick Connect (4)
100312791	FB/OF 1501 - 4001	NEMA 4 / Outdoor	100312501	4" Motorized Valve
			100167635	120V 60Hz Relay
			100134850	Self Tapping Screws (6)
			100150117	High Voltage J-Box
			100150118	High Voltage J-Box Cover
			100159617	.25 Female Quick Connect (6)
			100159633	.188 Female Quick Connect (4)
100280019	FB/OF 5001 - 6001	NEMA 4 / Outdoor	100279351	6" Motorized Valve
			100167635	120V 60Hz Relay
			100134850	Self Tapping Screws (6)
			100150117	High Voltage J-Box
			100150118	High Voltage J-Box Cover
			100159617	.25 Female Quick Connect (6)
			100159633	.188 Female Quick Connect (4)

Installation instructions

1. Install the motorized 2-way valve to the outlet boiler flange as shown in FIG. 1.
2. Install the 120V relay (100167635) onto the Crest jacket below the high voltage junction box as shown in FIG. 1.
3. Install the junction box over the relay (100167635) as shown in FIG. 1.
4. Route the conduit (if required) as shown in FIG. 1.

Figure 1 *Valve Installation - NEMA 4 / Outdoor VSI Valves*

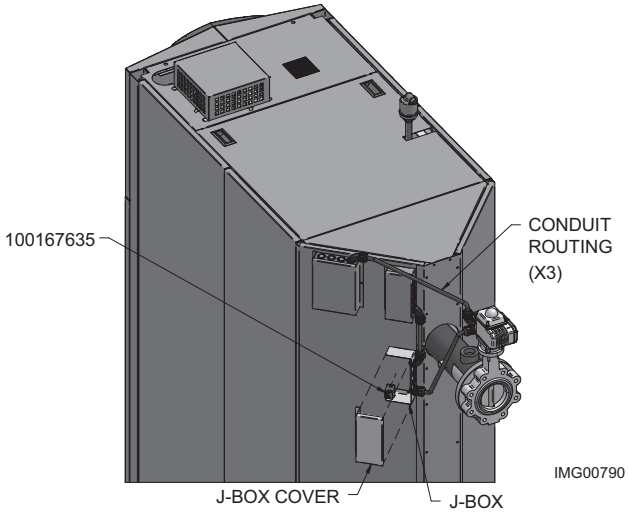
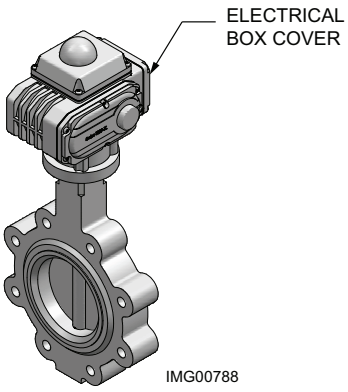


Figure 2 *Motorized 2-Way Valve - NEMA 4 / Outdoor VSI Valves*



Valve technical data

Valve Models: 100266791 and 100171685

Power Supply: 120V
Amp Draw: .24A
Rotation Time: 17 - 20 seconds
Valve Body: Ductile Iron
Max. Close-Off Pressure: 200 PSI
Seal: EPDM
Stem: 416 S.S.
Disc: 304 S.S.

Valve Models: 100279351

Power Supply: 120V
Amp Draw: .57A
Rotation Time: 25 - 30 seconds
Valve Body: Ductile Iron
Max. Close-Off Pressure: 200 PSI
Seal: EPDM
Stem: 416 S.S.
Disc: 304 S.S.

Wiring instructions - NEMA 4 / Outdoor VSI Valves

1. Remove the four (4) screws holding the electrical box cover plate on to the motorized valve actuator.
2. Route wires from Terminals #4 & #5 on the valve to Terminals #9 & #10 (louver proving) on the Crest low voltage connection board (FIG. 3, page 3).
3. Route wire from Terminal #2 (close) on the valve to the Normally Closed (NC) Contact on the relay using a kit-supplied quick connect (100159617). Route second wire from Terminal #3 (open) on the valve to the Normally Open (NO) Contact on the relay using a quick connect (100159617).
4. Route a wire from Terminal #1 (neutral) on the valve through the relay box and into the high voltage connection box. Connect this wire to the neutral (N) contact on the high voltage connection strip “120 V Supply”.
5. Route a wire from the Common (C) Terminal on the relay attaching a kit-supplied quick connect (100159617) to the “L” contact on the high voltage connection strip “120 V Supply”.
6. Route two wires from the relay coil utilizing a kit-supplied quick connect (100159633) to the two “Boiler Pump” contacts on the high voltage connection strip.
7. Replace the cover on the valve electrical box.
8. Put the cover (100150117) on the junction box (100150118) located on the back side of the Crest (FIG. 1).

2-Way Motorized Valve Control

The Boiler Pump control parameters must be set to match the design and operation of the system.

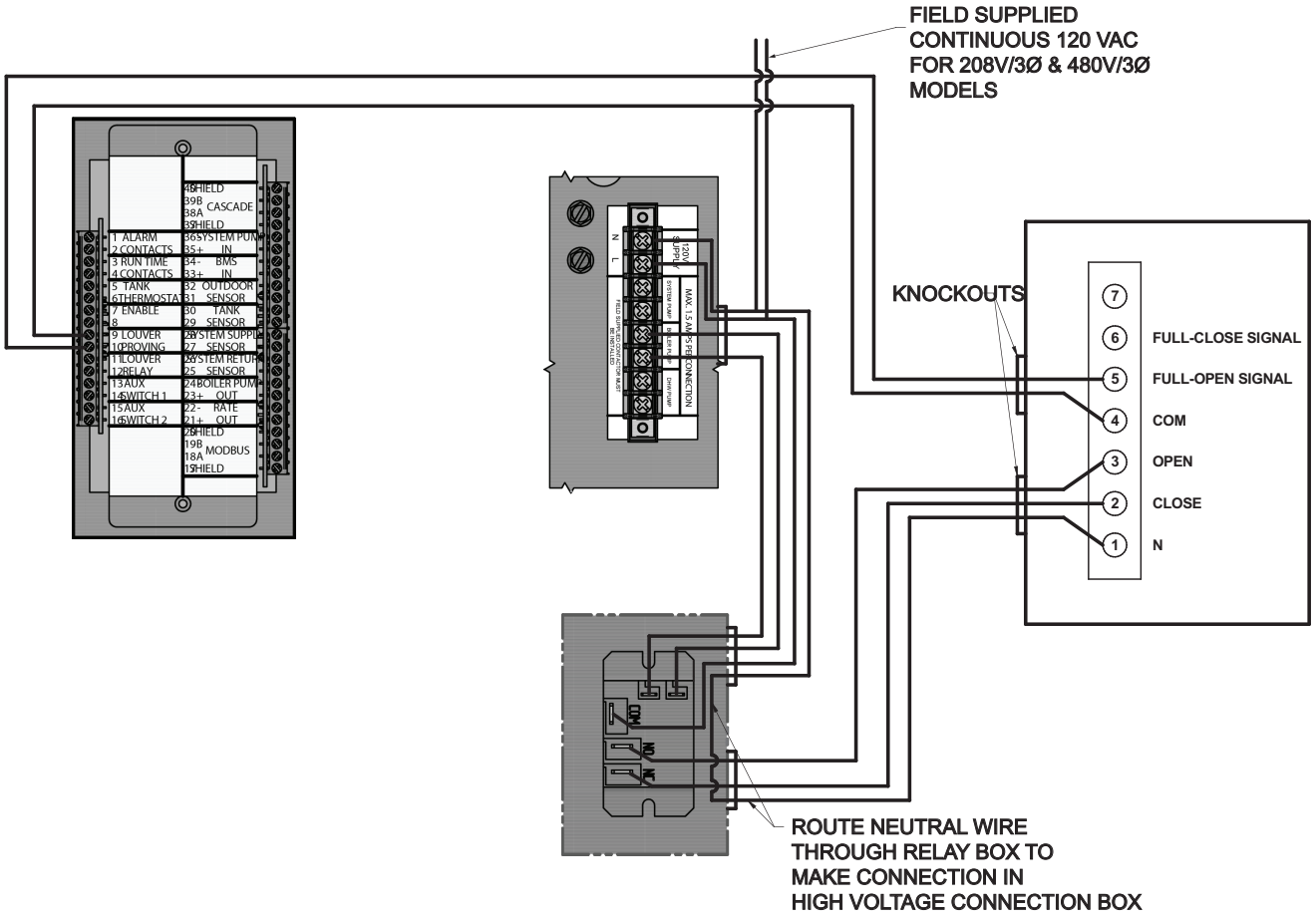
a. Boiler Pump Mode (K3) - must be set to ON with a call for heat to operate the 2-way motorized valves.

b. Boiler Pump Delay (K1) - can be used to keep the 2-way motorized valve open for a fixed period of time after the call for heat ends for a specific boiler. A minimum of 60 seconds is recommended to allow time for heat to be dissipated from the boiler after completing a call for heat.

c. Boiler Pump Anti-Seize Time (K2) - can be used to exercise (open) the 2-way motorized valve for a fixed period of time if it has not operated for 24 hours.

d. Number of Boiler Pumps Always On (J11) used to force a fixed number of isolation valves to always be energized regardless of the number of boilers that are firing. **Note:** The open 2-way motorized valves will rotate with priority of the boilers.

