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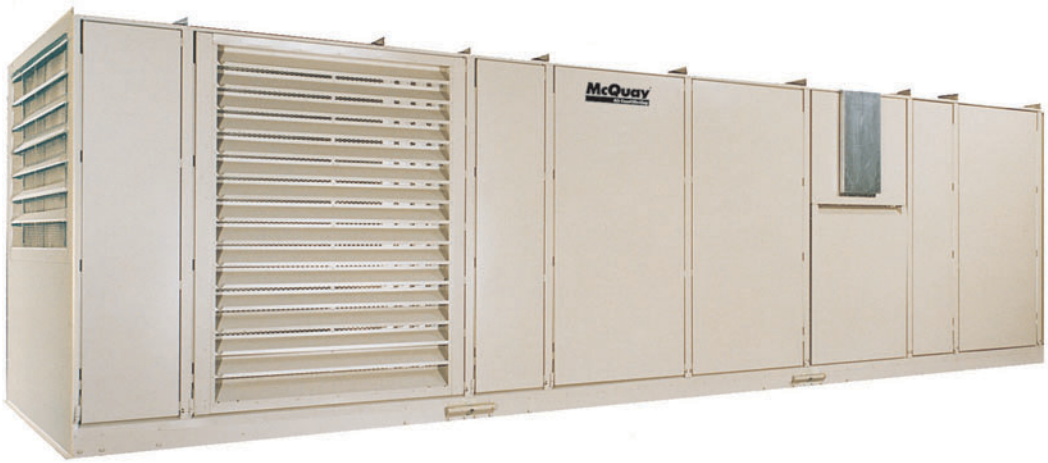
Find the *Daikin / McQuay 658160B-05* at our website: *Click HERE*

Installation and Maintenance Manual	IM 487-4
	Group: **Applied Systems**
	Part Number: IM 487
	Date: December 2004

RoofPak™ Applied Rooftop Systems
Air Handler

RAH 047C–077C
12000 to 50000 cfm

RDS 800C–802C
4000 to 20000 cfm



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Introduction

This manual provides general information about the "C" vintage McQuay RoofPak applied rooftop unit, models RDS and RAH. 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. For further information on the optional forced draft gas-fired furnace, refer to Bulletin No. IM 684 or IM 685.

The MicroTech II applied rooftop unit controller is available on "C" vintage applied rooftop units. For a detailed description of the MicroTech II components, input/output configurations, field wiring options and requirements, service procedures, see IM 696-3. For operation and information on using and programming the MicroTech II 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 rooftop unit operation literature

Rooftop unit control configuration	Operation manual bulletin number
VFDs	Vendor IM manuals
Discharge Air Control (VAV or CAV)	OM 137-2
Space Comfort Control (CAV-Zone temperature control)	OM 138-2

Gas Burner Nameplate

On units that include gas heat, the nameplate is located on the lower right corner on the main control box door. It includes the burner model number, minimum/maximum input, maximum temperature rise, and minimum cfm.

Hazard Identification Information

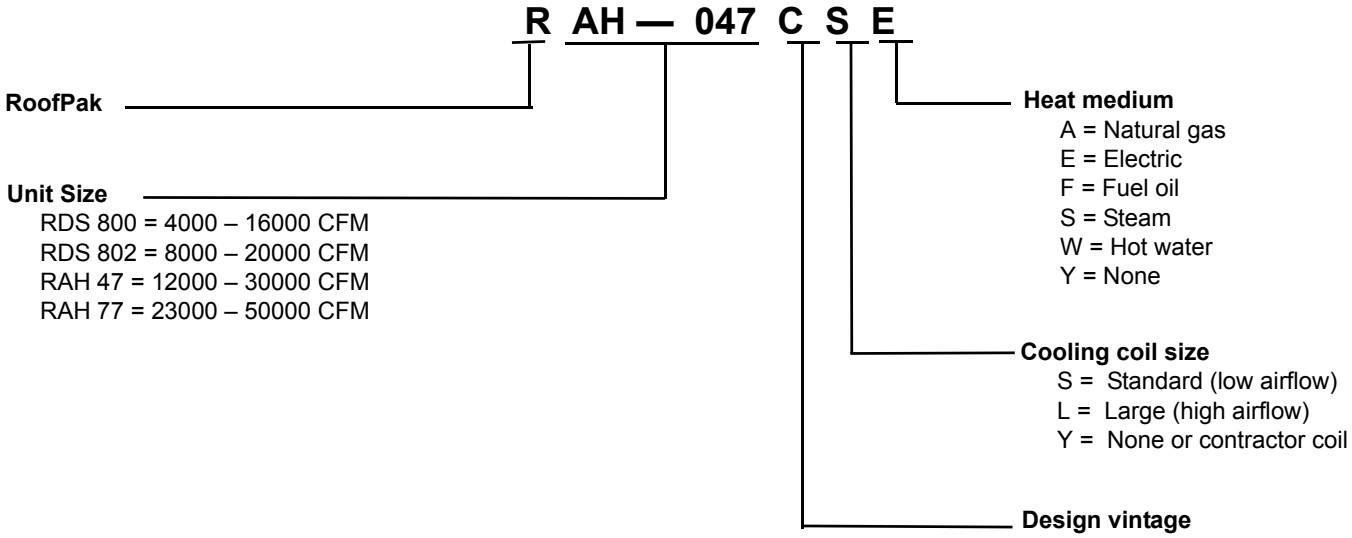
⚠ WARNING

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.