Figure 3 *Wiring Diagram - NEMA 4 / Outdoor VSI Valves*

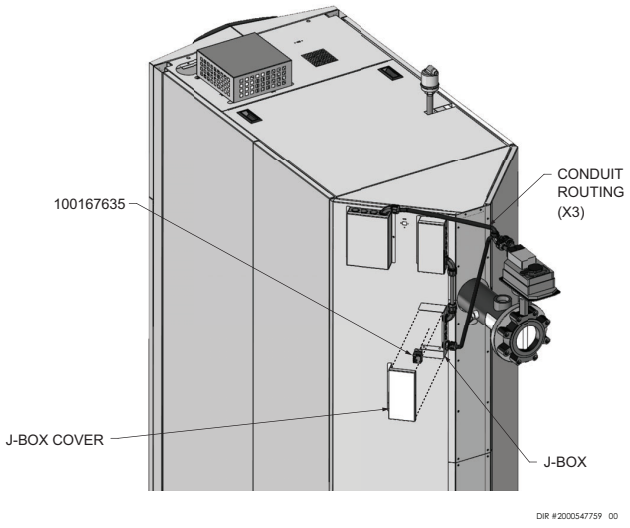


DIR #2000568889_000

Wiring instructions - Indoor Only Belimo Valves

1. Route wires S1 and S3 from end switch to Terminals #9 and #10 (louver proving) on the Crest low voltage connection board (FIG. 6, page 5).
2. Route wire #2 from the actuator on the valve to the Normally Closed (NC) Contact on the relay using a kit-supplied quick connect (100159617). Route wire #3 from the actuator on the valve to the Normally Open (NO) Contact on the relay using a quick connect (100159617).
3. Route wire #1 from the actuator on the valve through the relay box and into the high voltage connection box. Connect this wire to the Neutral (N) Contact on the high voltage connection strip "120V Supply."
4. Route a wire from the Common (C) Terminal on the relay attaching a kit-supplied quick connect (100159617) to the "L" contact on the high voltage connection strip "120V Supply).
5. Route two wires from the relay coil utilizing a kit-supplied quick connect (100159633) to the two "Boiler Pump" contacts on the high voltage connection strip.
6. Ensure the end switch is turned to the position indicated in Figure 7.
7. Put the cover (100150117) on the junction box (100150118) located on the back side of the Crest (FIG. 4).

Figure 4 *Valve Installation - Indoor Only Belimo Valves*



2-Way Motorized Valve Control

The Boiler Pump control parameters must be set to match the design and operation of the system.

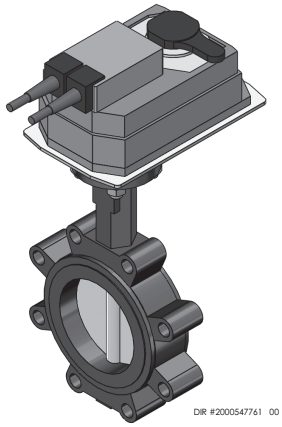
a. Boiler Pump Mode (K3) - must be set to ON with a call for heat to operate the 2-way motorized valves.

b. Boiler Pump Delay (K1) - can be used to keep the 2-way motorized valve open for a fixed period of time after the call for heat ends for a specific boiler. A minimum of 60 seconds is recommended to allow time for heat to be dissipated from the boiler after completing a call for heat.

c. Boiler Pump Anti-Seize Time (K2) - can be used to exercise (open) the 2-way motorized valve for a fixed period of time if it has not operated for 24 hours.

d. Number of Boiler Pumps Always On (J11) used to force a fixed number of isolation valves to always be energized regardless of the number of boilers that are firing. **Note:** The open 2-way motorized valves will rotate with priority of the boilers.

Figure 5 *Motorized 2-Way Valve - Indoor Only Belimo Valves*



Valve technical data

Valve Models: 100266791 and 100171685

Power Supply: 120V
Amp Draw: .05A
Rotation Time: 35 seconds
Valve Body: Ductile Iron
Seal: EPDM
Stem: 416 S.S.
Disc: 304 S.S.

Figure 6 *Wiring Diagram - Indoor Only Belimo Valves*

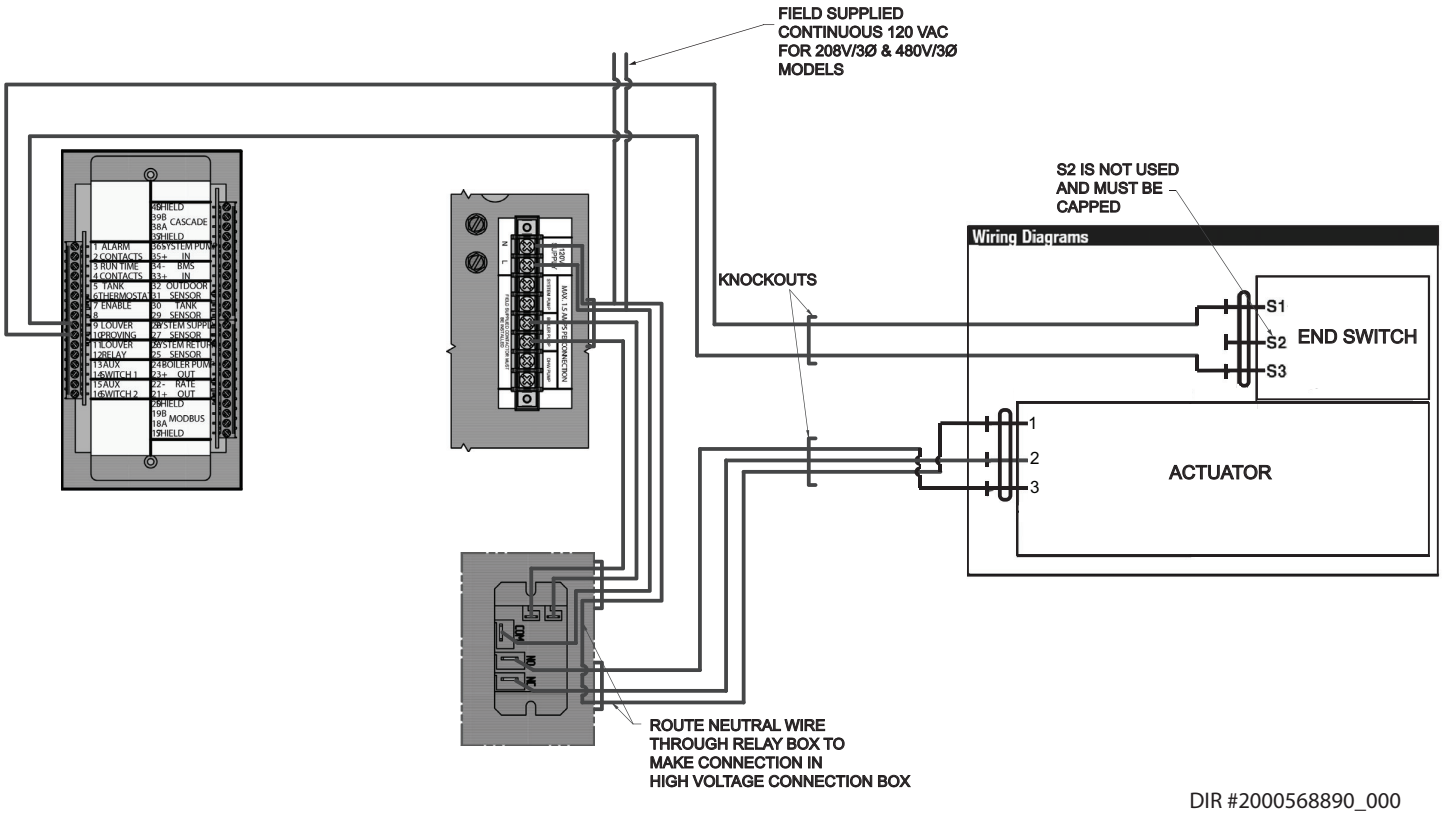
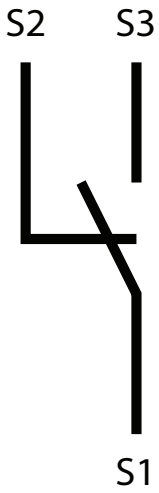


Figure 7 *End Switch Position*



NOTES

NOTES

Revision Notes: *Revision A (ECO C13214) initial release.*

Revision B (C#500001112) reflects the addition of Crest 751+ models and kit 100266962 for 3" isolation valves.

Revision C (PCP# 3000005469 / CN# 500006009) reflects the addition of the FB 6000 model.

Revision D (PCP# 3000009916 / CN# 500009626) reflects the addition of Belimo valves.

Revision E (PCP #3000030252 / CN #500019447) reflects an update to the kit numbers.

Revision F (PCP #3000036719 / CN #500025027) reflects an update to the Belimo wiring diagram.

Revision G (PCP #3000036901 / CN #500025206) reflects the addition of Figure 7.