Figure 1. Nomenclature

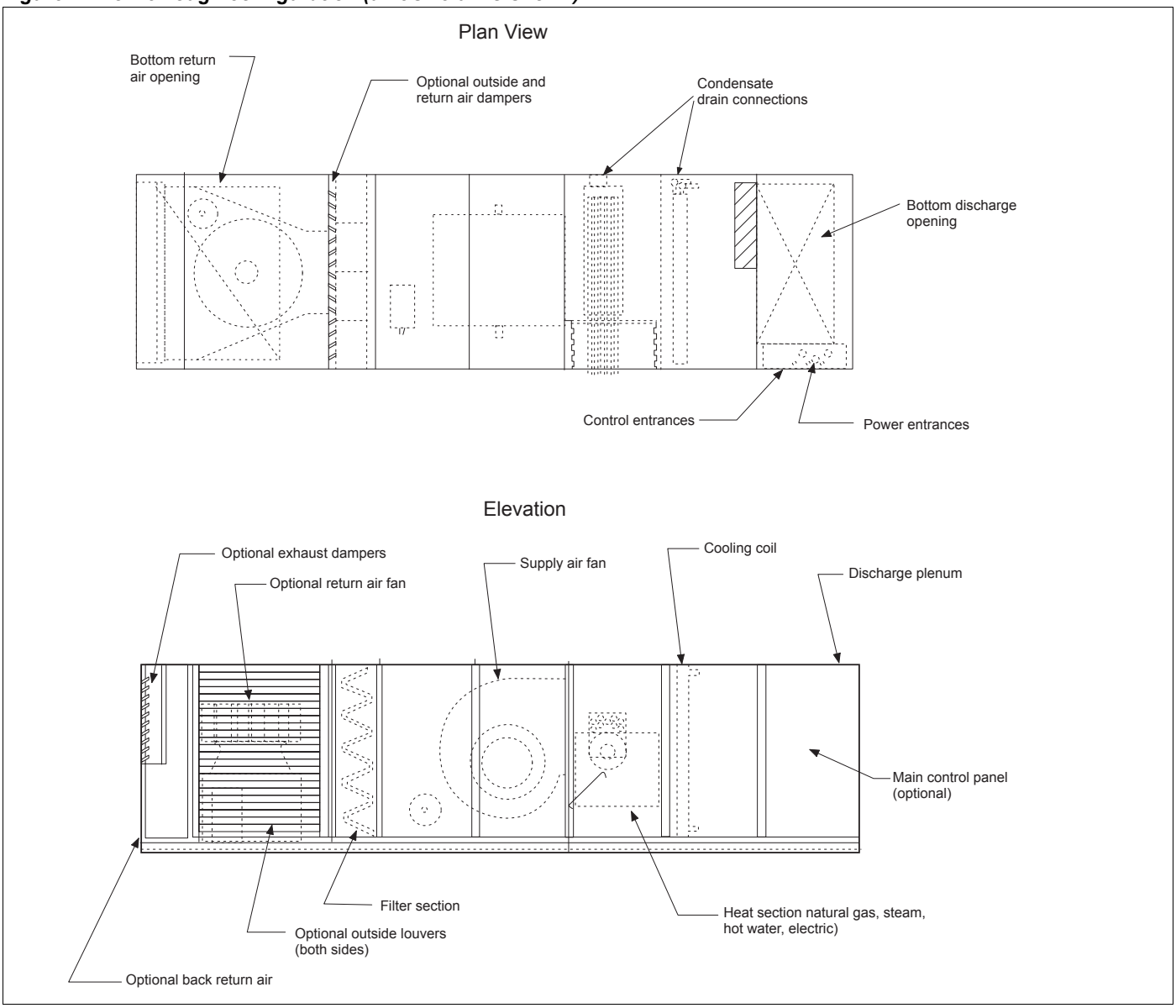


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Typical Component Locations

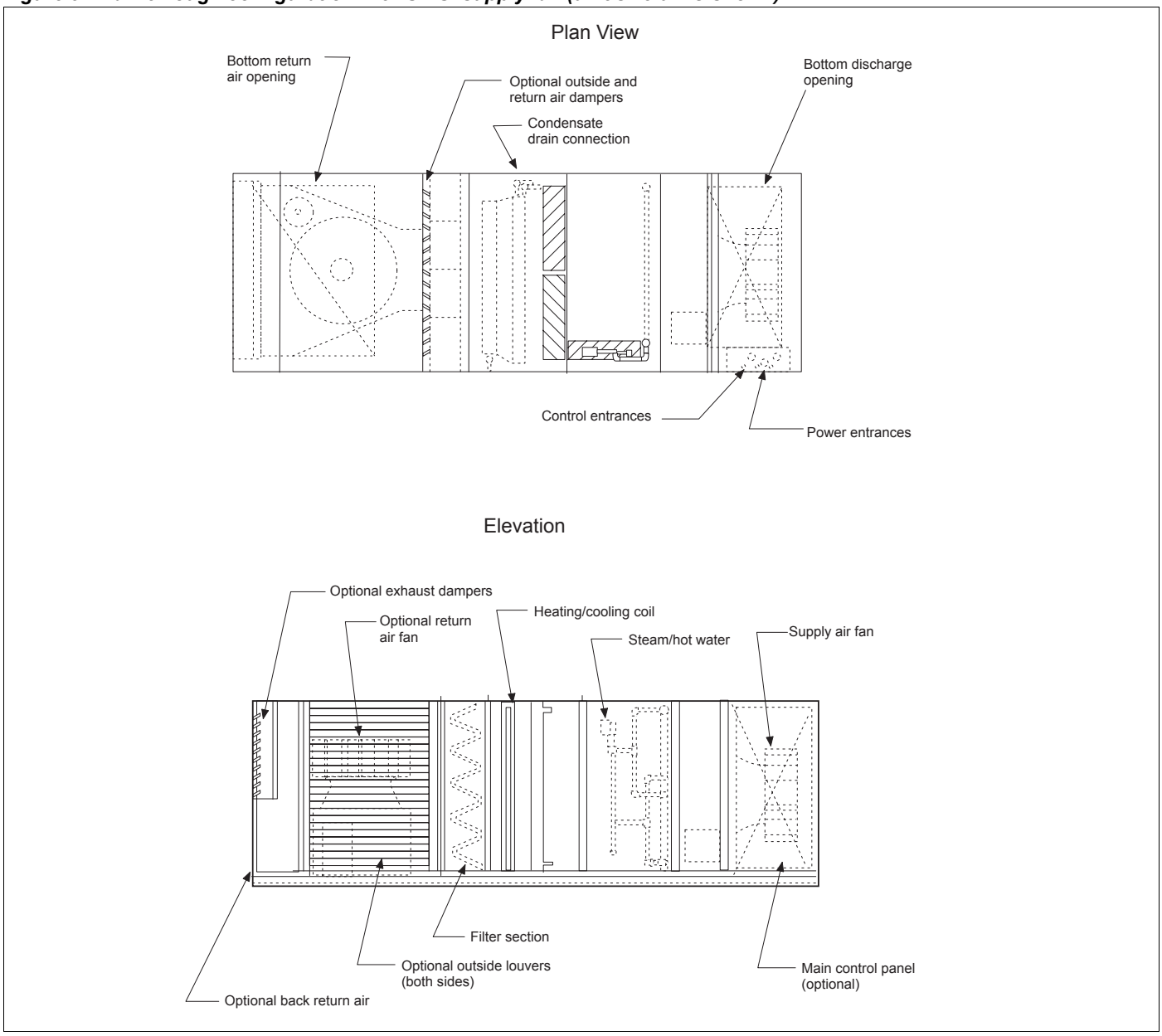
Figure 2 shows a typical blow-through unit with the locations of the major components. Figure 2 shows a typical draw-through unit with the locations of the major components. These figures are for general information only. See the project's certified submittals for actual specific dimensions and locations.

Figure 2. Blow-through configuration (unit size 077C shown)



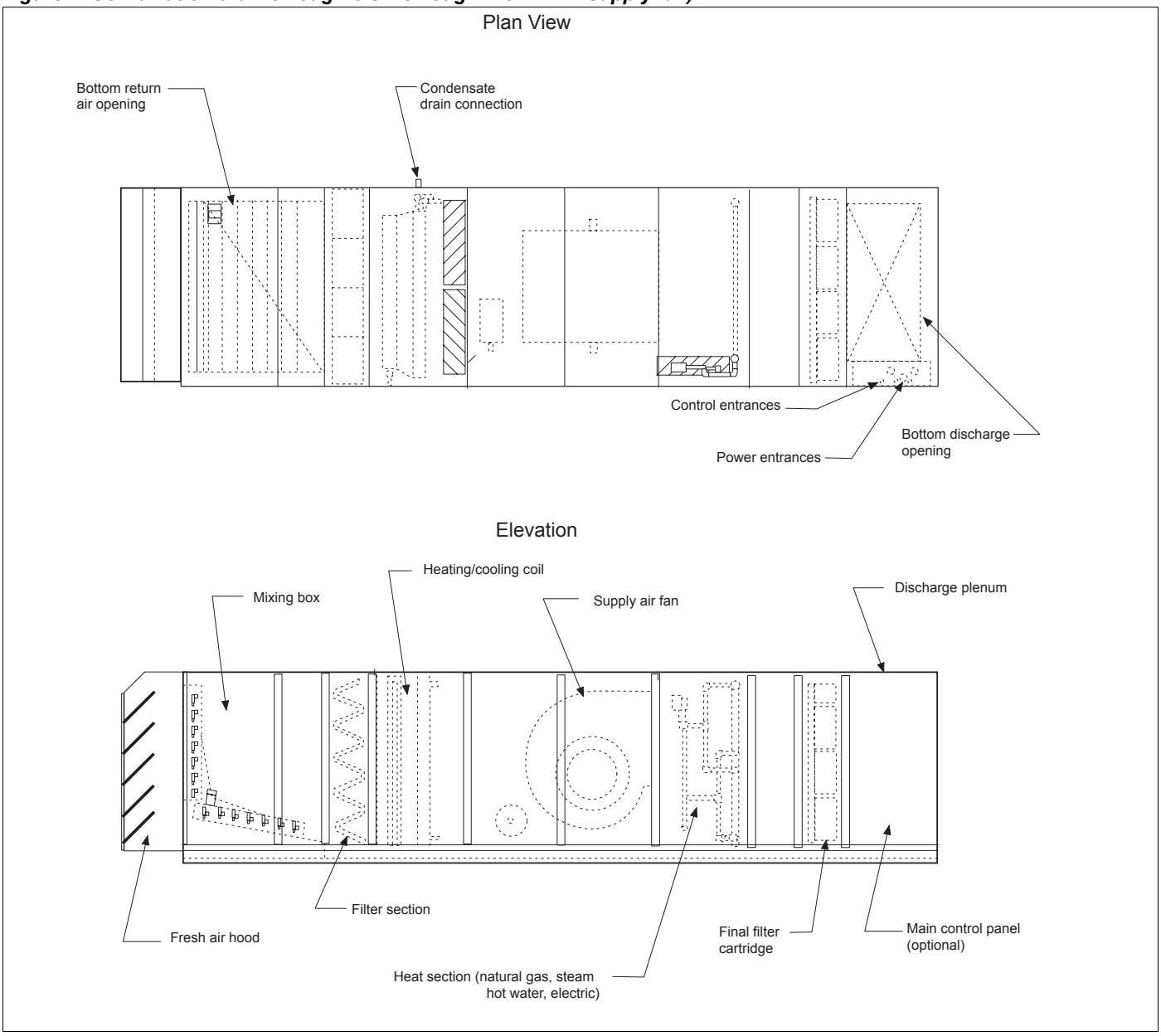
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Figure 3. Draw-through configuration with SWSI supply fan (unit size 077C shown)



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Figure 4. Combination draw-through/blow-through with DWDI supply fan)