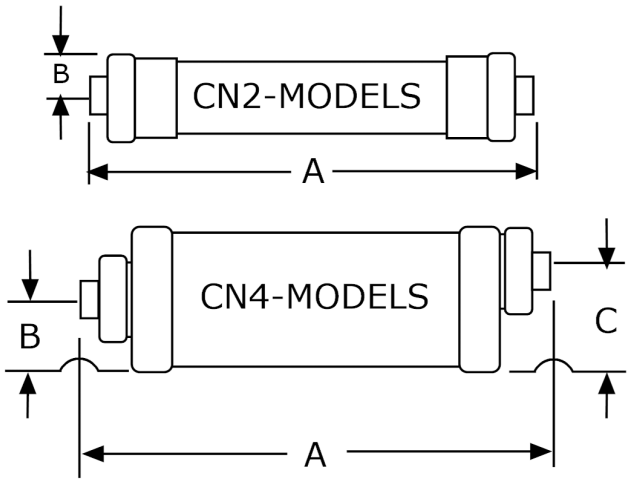
Neutra-Safe®
CONDENSATE NEUTRALIZERS

Neutrasafe Corporation
neutrasafe.com
421 Page Street, Suite 1
Stoughton, MA 02072

Neutra-Safe® Condensate Neutralizer

Tube Style

Installation, Operation and Maintenance Manual



Dimensions In Inches				
Model	**A**	**B**	**C**	**BTU/h**
CN2-220	14-3/4	1-3/8	n/a	220,000
CN2-300	18-3/4	1-3/8	n/a	300,000
CN4-600	12-3/4	2-1/2	3-3/8	600,000
CN4-850	16-3/4	2-1/2	3-3/8	850,000
CN4-1200	18-3/4	2-1/2	3-3/8	1,200,000
CN4-2000	27-3/4	2-1/2	3-3/8	2,000,000

⚠ WARNING ⚠

- Neutra-Safe® condensate neutralizers should only be installed by a qualified professional.
- Read all instructions before installing. Perform steps in the order given. Failure to comply could result in substantial property damage, severe personal injury, or death.
- Do not allow flue gases to vent through condensate neutralizer. All condensate drain lines must have a gas trap before entering the neutralization unit. Failure to comply could result in substantial property damage, severe personal injury or death.
- Neutra-Safe neutralizers should only be connected to a condensate outlet that is installed per the appliance manufacturer's instructions. Failure to comply could result in substantial property damage, severe personal injury, or death.

IMPORTANT

- All piping should be in accordance with relevant building and mechanical codes, as well as any local, state or federal regulations.
- Do not connect more than one appliance to each neutralizer.
- Neutralizer should be installed below all traps and condensate outlets.
- Neutra-Safe condensate neutralizers should always be mounted with a minimum of ¼" pitch downwards towards the outlet. It is also recommended that the installer maintain a pitch of ¼" per foot between the condensate neutralizer outlet and the pump or drain.
- Do not use pipe dope on threaded fittings—use only Teflon tape.
- Neutra-Safe condensate neutralizers may **NOT** be installed in the vertical position.
- It is recommended that the neutralizer be installed before the condensate pump.
- All condensate traps should be primed before commencing operation of the appliance.
- Neutra-Safe condensate neutralizer media should be replaced at least once a year or when pH falls below local regulations.

MOUNTING OPTIONS

- It is recommended that Neutra-Safe condensate neutralizers be installed as close as possible to the outlet of the gas trap.
- Maintain a downwards pitch of ¼" towards the outlet of the neutralizer.
- Care should be taken when selecting mounting hardware. It is recommended that a mounting bracket capable of supporting the weight of a fully charged neutralizer kit be used. This will vary depending on the model.
- Neutra-Safe® condensate neutralizers may be installed on or above the floor so long as a pitch of ¼" per foot is maintained between the neutralizer and the drain or pump.

INSTALLATION

1. Neutra-Safe condensate neutralizers include built-in unions with ½" NPT tappings at either end. Snap in brackets included in CN2-220 and CN2-300 models for mounting neutralizer.
2. If using PVC pipe, apply Teflon tape to the threads of provided PVC socket adaptors and attach to neutralizer. **Do not over tighten.**
3. Identify suitable location for assembled condensate neutralizer. **Observe direction of flow as indicated on neutralizer.**
4. Position and secure the mounting brackets maintaining a pitch downwards of ¼" towards the outlet.
5. Prime and glue PVC pipe to fittings.
   Note: If using flexible tubing, be sure to use hose clamps at barb fittings.
   Note: It is recommended that PVC pipe be used wherever possible as this will reduce any risk of tube kinking. Neutra-Safe® provides two ½" MNPT x ¾" PVC socket adaptors for this purpose
6. Route PVC pipe or tubing to drain or pump, maintaining a pitch of ¼" per foot.
7. Models **CN4-600, CN4-850, CN4-1200 and CN4-2000** should have the **OUTLET** positioned between 9 and 10 o'clock or 2 and 3 o'clock position and an atmospheric vent may be needed after the neutralizer.
8. Fill condensate trap with water until flow is established through neutralizer.
9. Observe neutralizer during boiler operation to ensure unrestricted condensate flow.

MAINTENANCE

1. All service items should be undertaken by a qualified professional.
2. Visually inspect unit for signs of leaking or damage.
3. Neutralizer media should be replaced at least once a year or when pH falls below local regulations. Neutralizer efficiency can only be determined by measuring pH level of condensate outflow.
4. Refer to chart below for appropriate refill kit.

Neutra-Safe® Replacement Media Kits	
Model #	**Recharge Kit #**
CN2-220 models	22RCK-S
CN2-300	30RCK
CN4-600	60RCK
CN4-850	85RCK
CN4-1200	120RCK
CN4-2000	200RCK

NOTE: Be careful not to lose the O-rings at either end of cartridge.

1. Unscrew unions at both ends of neutralizer. If necessary, rotate cartridge to release O-ring.
2. Remove cartridge and dispose of old media. Rinse inside of cartridge. Add replacement media.
3. Check to make sure that O-rings are in place before reinstalling cartridge. **Do not over-tighten.**
4. Prime flue gas trap with a minimum of 1 gallon of water.
5. Observe neutralizer during boiler operation to ensure unrestricted condensate flow.

OPERATION & MAINTENANCE INSTRUCTIONS

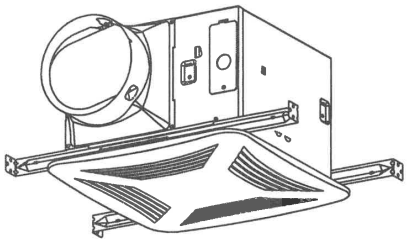
Contractor: **Eastern Mechanical**

Job: **Joel Smilow**

Product: **Exhaust Fans**

T.F. Melia Associates, Inc
9 Progress Drive
Cromwell, CT 06416

VENTILATION FAN



MODEL: PC80XP PC110XP PC150XP

WARNING

TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:

a). Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
b). Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switching on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
c). Installation work and electrical wiring must be done by a qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction codes and standards.
d). Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment to prevent backdrafting. Follow the heating equipment manufacturer's guideline and safety standards such as those published by the National Fire Protection Association (NFPA), and the American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), and the local code authorities.
e). When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.
f). Ducted fans must always be vented to the outdoors.
g). Acceptable for use over a tub or shower when connected to a GFCI (Ground Fault Circuit Interrupter) - protected branch circuit (ceiling installation only).
h). This unit must be grounded.
i). Not for Use in Kitchens.
j). To reduce risk of fire and to properly exhaust air, be sure to duct air outside – Do not vent exhaust air into spaces within walls or ceilings or into attics, crawl spaces, or garages
k). WARNING: To Reduce The Risk Of Fire Or Electric Shock, Do Not Use This Fan With Any Solid-State Speed Control Device.
l). The fan must not be installed in a ceiling thermally insulated to a value greater than R40.

CAUTION

1. For general ventilating use only. Do not use to exhaust hazardous or explosive materials and vapors.
2. This product is designed for installation in ceilings up to a 12/12 pitch (45 degree angle). Duct connector must point up.
3. To avoid motor bearing damage and noisy and/or unbalanced impellers, keep drywall spray, construction dust, etc. off power unit.
4. Please read specification label on product for further information and requirements.

*The manual in electronic format can be download in our company web, or obtained from our dealer.

CLEANING & MAINTENANCE

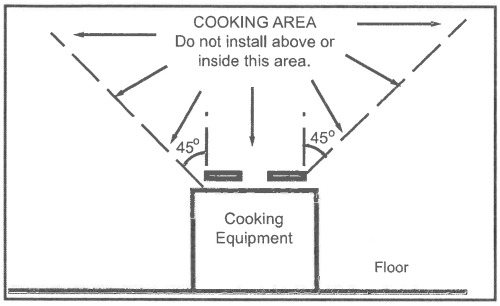
For quiet and efficient operation, long life, and attractive appearance - remove grille and vacuum interior of unit with the dusting brush attachment.
The motor is permanently lubricated and never needs oiling. If the motor bearings are making excessive or unusual noises, replace the motor with the exact service motor. The impeller should also be replaced.