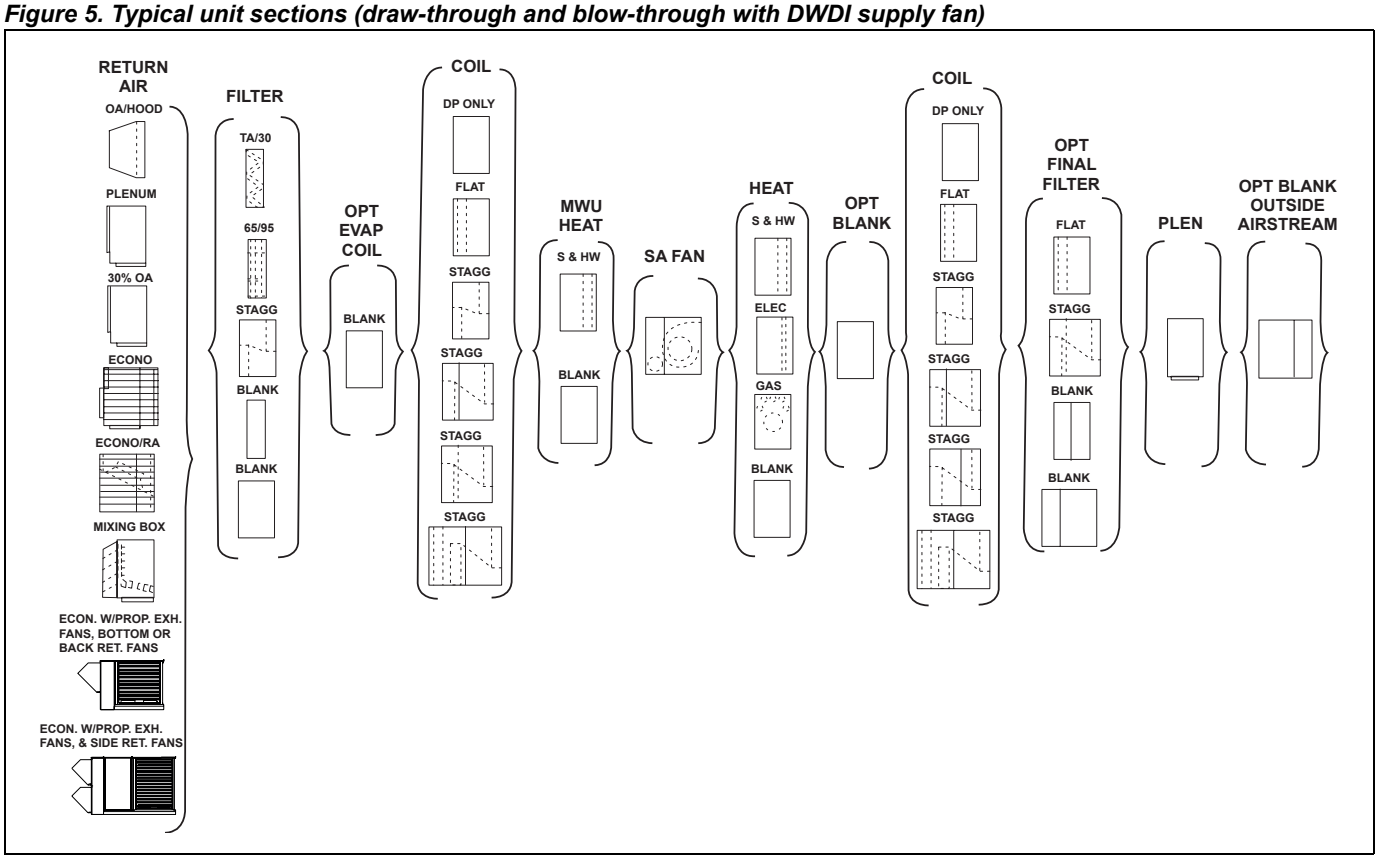


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Typical Unit Sections

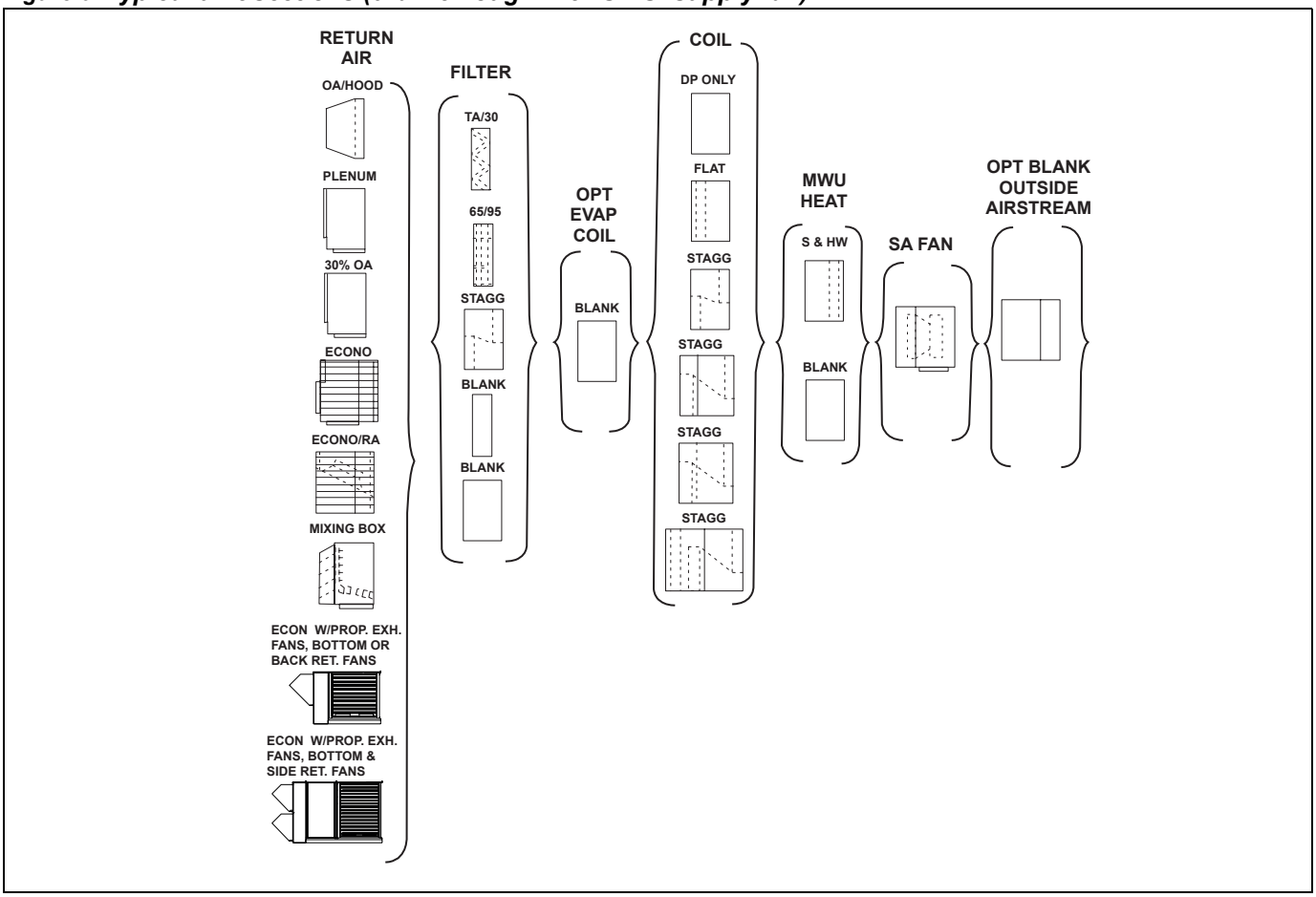
The individual sections that make up a rooftop can vary from unit to unit. All available sections are shown in Figure 5 and Figure 6.

Figure 5. Typical unit sections (draw-through and blow-through with DWDI supply fan)



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Figure 6. Typical unit sections (draw-through with SWSI supply fan)



Note: Views shown for 047C family. Not to scale

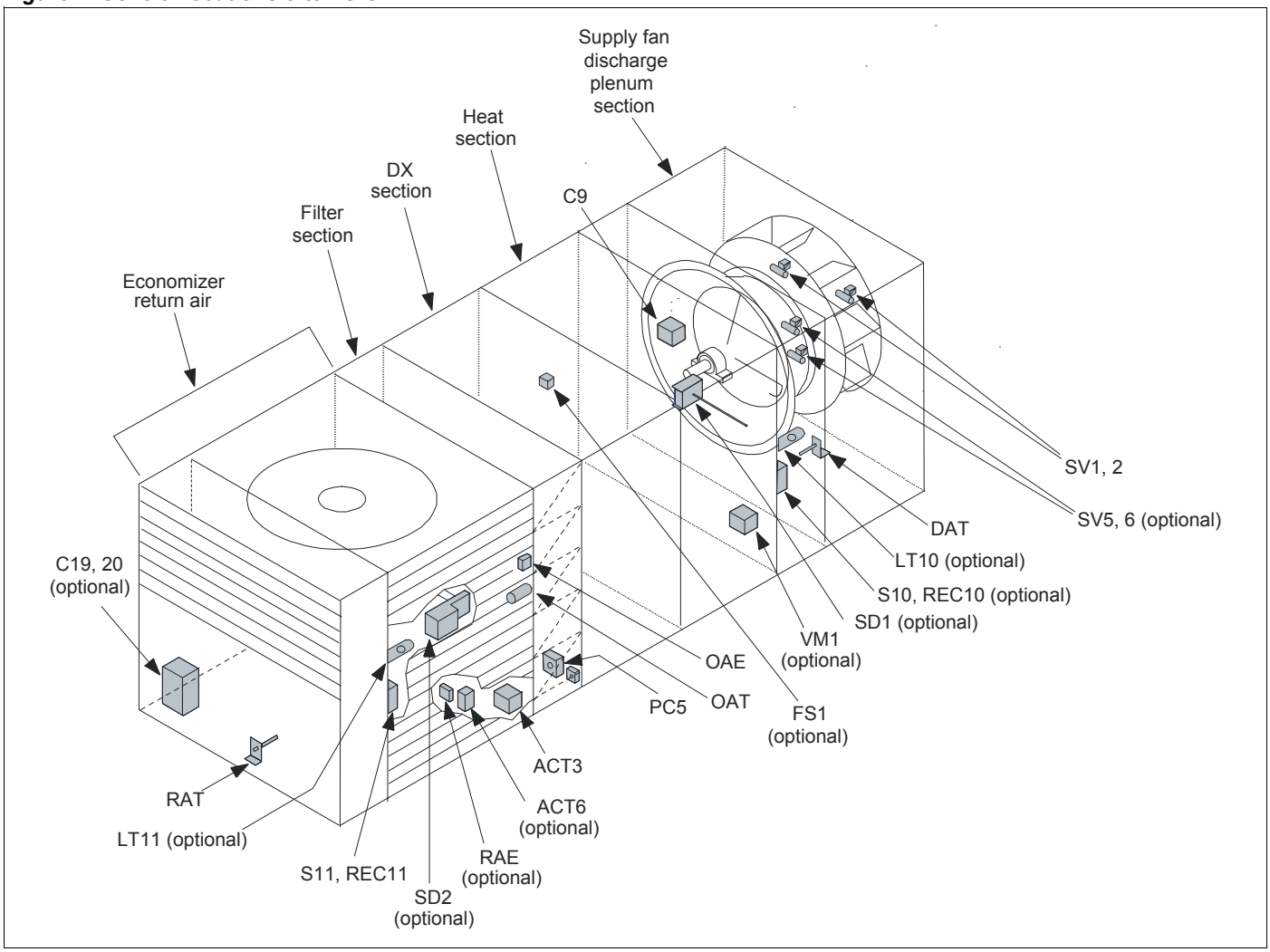
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Control Locations

All controls are optional. If controls are ordered, Figure shows the locations of the various control components mounted throughout the units. See “Control Panel” on page 8 for the locations of control components mounted in control panels.

Additional information is included in Table 2 on page 15 and the wiring diagram legend, which is included in “Wiring Diagrams” on page 57. Figure shows the blow-through heat and the blow-through coil sections.

Figure 7. Control locations cftc f C CX F

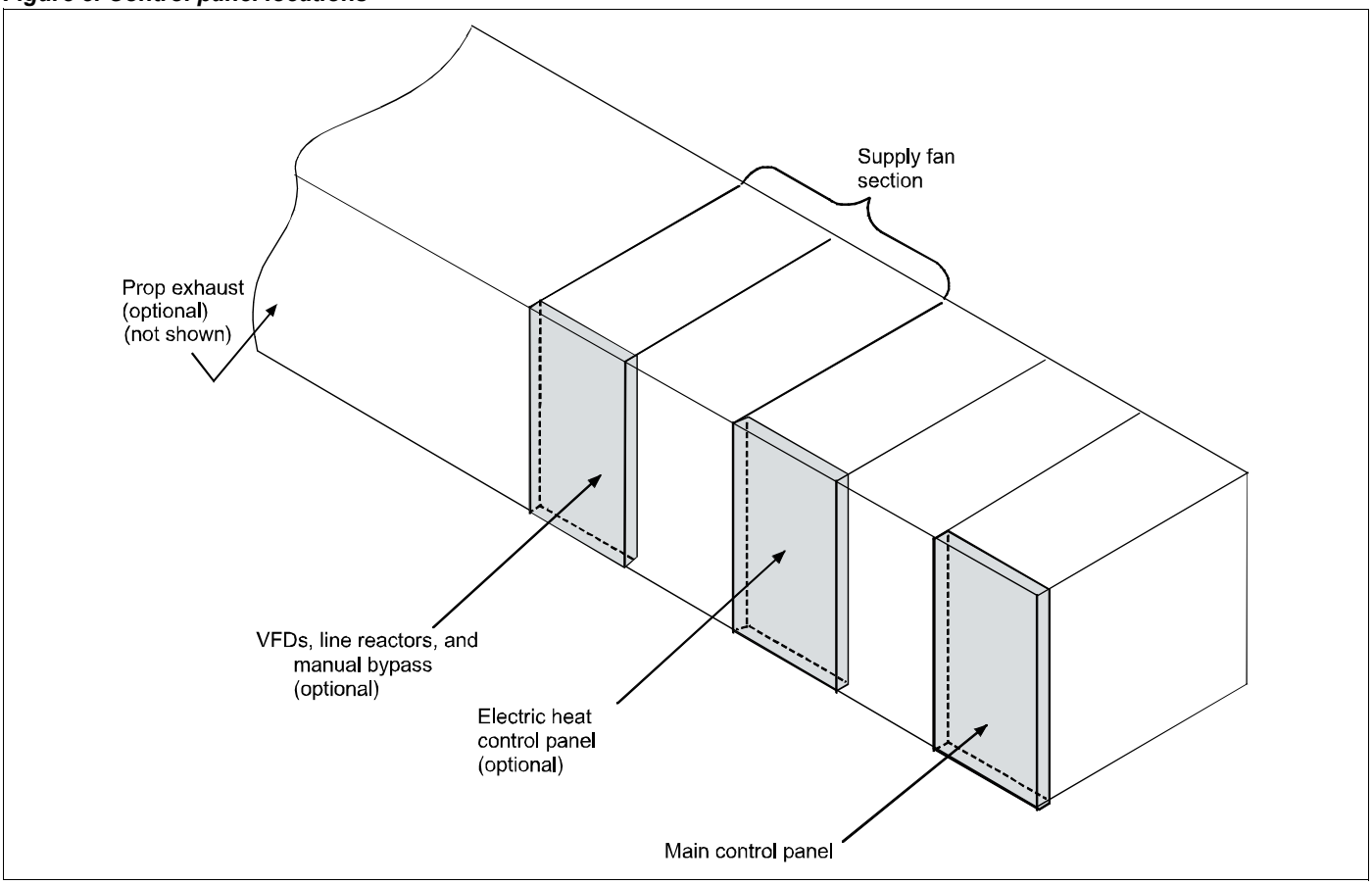


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Control Panel

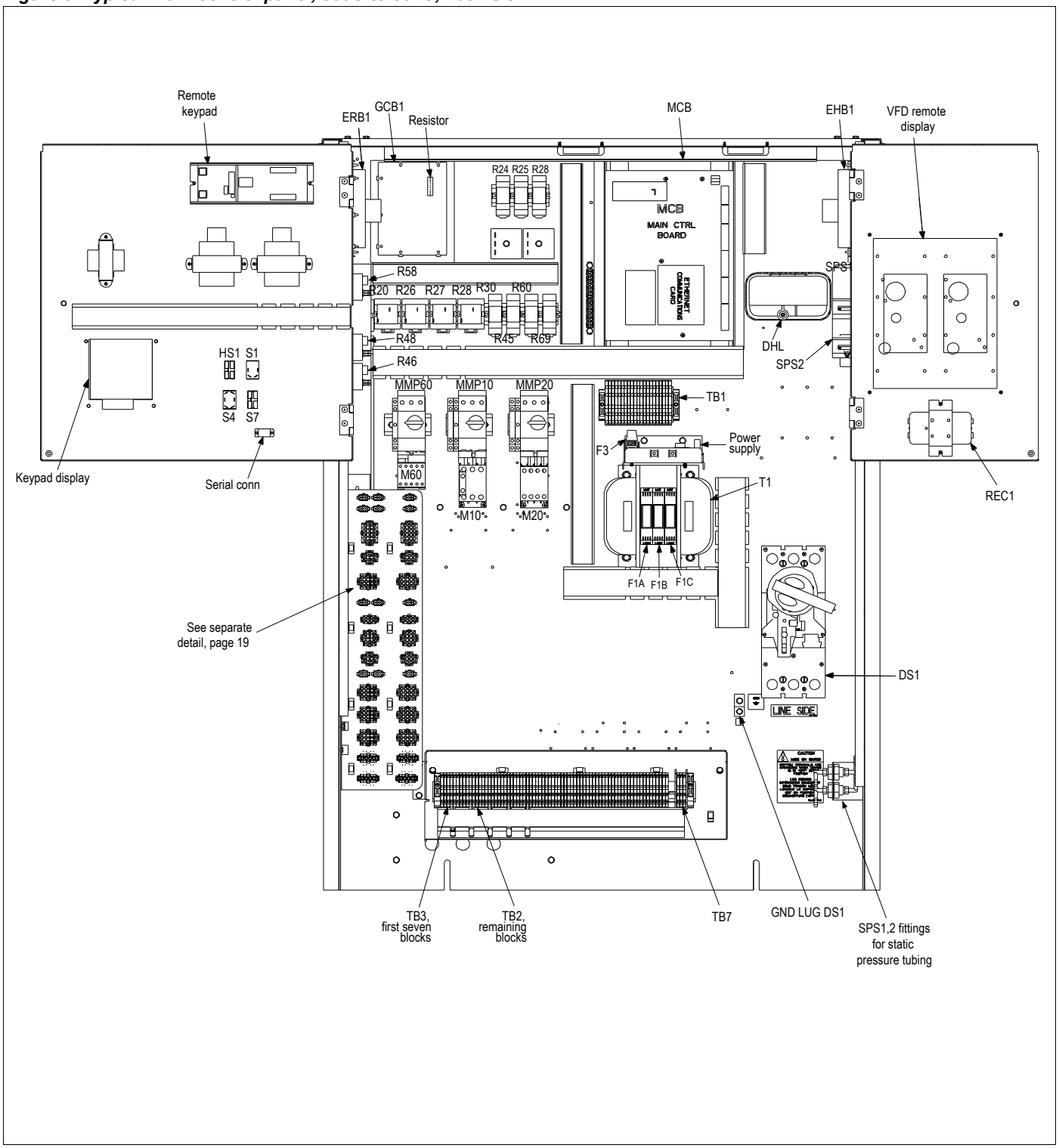
The unit control panels and their locations are shown in the following figures. These figures show a typical unit configuration. Specific unit configurations may differ slightly from these figures depending on the particular unit options.

Figure 8. Control panel locations



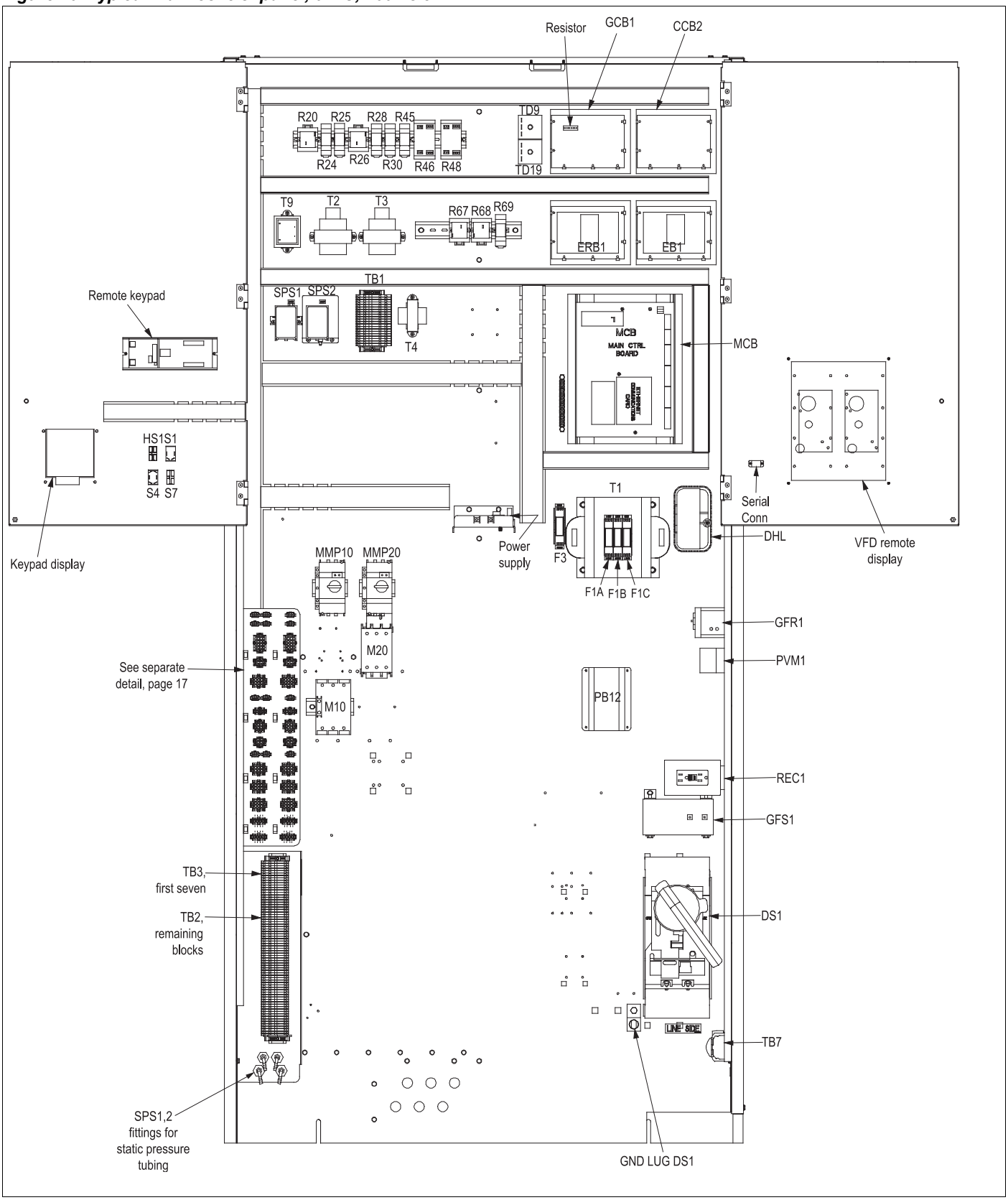
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Figure 9. Typical main control panel, 800C to 802C, 460 volt