OPERATION

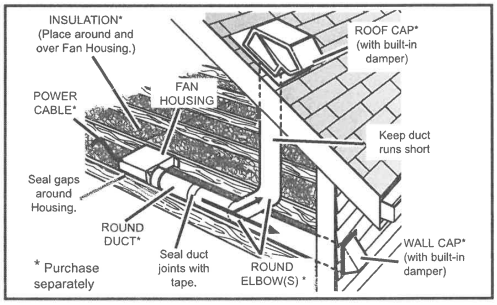
Use an on/off switch to operate this fan. See "Connect Wiring" for details。

PLAN THE INSTALLATION

1. Do not use in a cooking area.

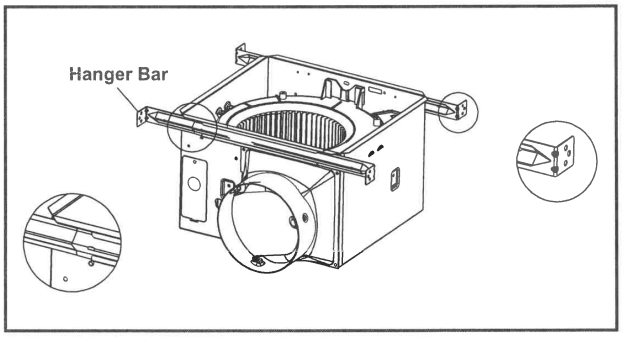


2. Two ways to connect ductwork to a factory-shipped unit.

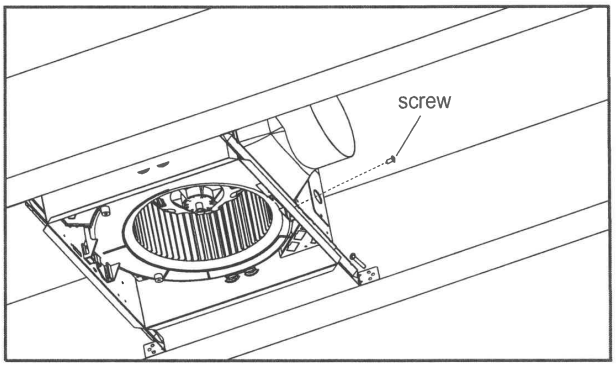


ASSEMBLY INSTRUCTIONS

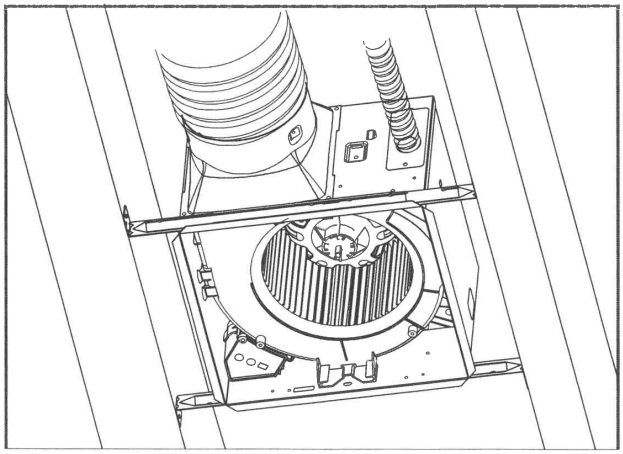
1.Sliding hanger bars have been provided, which allow the housing to be positioned accurately anywhere between the framing. The bars span up to 24 in. and can be used on all types of framing: I-joist, standard joist, and truss construction. Slide hanger bars onto housing and adjust as needed to fit between framing.



2.Extend the hanger bars to the width of the framing. Position the ventilator with the bottom edge of the hanger bar tabs are flush with the bottom edge of the framing, holding the ventilator in place.Secure hanger bars to framing using one screw on each end of hanger bar.Select a proper hole and secure the hanger bars together using one screw.



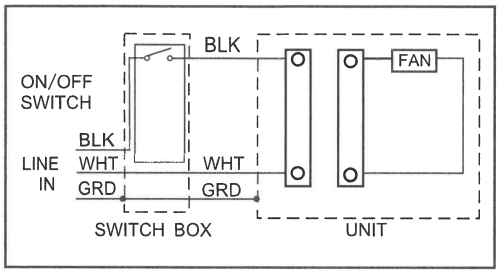
3.INSTALL ROUND DUCTWORK
Connect the round ductwork (not included) to the damper/duct connector,and run the ductwork to a roof or wall cap (not included). Using tape (not included), secure all the ductwork connections so that they are air tight.

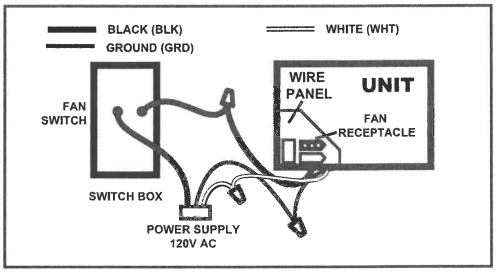


The ducting from this fan to the outside of building has a strong effect on the air flow, noise and energy use of the fan. Use the shortest, straightest duct routing possible for best performance, and avoid installing the fan with smaller ducts than recommended. Insulation around the ducts can reduce energy loss and inhibit mold growth. Fans installed with existing ducts may not achieve their rated air flow.

CONNECT ELECTRICAL WIRING

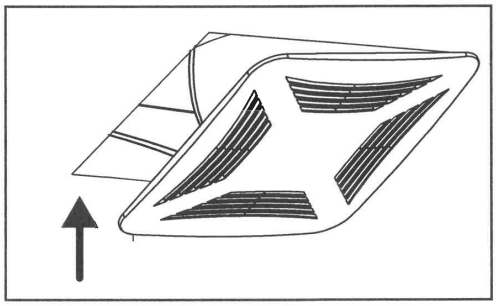
Run 120 V AC house wiring to the location of the fan. Use only UL-approved connectors (not included) to attach the house wiring to the wiring plate. Refer to the wiring diagram, and connect the wires as shown.





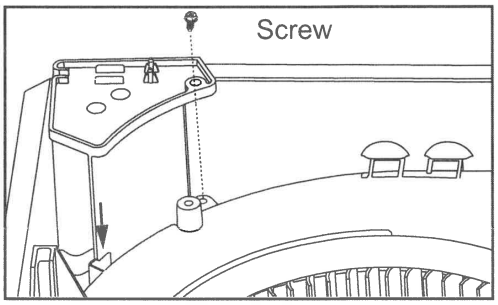
INSTALL GRILLE

Install ceiling material to complete the ceiling construction and cut around the fan housing.
To attach the grille assembly to the fan housing, pinch the grille springs on the sides of the grille assembly and position the grille into the housing with the grille springs in the appropriate slots. Push the grille assembly towards the ceiling to secure.



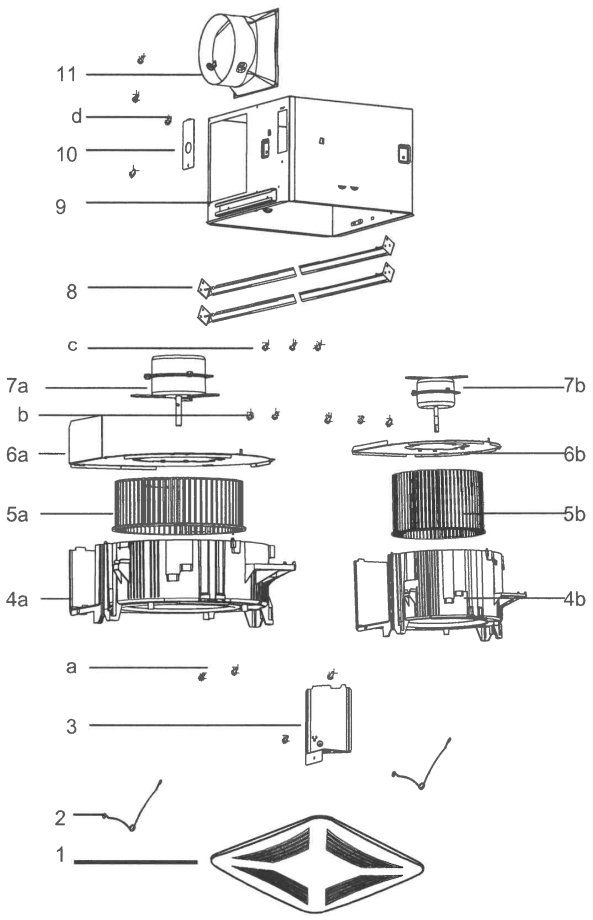
OPTION FUNCTION

If adding a Plug and Play Module (PCHSP – Humidity Sensor/ PCSCP – Speed Control/ PCMHKP – Motion/Humidity Sensor, etc.), align the module as shown in the diagram to the right. Secure the module to the housing with the screw and connect the plug to the corresponding plug on the wire panel at the opposite corner of the fan housing (replace the standard fan grille with a motion sensing/lighted grille and make the additional plug connections as necessary). Refer to the individual module accessory IOMs for more details and wiring instructions



SERVICE PARTS

PART	PART NAME		Qty.
1	Grille Assembly (includes part 2)		1
2	Grille Spring		2
3	Wire Panel / Harness Assemblye		1
4a	Blower	PC80XP	1
5a	Blower Wheel		1
6a	Motor Plate		1
7a	Motor		1
4b	Blower	PC110XP PC150XP	1
5b	Blower Wheel		1
6b	Motor Plate		1
7b	Motor		1
8	Hanger Bar Kit		4
9	Housing		1
10	Wiring plate		1
11	Damper / Duct Connector		1
a	Screw		3
b	Screw		5
c	Screw		3
d	Screw		6



* Blower Assembly includes part 4,5,6,7,b,c,
WARNING: Ensure that the fan is switched off from the supply mains before replacing.