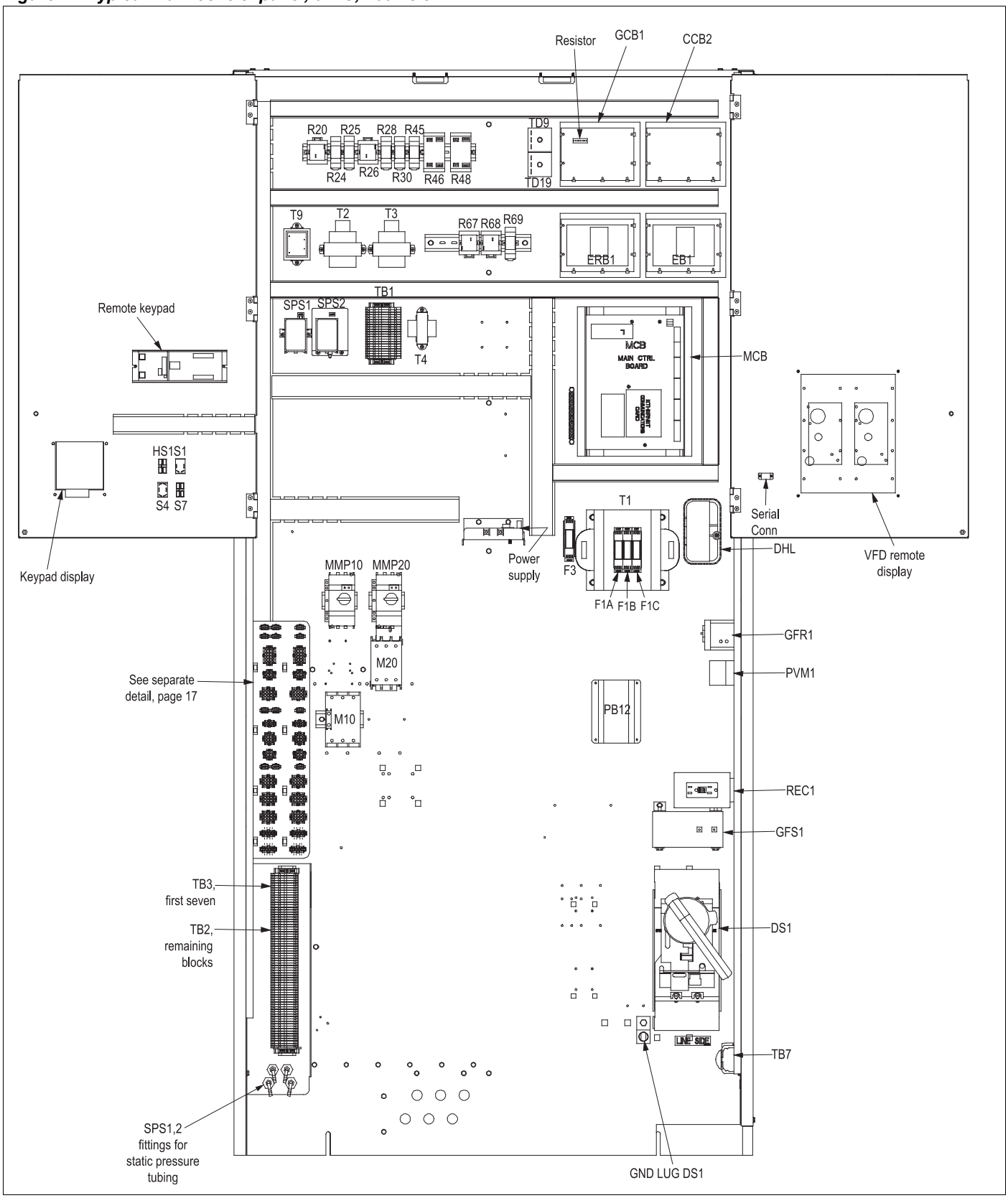
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Figure 10. Typical main control panel, 047C, 460 volt



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Figure 11. Typical main control panel, 077C, 460 volt



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Figure 12. Typical gas heat panel, 1000 MBH

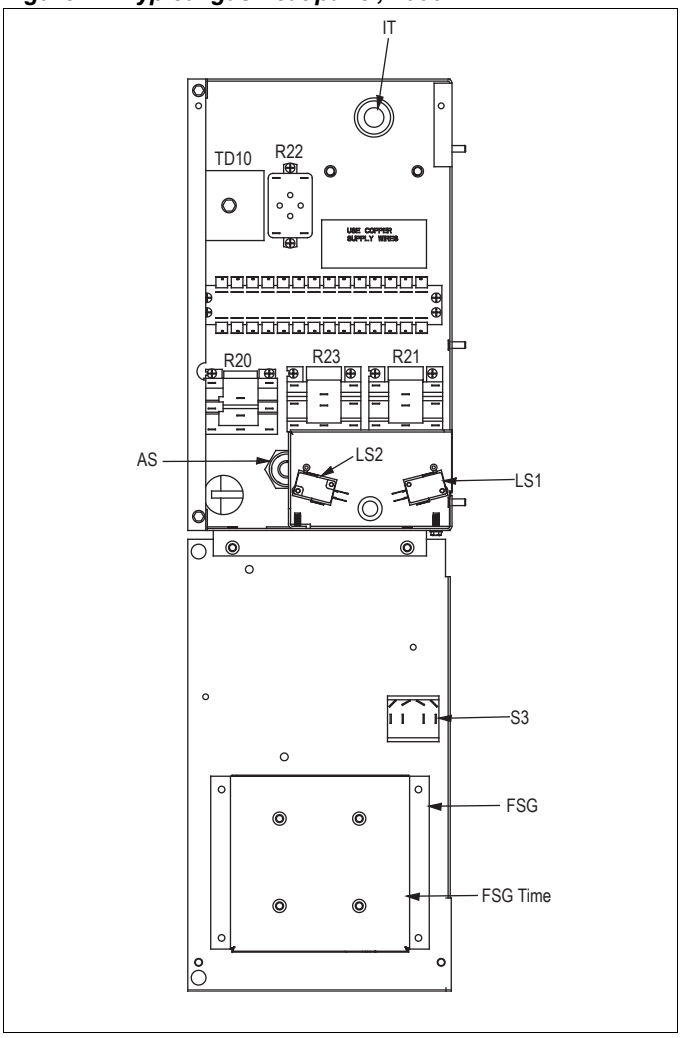


Figure 13. Typical propeller exhaust panel, three fans, 460 volt

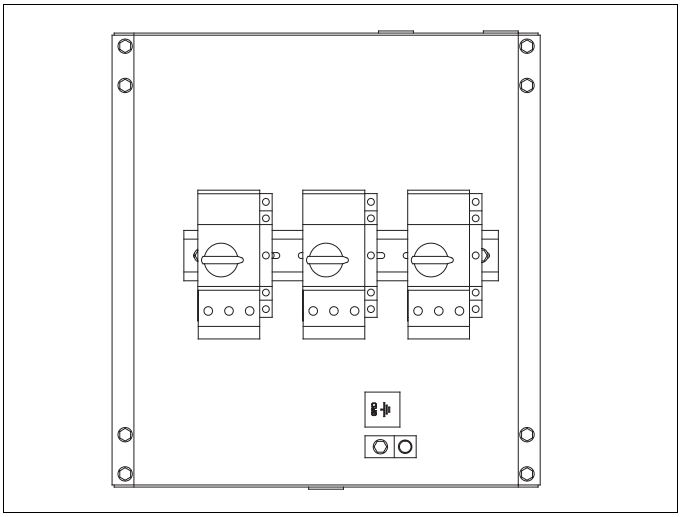


Figure 14. VFD bypass panel, 40 HP, 460 volt)

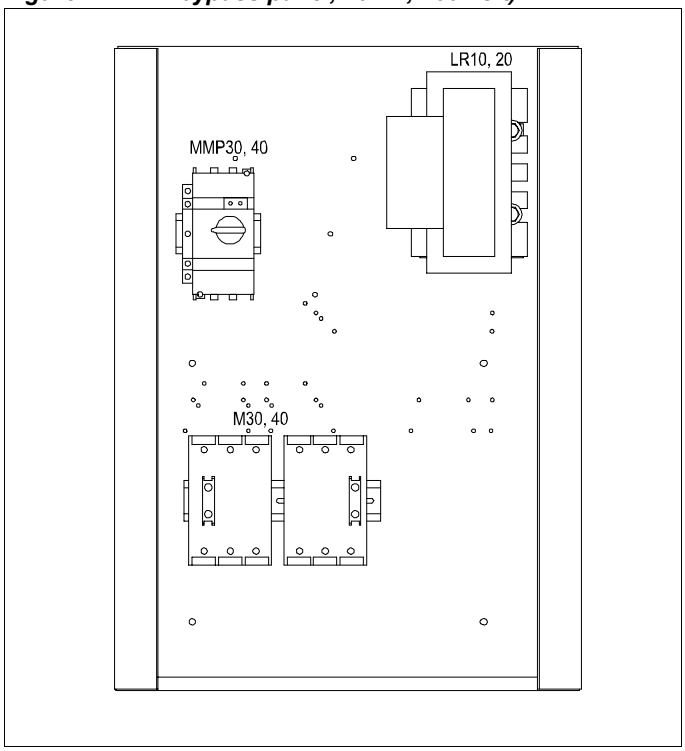
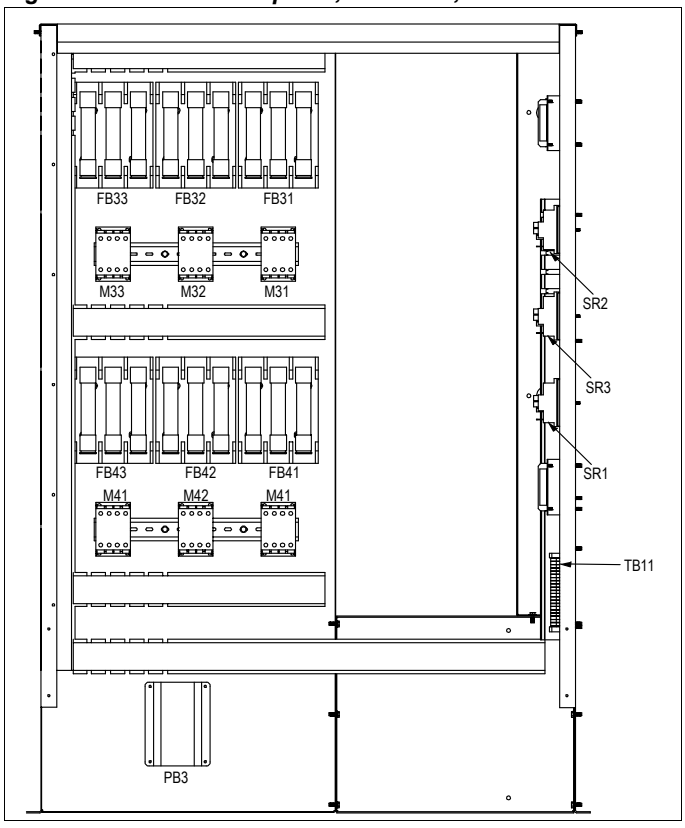


Figure 15. Electric heat panel, sizes 800, 802C



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Figure 16. Electric heat panel, 047C

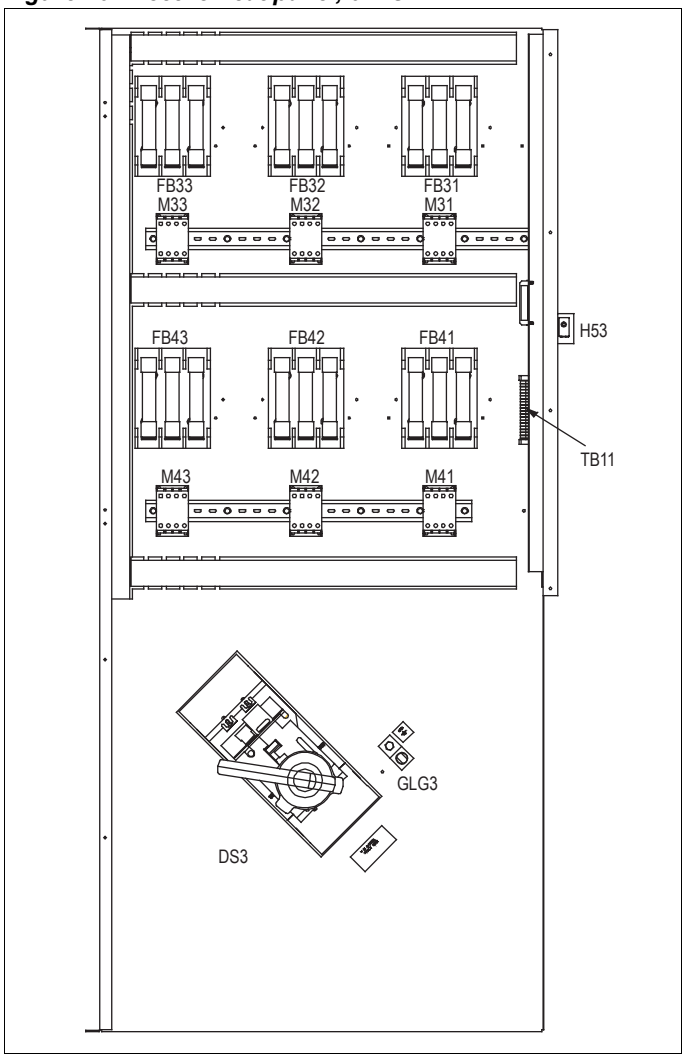
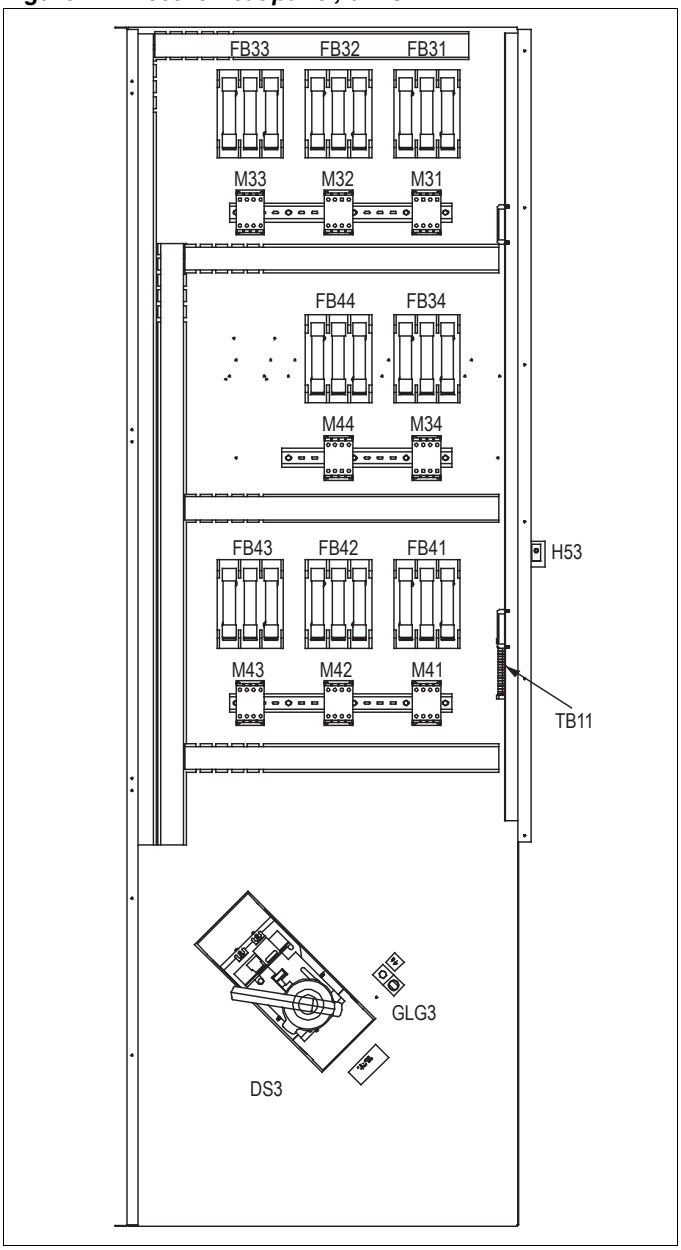
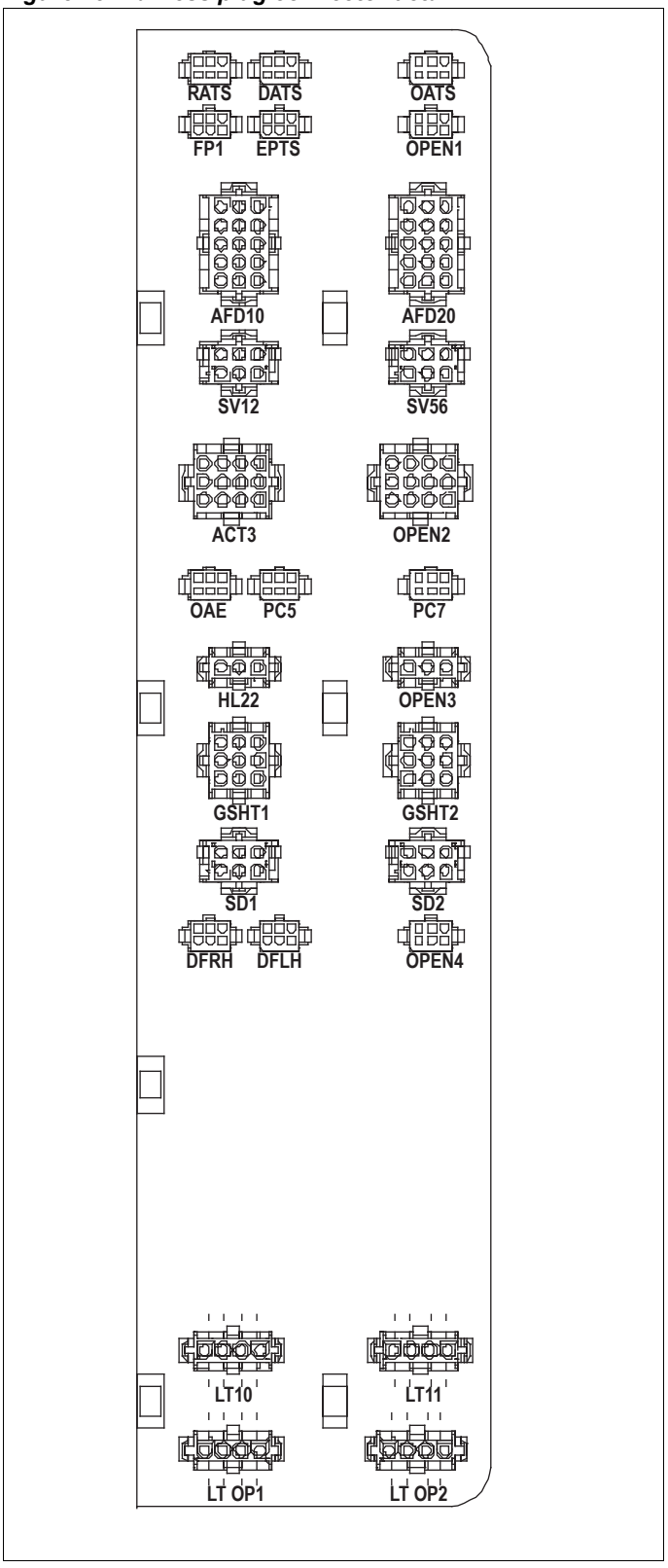


Figure 17. Electric heat panel, 077C



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Figure 18. Harness plug connector detail



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Controls, Settings, and Functions

Table 2 below lists all of the unit control devices. Included in the table are the device symbol, a description of the device, its function, and any reset information, its location, any device setting, any setting ranges, differentials, and the device part number.