WARRANTY

S&P USA Ventilation Systems, LLC. & S&P Canada Ventilation Products, Inc. warrants to the original end user of its products that our exhaust fans will be free from defects in materials and workmanship for a period of Five (5) years from the date of original purchase. 6 years warranty for motor and 5 years warranty for the remaining fan parts. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF SUITABILITY FOR A PARTICULAR PURPOSE.

During this five year period, S&P will, at its option, repair returned products or parts, or provide replacement products or parts, without charge, for any product or part which is found to be defective under normal use.

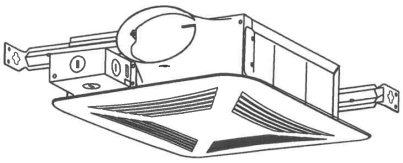
This warranty does not cover normal maintenance and service or any parts that have been subject to misuse, negligence, accident, improper maintenance or repair, faulty installation or installation contrary to recommended installation instructions. S&P's obligation to repair or replace, at S&P's option, shall be the purchaser's sole and exclusive remedy under this warranty. No labor or materials are covered by this warranty. S&P shall not be liable for incidental damages arising out of or in connection with product use or performance.

To make a warranty claim, visit http://www.solerpalau-usa.com/sp-form/claims.html.

S&P USA Ventilation Systems,LLC.
6393 Powers Avenue Jacksonville, FL 32217
P. 904-731-4711

S&P Canada Ventilation Products, Inc.
6710 Maritz Drive Unit #7
Mississauga, ON L5W 0A1 - Canada

VENTILATION FAN



MODEL: PCLP50 PCLP80 PCLP100

WARNING

TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:

a). Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
b). Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switching on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
c). Installation work and electrical wiring must be done by a qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction codes and standards.
d). Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment to prevent backdrafting.Follow the heating equipment manufacturer's guideline and safety standards such as those published by the National Fire Protection Association (NFPA),and the American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), and the local code authorities.
e). When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.
f). Ducted fans must always be vented to the outdoors.
g). Acceptable for use over a tub or shower when connected to a GFCI (Ground Fault Circuit Interrupter) - protected branch circuit (ceiling installation only).
h). This unit must be grounded.
i). Not for Use in Kitchens.
j). To reduce risk of fire and to properly exhaust air, be sure to duct air outside – Do not vent exhaust air into spaces within walls or ceilings or into attics,crawl spaces, or garages.
k). WARNING: To Reduce The Risk Of Fire Or Electric Shock, Do Not Use This Fan With Any Solid-State Speed Control Device.
l). The fan must not be installed in a ceiling thermally insulated to a value greater R40.

CAUTION

1. For general ventilating use only. Do not use to exhaust hazardous or explosive materials and vapors.
2. This product is designed for installation in ceilings up to a 12/12 pitch (45 degree angle). Duct connector must point up.
3. To avoid motor bearing damage and noisy and/or unbalanced impellers, keep drywall spray, construction dust, etc. off power unit.
4. Please read specification label on product for further information and requirements.

CLEANING & MAINTENANCE

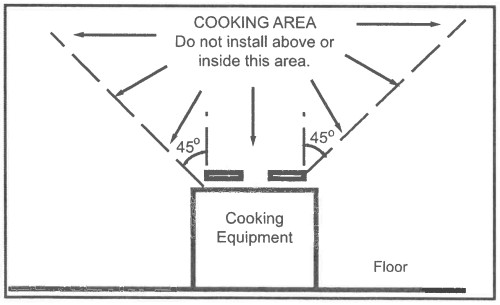
For quiet and efficient operation, long life, and attractive appearance - lower or remove grille and vacuum interior of unit with the dust brush attachment.
The motor is permanently lubricated and never needs oiling. If the motor bearings are making excessive or unusual noises, replace the motor with the exact service motor. The impeller should also be replaced.

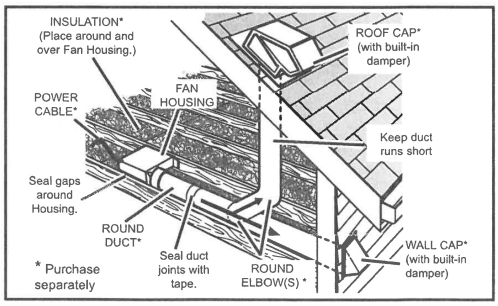
OPERATION

Use an on/off switch to operate this fan. See "Connect Wiring" for details.

PLAN THE INSTALLATION

1. Do not use in a cooking area.
2. Two ways to connect ductwork to a factory-shipped unit.



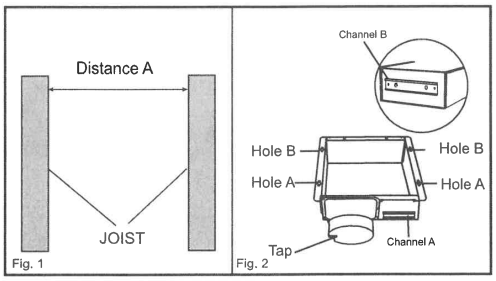


ASSEMBLY INSTRUCTIONS

1. Before installation, you need to know:

Screw A		ST4.2*13mm
Screw B		ST4.2*25mm
Hanger bar (short)		7 1/2 in (190mm)
Hanger bar (long)		13 3/8 in (340mm)

Note: Hanger bar (short) only can slide into channel A.



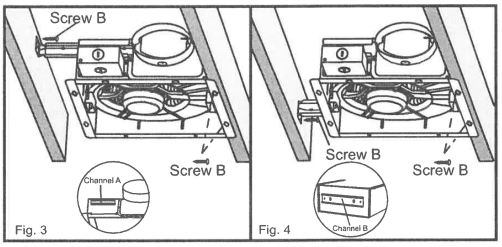
a. Mount with mounting holes and hanger bar(Ⅰ)

Slide one hanger bar into the channel on the housing and adjust as needed to fit between framing. Hold housing in place so that the housing contacts the bottom of the joist, Screw housing to joist through the hole A and hole B. Screw the hanger bar onto the other side of joist through the hole (refer to the right diagram).

Screw hanger bar to housing with screw A.

The choice of Hanger Bar

Distance A	Hanger Bar	Channel
13 3/4 in to 15 15/16 in (350mm-405mm)	Hanger bar (short)	Channel A (Fig. 3)
19 11/16 in to 21 7/8 in (500mm-555mm)	Hanger bar (long)	Channel A (Fig. 3)
13 3/8 in to 19 11/16 in (340mm-500mm)	Hanger bar (long)	Channel B (Fig. 4)



b. Mount with mounting holes and hanger bar(Ⅱ)

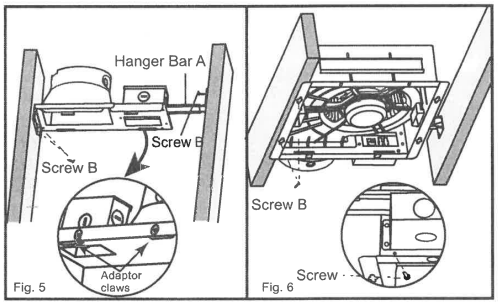
Disconnect plug connector from receptacle and remove adaptor from housing before starting installation. Slide one hanger bar into the channel A on the housing and adjust as needed to fit between framing.Insert the housing into joists make sure that adaptor claws are properly inserted into housing slots. Secure the housing to adaptor by using screw .

Screw housing to joist through the hole A and hole B

Screw hanger bar to housing with screw A.

The choice of Hanger Bar

Distance A	Hanger Bar A
13 3/4 in to 15 15/16 in (350mm-405mm)	Hanger bar (short)
19 11/16 in to 21 7/8 in (500mm-555mm)	Hanger bar (long)



c. Mount with hanger bars only

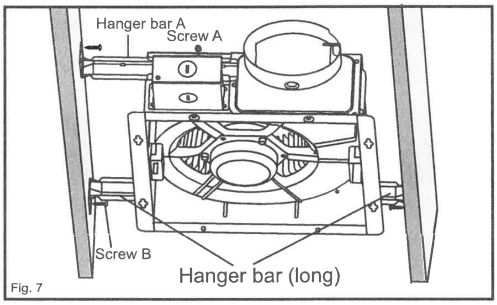
Slide hanger bars onto housing and adjust as needed to fit between framing. Extend the hanger bars to the width of the framing. Position the ventilator with the housing tabs wrapped around the bottom edge of the framing, holding the ventilator in place.

Secure hanger bars to framing using one screw on each end of hanger bar (refer to the right diagram).

Screw hanger bar to housing with screw A.