Table 2: Controls, settings, and functions

Symbol	Description	Function	Reset	Location	Setting	Range	Differential	Part no.
DAT	Discharge air temperature sensor	Senses discharge air temperature	N/A	Discharge air section	N/A		N/A	060004705
DHL	Duct high limit switch	Prevents excessive VAV duct pressures; shuts off fan	Auto	Main control panel	3.5" w.c (871.8 Pa)	0.05–5.0" w.c. (12.5–1245.4 Pa)	.05" w.c. (12.5 Pa), fixed	065493801
EFT	Entering fan air temperature sensor	Senses entering fan air temperature	N/A	Inlet of supply fan	N/A		N/A	060004705
FP1, 2	Evaporator frost protection	Senses low refrigerant temperature	N/A	Return bends of evaporative coil	Opens at 30°F Closes at 45°F	N/A	N/A	072501901
FS1	Freezestat	Shuts off fans, opens heating valve, and closes outdoor damper if low air temperature at coil is detected	Auto	Heating section	38°F (3°C) or as required	35°F–45°F (2°C–7°C)	12°F (7°C), fixed	065830001
MCB	Main control board	Processes input information	N/A	Main control box	N/A	N/A	N/A	060006101
OAE	Enthalpy control (electro-mechanical)	Returns outside air dampers to minimum position when enthalpy is too high	Auto	Economizer section	"B" or as required	A–D	Temperature: 3.5°F (2°C) Humidity: 5% fixed	030706702
	Enthalpy control (electronic)	Returns outside air dampers to minimum position when outside air enthalpy is higher than return air empalthy (use RAE)	Auto	Economizer section	Fully CW past "D" (when used with RAE)	A–D	N/A	049262201
OAT	Outside air temperature sensor	Senses outside air temperature	N/A		N/A		N/A	060004705
PC5	Dirty filter switch	Senses filter pressure drop	Auto	First filter section	As required	.05-5" w.c. (12.5–1245.4 Pa)	.05" w.c. (12.5 Pa)	065493801
PC6	Dirty filter switch	Senses filter pressure drop	Auto	Final filter section	As required	.05-5" w.c. (12.5–1245.4 Pa)	.05" w.c. (12.5 Pa)	065493801
PC7	Airflow proving switch	Senses supply fan pressure to prove airflow	Auto	Supply fan section	.10" w.c. (25 Pa)	.05-5" w.c. (12.5–1245.4 Pa)	.05" w.c. (12.5 Pa), fixed	060015801
RAE	Return air enthalpy sensor	Used to compare return air enthalpy to outside air enthalpy (used with OAE)	N/A	Economizer section	N/A	N/A	N/A	049262202
RAT	Return air temperature sensor	Senses return air temperature	N/A	Return air section	N/A		N/A	060004705
SD1	Smoke detector, supply air	Initiates unit shutdown if smoke is detected	Manual	Discharge air section	N/A	N/A	N/A	04925001
SD2	Smoke detector, return air	Initiates unit shutdown if smoke is detected	Manual	Return air section	N/A	N/A	N/A	04925001
SPS1	Static pressure sensor duct #1	Converts static pressure signals to voltage signals	N/A	Main control box	N/A	0–5" w.c. (0–1245.4 Pa) 1–6 VDC out	N/A	049545007
SPS2	Static pressure sensor duct #2	Converts static pressure signals to voltage signals and sends them to MicroTech II controller	N/A	Main control box	N/A	0–5" w.c. (0–1245.4 Pa) 1–6 VDC out	N/A	049545007
	Static pressure sensor: building (space) pressure	Converts static pressure signals to voltage signals.	N/A	Main control box	N/A	-025–0.25" w.c. (-62.3–62.3 Pa) 1–5 VDC out	N/A	049545006
S1	System switch	Shuts off entire control circuit (except crankcase heaters)	N/A	Main control box	N/A	N/A	N/A	001355000
S7	ON-OFF-AUTO switch	Used to manually switch unit	N/A	Main control box	N/A	N/A	N/A	

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Mechanical Installation

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.

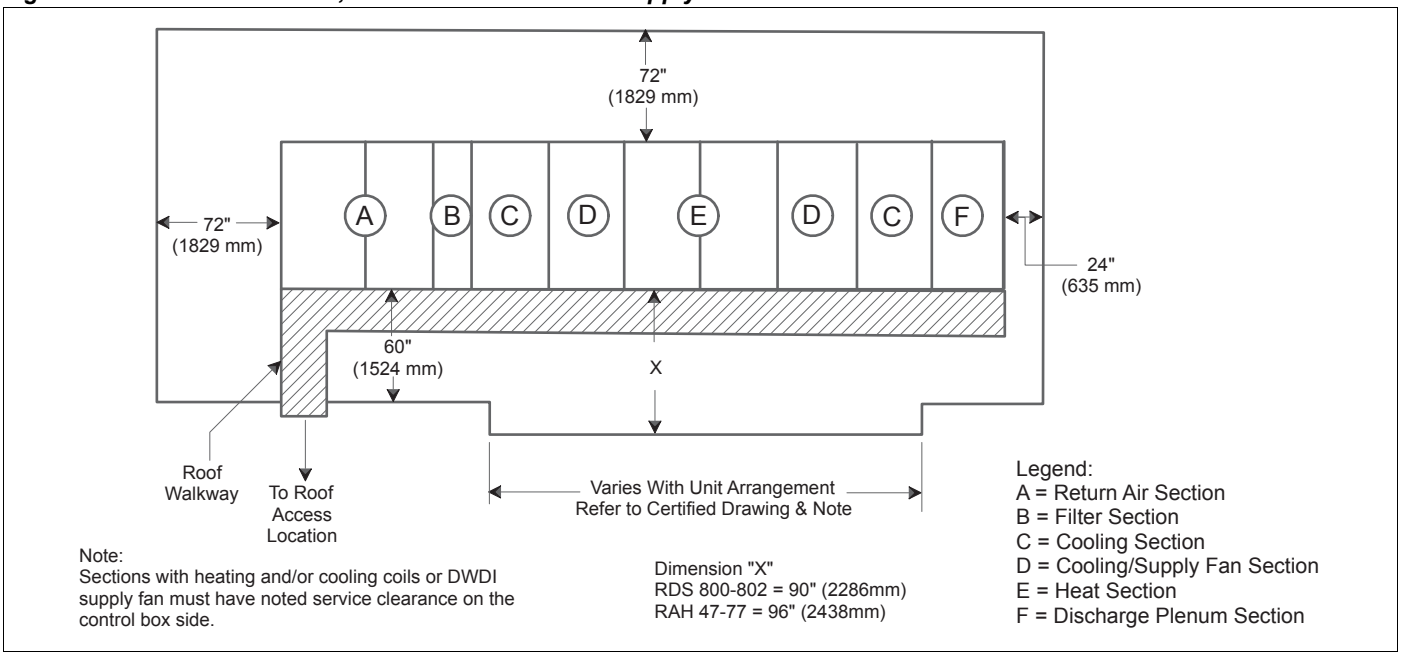
Before unloading the unit, check the unit nameplate to make sure the voltage complies with the power supply available.

Unit Clearances

Service Clearance

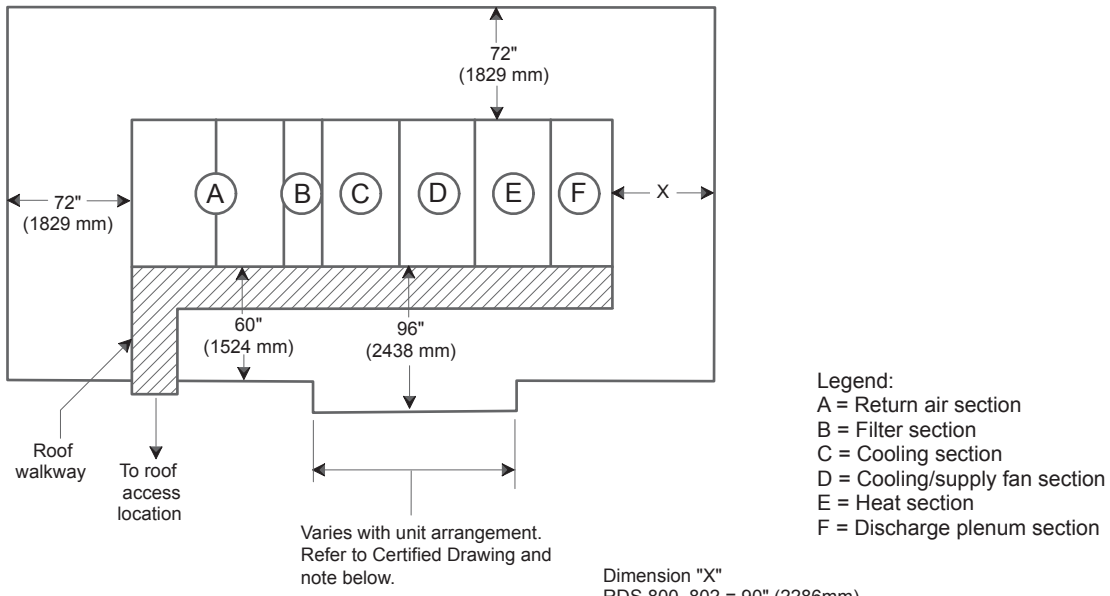
Allow service clearance approximately as indicated in Figure 19. Also, McQuay recommends providing a roof walkway to the rooftop unit as well as along at least the two sides of the unit that provide access to most controls and serviceable components.

Figure 19. Service clearances, unit with housed DWDI supply fan



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Figure 20. Service clearances, unit with SWSI plenum supply fan



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 will 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 “Service Clearance” on page 16. See also Figure 19 on page 16.
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 exhaust vents or other 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 21). This is particularly important to prevent blowing snow from entering outside air intake and to maintain adequate head pressure control when mechanical cooling is required at low outdoor air temperatures.