The choice of Hanger Bar A

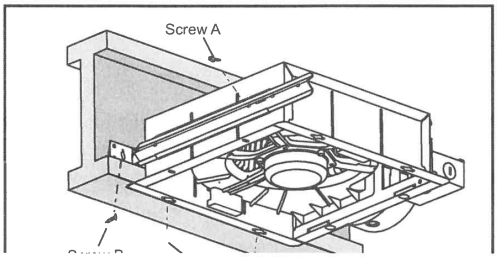
Distance A	Hanger Bar A
14 in to 23 1/2 in (356mm-597mm)	Hanger bar (short)
19 11/16 in to 23 1/2 in (500mm-597mm)	Hanger bar (long)



d. Mount to I-joist

Slide one hanger bar (long) into channel B on the housing and adjust as needed to fit between framing. Hold housing in place so that the housing contacts the bottom of the joist. Screw housing to joist through the hole A and hole B. Screw the hanger bar onto the other side of joist through the hole (refer to the right diagram).

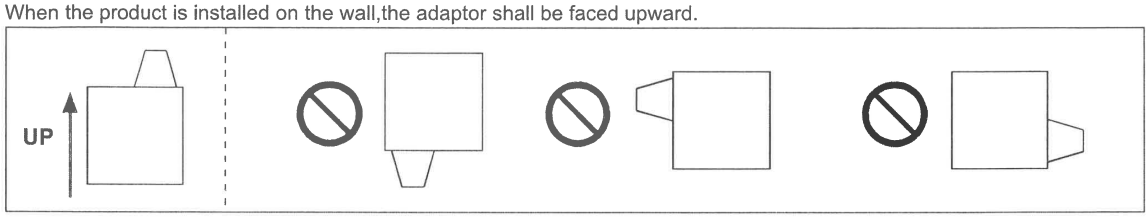
Screw hanger bar to housing with screw A.



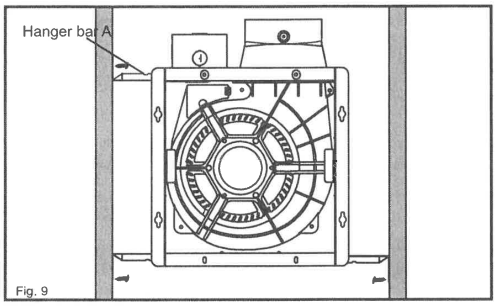
ASSEMBLY INSTRUCTIONS

e. Wall installation with hanger bars only

When the product is installed on the wall,the adaptor shall be faced upward.



Slide hanger bars onto housing and adjust as needed to fit between framing. Extend the hanger bars to the width of the framing. Holding the ventilator in place.Secure hanger bars to framing using one screw on each end of hanger bar (refer to the right diagram).
Screw hanger bar to housing with screw A.
Note: Ensure the tap (Fig.2) in vertical position before installation.



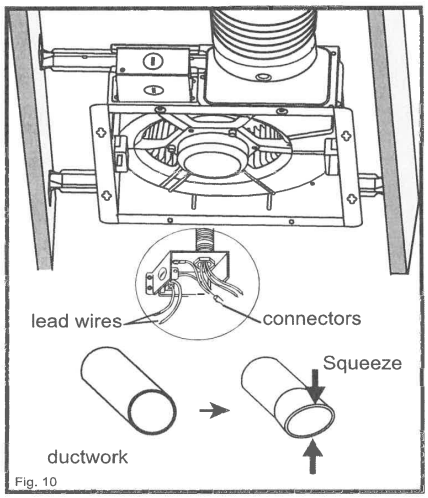
The choice of Hanger Bar A

Distance A	Hanger Bar A
14 in to 23 1/2 in (356mm-597mm)	Hanger bar (short)
19 11/16 in to 23 1/2 in (500mm-597mm)	Hanger bar (long)

2. Install ductwork and junction box

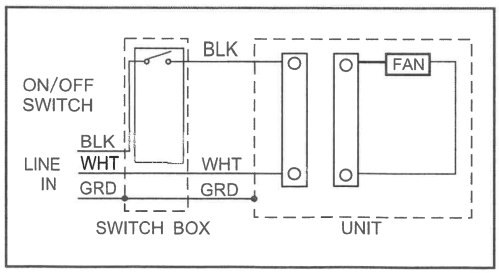
Remove junction box cover and secure conduit or stress relief to junction box knock-out hole.Using connectors ,connect house power wires to ventilating fan wires (refer to wiring diagram) replace the junction box cover. Squeeze the ductwork to fit the adaptor then slip onto the adapter and secure it with duct tape (not included) ,secure all the ductwork connections so that they are air tight.

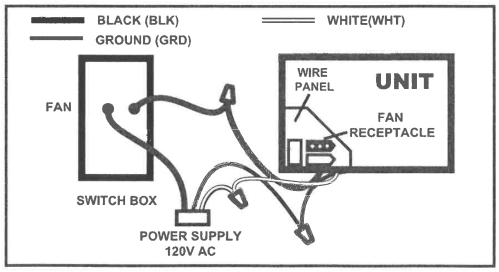
The ducting from this fan to the outside of building has a strong effect on the air flow, noise and energy use of the fan. Use the shortest, straightest duct routing possible for best performance, and avoid installing the fan with smaller ducts than recommended. Insulation around the ducts can reduce energy loss and inhibit mold growth. Fans installed with existing ducts may not achieve their rated air flow.



CONNECT ELECTRICAL WIRING

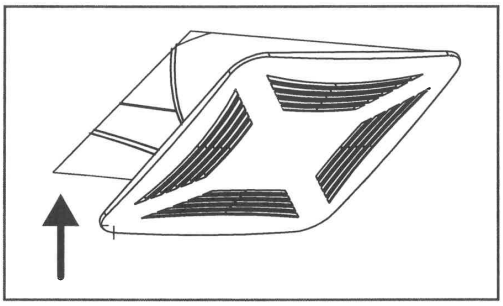
Run 120V AC house wiring to the location of the fan. Use only UL-approved connectors (not included) to attach the house wiring to the wiring plate. Refer to the wiring diagram, and connect the wires as shown.





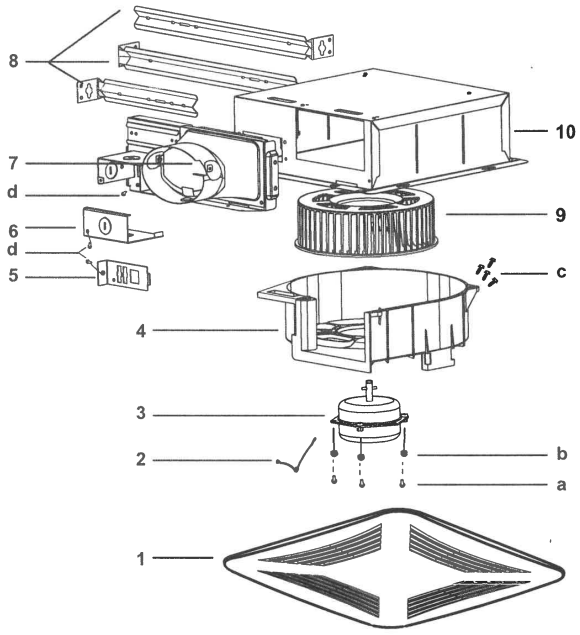
INSTALL GRILLE

Install ceiling material to complete the ceiling construction. Then, cut around the fan housing.
To attach the grille assembly to the fan housing, pinch the grille springs on the sides of the grille assembly, and position the grille into the housing with the grille springs in the appropriate slots. Push the grille assembly towards the ceiling to secure.



SERVICE PARTS

PART	PART NAME	Qty.
1	Grille Assembly (includes part 2)	1
2	Grille Spring	2
3	Motor	1
4	Blower	1
5	Wire Panel / Harness Assembly	1
6	Junction box cover	1
7	Adaptor	1
8	Hanger Bar Kit	4
9	Blower Wheel	1
10	Housing	1
a	Screw	3
b	Nut, Hex Lock	3
c	Screw	4
d	Screw	3



* Blower Assembly includes part 4, 3, 9, a, b, c.

WARNING: Before replacing, be sure to turn off power at power source.

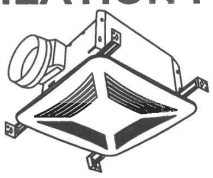
WARRANTY

S&P USA Ventilation Systems, LLC. & S&P Canada Ventilation Products, Inc. warrants to the original end user of its products that our exhaust fans will be free from defects in materials and workmanship for a period of Five (5) years from the date of original purchase. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF SUITABILITY FOR A PARTICULAR PURPOSE.
During this five year period, S&P will, at its option, repair returned products or parts, or provide replacement products or parts, without charge, for any product or part which is found to be defective under normal use.
This warranty does not cover normal maintenance and service or any parts that have been subject to misuse, negligence, accident, improper maintenance or repair, faulty installation or installation contrary to recommended installation instructions. S&P's obligation to repair or replace, at S&P's option, shall be the purchaser's sole and exclusive remedy under this warranty. No labor or materials are covered by this warranty. S&P shall not be liable for incidental damages arising out of or in connection with product use or performance.
This warranty gives you specific legal rights. You may also have other rights which vary from state to state.
To qualify for warranty service, you must notify S&P at the address or telephone number stated below, provide the model number and part identification, and describe the nature of any defect in product or part. You may be required to ship a defective part to S&P. There will be no charge for shipping repaired or replacement parts from S&P to you if your address is in the United States or Canada. At the time of requesting warranty service, you must present evidence of the original purchase date.

S&P USA Ventilation Systems,LLC.
6393 Powers Avenue Jacksonville, FL 32217
P. 904-731-4711
F. 904-731-8322
www.spvg-northamerica.com

S&P Canada Ventilation Products, Inc.
5600 Ambler Drive Mississauga, ON L4W 2K9
P. 866-733-0233
F. 866-358-5346
www.solerpalaucanada.com

VENTILATION FAN



Model: PCD110X PCD110XH

WARNING

WARNING -TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:

a). Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer
b). Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switching on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
c). Installation work and electrical wiring must be done by a qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction codes and standards.
d). Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment to prevent backdrafting. Follow the heating equipment manufacturer's guideline and safety standards such as those published by the National Fire Protection Association (NFPA), and the American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), and the local code authorities.
e). When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.
f). Ducted fans must always be vented to the outdoors.
g). Acceptable for use over a tub or shower when connected to a GFCI (Ground Fault Circuit Interrupter) - protected branch circuit (ceiling installation only).
h). This unit must be grounded.
i). Not for Use in Kitchens.
j). To reduce risk of fire and to properly exhaust air, be sure to duct air outside – Do not vent exhaust air into spaces within walls or ceilings or into attics, crawl spaces, or garages
k). WARNING: To Reduce The Risk Of Fire Or Electric Shock, Do Not Use This Fan With Any Solid-State Speed Control Device.
l). The fan must not be installed in a ceiling thermally insulated to a value greater R40.

CAUTION

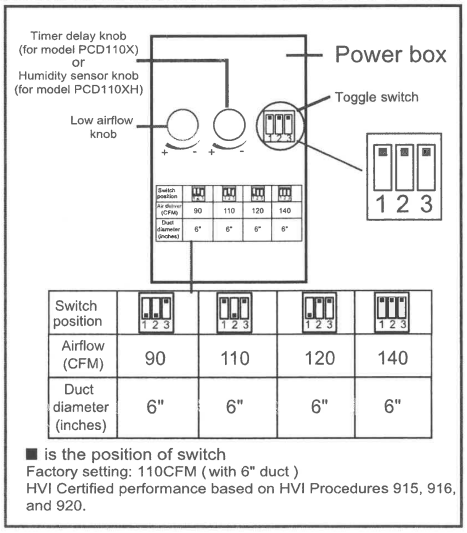
1. For general ventilating use only. Do not use to exhaust hazardous or explosive materials and vapors.
2. This product is designed for installation in ceilings up to a 12/12 pitch (45 degree angle). Duct connector must point up.
3. To avoid motor bearing damage and noisy and/or unbalanced impellers, keep drywall spray, construction dust, etc. off power unit.
4. Please read specification label on product for further information and requirements.
   *The manual in electronic format can be download in our company web, or obtained from our dealer.

CLEANING & MAINTENANCE

For quiet and efficient operation, long life, and attractive appearance - lower or remove grille and vacuum interior of unit with the dusting brush attachment.
The motor is permanently lubricated and never needs oiling. If the motor bearings are making excessive or unusual noises, replace the motor with the exact service motor. The impeller should also be replaced.

OPERATION

The control box, located inside the fan housing, has three separate adjustments:
(1) The low airflow knob adjusts the lower airflow from 40CFM up to the air flow rate of the high fan speed determined by the toggle switch setting.
(2) (a)The time delay knob is adjustable from 3 to 30 minutes and will switch the fan to the low speed setting after the set period of time(for model PCD110X).
(b)The humidity sensor knob set user-adjustable setpoint(for model PCD110H).
(3) The toggle switch will adjust the upper fan speed setting from 90 to 140 CFM .



Switch position	1 2 3	1 2 3	1 2 3	1 2 3
Airflow (CFM)	90	110	120	140
Duct diameter (inches)	6"	6"	6"	6"

■ is the position of switch
Factory setting: 110CFM (with 6" duct)
HVI Certified performance based on HVI Procedures 915, 916, and 920.

For model PCD110X
To Turn Fan ON
Turn the switch I ON.(according to the following "CONNECT ELECTRICAL WIRING")
• Fan will run at the certified airflow rate if the switch II is ON.
• Fan will run at the user-adjustable airflow rate if the switch II is OFF.
To Use Fan Time Delay Airflow Rate Change
1. Turn the switch I ON.
2. Turn the switch II ON - fan will run at the certified airflow rate.
3. When the switch II is turned OFF, fan will continue to run at the certified airflow rate until the user-adjustable time delay has elapsed, and then will automatically change to the user-adjustable airflow rate.
To Turn Fan OFF
Turn the switch I OFF
For model PCD110XH
1) Fan run continuously at a low speed(adjustable by low airflow knob) and automatically boost up to high speed when either of these conditions is detected: a)Humidity above a user-adjustable setpoint (50%-100% relative humidity). b) rapid to moderate (user-adjustable) increases in humidity .After delay timer (20 minutes) returns fan to the default low speed.Humidity sensor description accroding to "HUMIDITY SENSOR OPERATION" and"SENSITIVITY ADJUSTMENT".
2) When the switch is turned on, the fan will run at high speed. When the switch is turned OFF, fan will continue to run at the certified airflow rate until the delay timer (20 minutes) has elapsed,and then will automatically change to the user-adjustable airflow rate.

OPERATION

HUMIDITY SENSOR OPERATION

The humidity-sensing fan uses a sophisticated humidity sensor that responds to: (a) rapid to moderate (user-adjustable) increases in humidity or (b) humidity above a user-adjustable set-point (50%-100% relative humidity). Fan run continuously at a pre-set lower level (set by Humidity sensor knob) and automatically boost up to certified airflow rate when environmental conditions change). If the fan continuously responds to changing environmental conditions, "H" (means "humidity") adjustment may be required. This figure is factory-set for about 75% (Ambient temperature of 25℃).

SENSITIVITY ADJUSTMENT

The "H" has been factory set for most shower applications. However, if the fan is in a tub area or is being used for dampness control, the "H" may need to be increased toward maximum "+". If the control is responding too often to changing environmental conditions, movement toward less "-" "H" may be required.

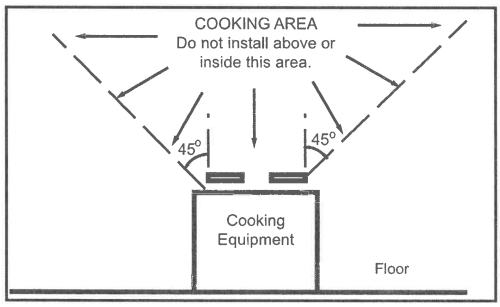
To adjust the "H":

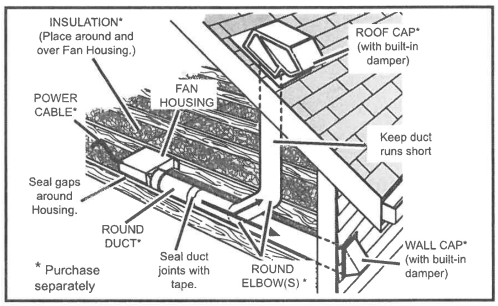
1. Disconnect power at service entrance.
2. Through the grille, locate the slot marked "H".
3. Carefully rotate the "H" adjustment toward "+" or "-".
4. Turn on power and check operation by turning on the shower or other humidity source until the fan turns on.
5. Repeat above steps if necessary.

When the temperature changes, humidity sensor values will have deviation.

PLAN THE INSTALLATION

1. Do not use in a cooking area.
2. Two ways to connect ductwork to a factory-shipped unit.





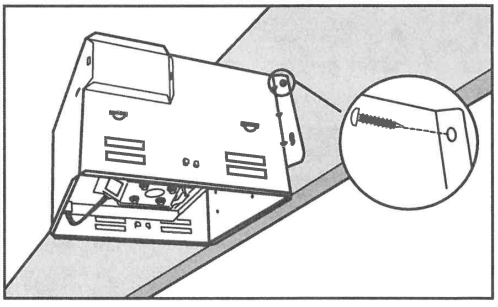
TYPES OF TYPICAL INSTALLATIONS

1. Housing mounted to I-joists (Start at "ASSEMBLY INSTRUCTIONS 1")
2. Housing mounted to joists (Start at "ASSEMBLY INSTRUCTIONS 1")
3. Housing mounted to truss (Start at step "ASSEMBLY INSTRUCTIONS 2")

ASSEMBLY INSTRUCTIONS

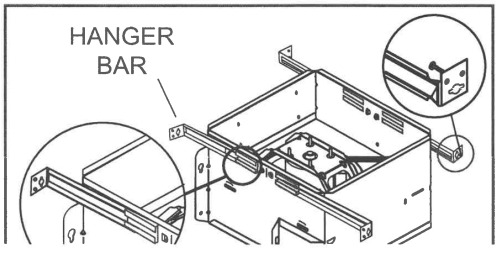
1. MOUNT HOUSING TO JOIST OR I-JOIST.

   Hold the housing so that it is in contact with the bottom of the joist. Attach the housing with four (4) screws to the joist through the holes in each mounting flange.



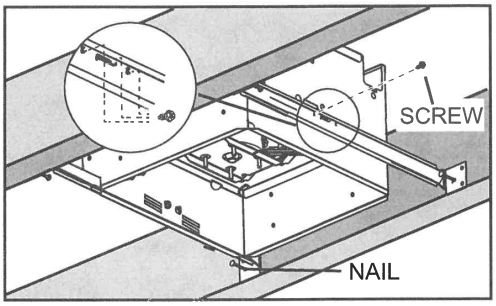
2. MOUNT WITH HANGER BARS

   2a. Sliding hanger bars have been provided, which allow the housing to be positioned accurately anywhere between the framing. The bars span up to 24 in. and can be used on all types of framing: I-joist, standard joist, and truss construction. Slide hanger bars onto housing and adjust as needed to fit between framing.



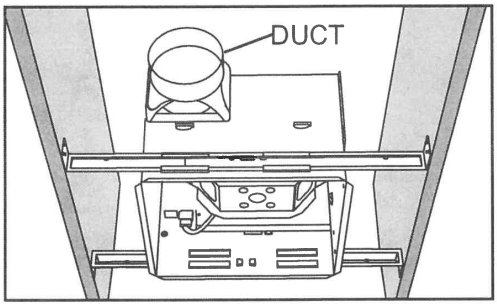
ASSEMBLY INSTRUCTIONS

2b. Extend the hanger bars to the width of the framing. Position the ventilator with the hanger bar tabs wrapped around the bottom edge of the framing, holding the ventilator in place.
Secure hanger bars to framing using one screw on each end of hanger bar. Select a proper hole and secure the hanger bars together using flange screws.



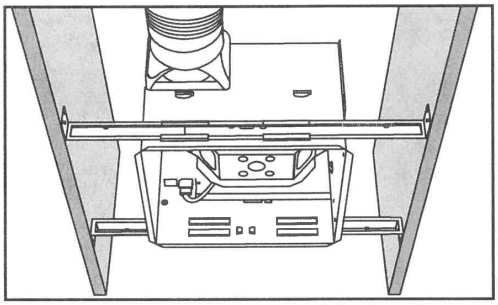
3. ATTACH DAMPER/DUCT CONNECTOR
Snap the damper/duct connector onto the fan housing. The connector must be flush with the top of the housing, and the damper flap should fall closed.

Insulated flexible duct is recommended for the quietest possible installation. If rigid duct is used, a short (1-3 feet) section of insulated flexible duct will ensure quiet operation



4. INSTALL ROUND DUCTWORK
Connect the round ductwork (not included) to the damper/duct connector, and run the ductwork to a roof or wall cap (not included). Using tape (not included), secure all the ductwork connections so that they are air tight.

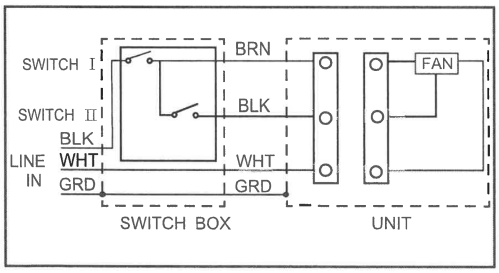
The ducting from this fan to the outside of building has a strong effect on the air flow, noise and energy use of the fan. Use the shortest, straightest duct routing possible for best performance, and avoid installing the fan with smaller ducts than recommended. Insulation around the ducts can reduce energy loss and inhibit mold growth. Fans installed with existing ducts may not achieve their rated air flow.

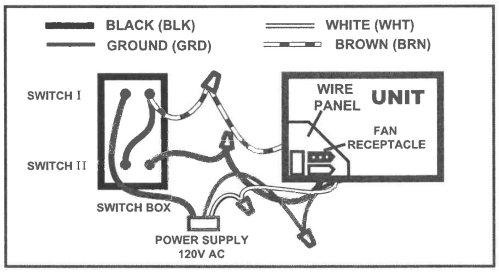


CONNECT ELECTRICAL WIRING

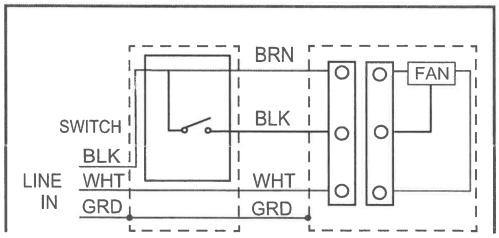
Run 120 V AC house wiring to the location of the fan. Use only UL-approved connectors (not included) to attach the house wiring to the wiring plate. Refer to the wiring diagram, and connect the wires as shown.

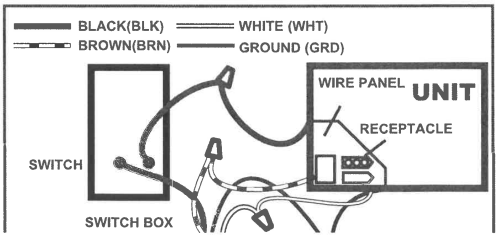
For model PCD110X





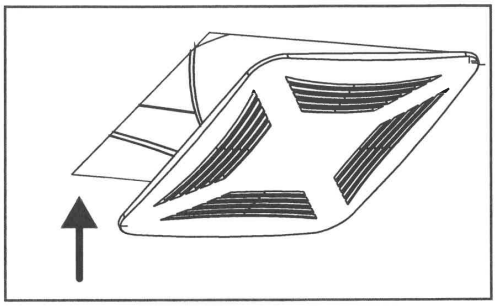
For model PCD110XH





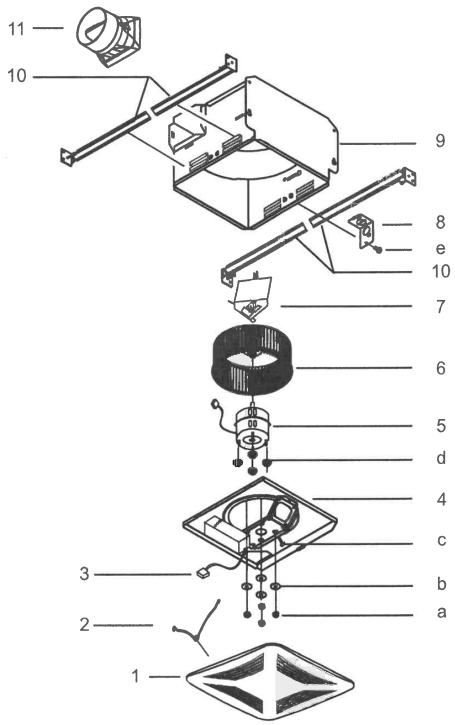
INSTALL GRILLE

Install ceiling material to complete the ceiling construction. Then, cut around the fan housing.
To attach the grille assembly to the fan housing, pinch the grille springs on the sides of the grille assembly, and position the grille into the housing with the grille springs in the appropriate slots. Push the grille assembly towards the ceiling to secure.



SERVICE PARTS

PART	PART NAME	Qty.
1	Grille Assembly (includes part 2)	1
2	Grille Spring	2
3	Power Box	1
4	Motor Plate	1
5	Motor	1
6	Blower Wheel	1
7	Wire Panel / Harness Assembly	1
8	Wiring plate	1
9	Housing	1
10	Hanger Bar Kit	4
11	Damper / Duct Connector	1
a	Nut, Hex Lock	4
b	Washer	4
c	Screw	1
d	Isolator	4
e	Screw	1



* Blower Assembly includes part 6, 5, d, 4, c, b, a.
Replacement installation:
Remove the screw (part c), then take out the motor plate (part 4) from the housing (part 9) by pushing down the rib in the plate while pulling out on the side of the housing. Replace the broken parts.
WARNING: Before replacing, be sure to turn off power at power source.

WARRANTY

S&P USA Ventilation Systems, LLC. & S&P Canada Ventilation Products, Inc. warrants to the original end user of its products that our exhaust fans will be free from defects in materials and workmanship for a period of Five (5) years from the date of original purchase. 6 years warranty for motor and 5 years warranty for the remaining fan parts. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF SUITABILITY FOR A PARTICULAR PURPOSE.
During this five year period, S&P will, at its option, repair returned products or parts, or provide replacement products or parts, without charge, for any product or part which is found to be defective under normal use.
This warranty does not cover normal maintenance and service or any parts that have been subject to misuse, negligence, accident, improper maintenance or repair, faulty installation or installation contrary to recommended installation instructions. S&P's obligation to repair or replace, at S&P's option, shall be the purchaser's sole and exclusive remedy under this warranty. No labor or materials are covered by this warranty. S&P shall not be liable for incidental damages arising out of or in connection with product use or performance.
This warranty gives you specific legal rights. You may also have other rights which vary from state to state.
To qualify for warranty service, you must notify S&P at the address or telephone number stated below, provide the model number and part identification, and describe the nature of any defect in product or part. You may be required to ship a defective part to S&P. There will be no charge for shipping repaired or replacement parts from S&P to you if your address is in the United States or Canada. At the time of requesting warranty service, you must present evidence of the original purchase date.

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