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Overhead Clearance

1 Unit(s) surrounded by screens or solid walls must have no overhead obstructions over any part of the unit.

2 The following restrictions must be observed for overhead obstructions above the air handler section (see Figure 21):

- **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 21. Overhead clearance

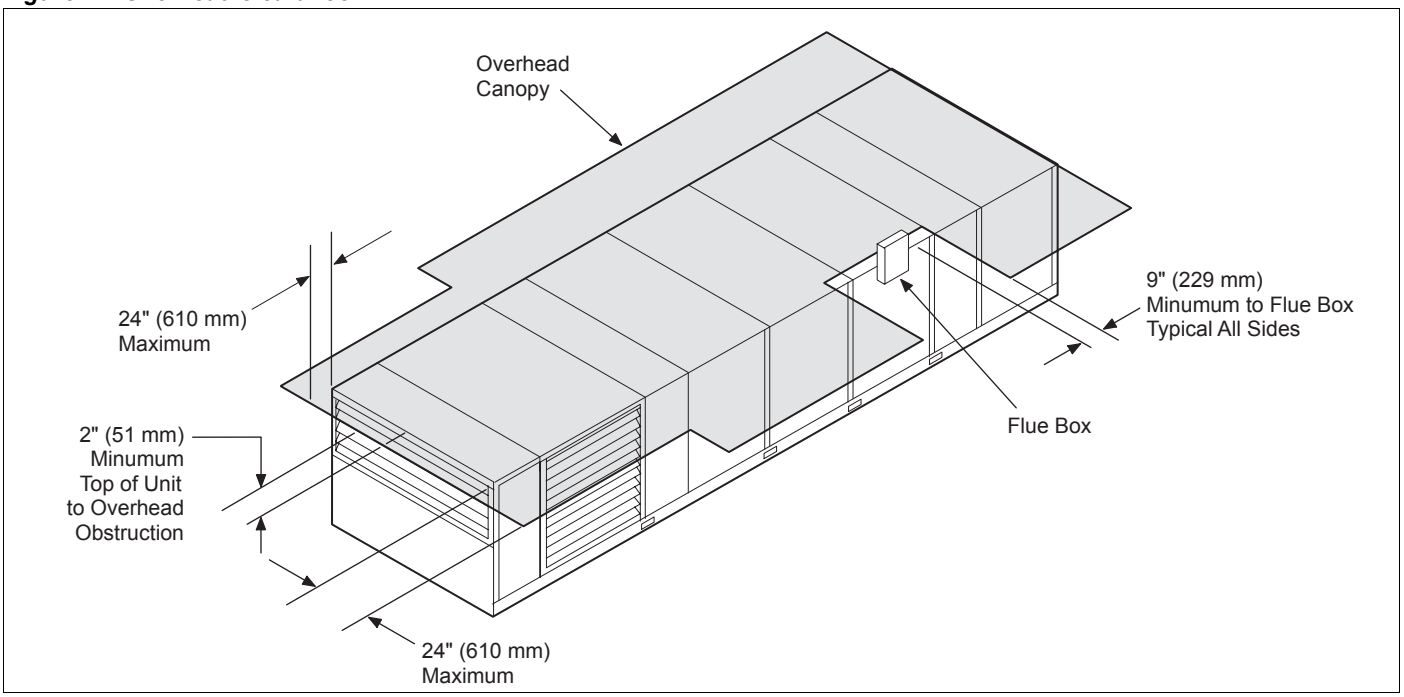
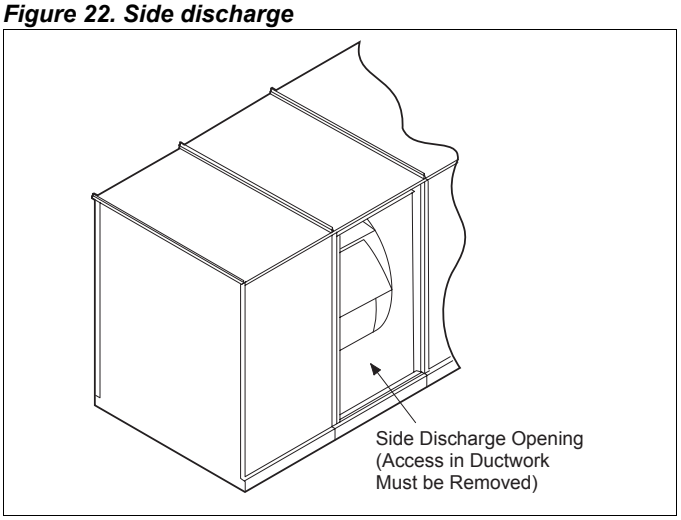


Figure 22. Side discharge



Notice

On units with side discharge, access to plenum-mounted components becomes difficult once ductwork is installed. Installer must provide access in the ductwork for plenum mounted controls

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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.

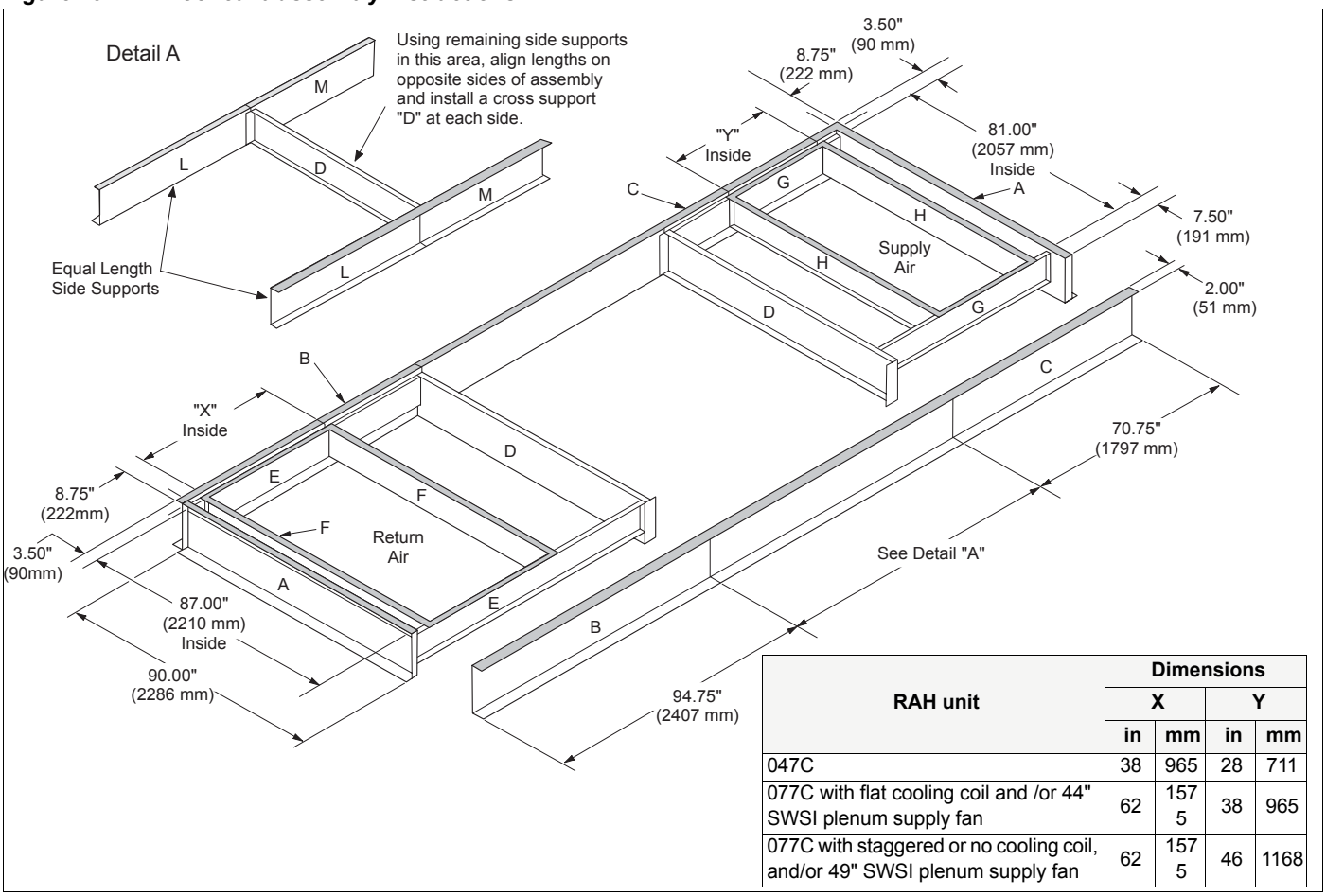
Integral supply and return air duct flanges are provided with the RAH roof curb, allowing connection of duct work to the curb before the unit is set. The gasketed top surface of the duct flanges seals against the unit when it is set on the curb. These flanges must not support the total weight of the duct work. Assembly of a typical RAH roof curb is shown in Figure 23 on page 20. Parts A through H are common to all units having bottom return openings. Depending on the unit length, Parts L and M may be included with the roof curb kit to create the correct overall curb length.

Assembly instructions (Figure 23 on page 20)

1. Set curbing parts A through H per dimensions shown over roof opening or on a level surface. Note location of return and supply air openings.
2. If applicable, set other curbing parts (D, L, M, etc.) in place making sure that the orientation complies with the assembly instructions. Check alignment of all mating bolt holes. See Detail “A.”
3. Bolt curbing parts together using fasteners provided. Tighten all bolts finger tight.
4. Square entire curbing assembly and securely tighten all bolts.
5. Position curb assembly over roof openings. Curb must be level from side to side and over its length. Check that top surface of the curb is flat with no bowing or sagging.
6. Weld curbing in place. Caulk all seams watertight. Remove backing from 0.25" (6 mm) thick × 1.50" (38 mm) wide gasketing and apply to surfaces shown by cross-hatching.
7. Flash curbing into roof as shown in Detail “B.”
8. Parts E and F are not required on units with no return shaft within the curb perimeter.
9. Parts G and H are not required on units with no supply shaft within the curb perimeter.
10. Be sure that electrical connections are coordinated (see Figure 26).

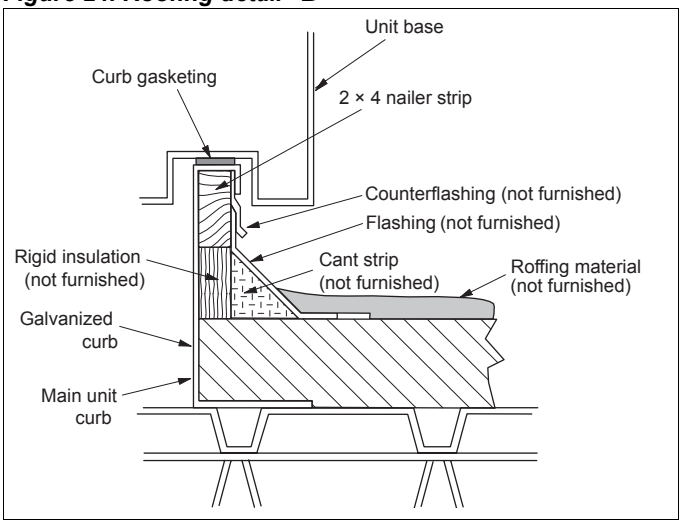
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Figure 23. RAH roof curb assembly instructions



RAH unit	Dimensions			
	X		Y	
	in	mm	in	mm
047C	38	965	28	711
077C with flat cooling coil and /or 44" SWSI plenum supply fan	62	1575	38	965
077C with staggered or no cooling coil, and/or 49" SWSI plenum supply fan	62	1575	46	1168

Figure 24. Roofing detail "B"



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Figure 25. RDS roof curb assembly instructions

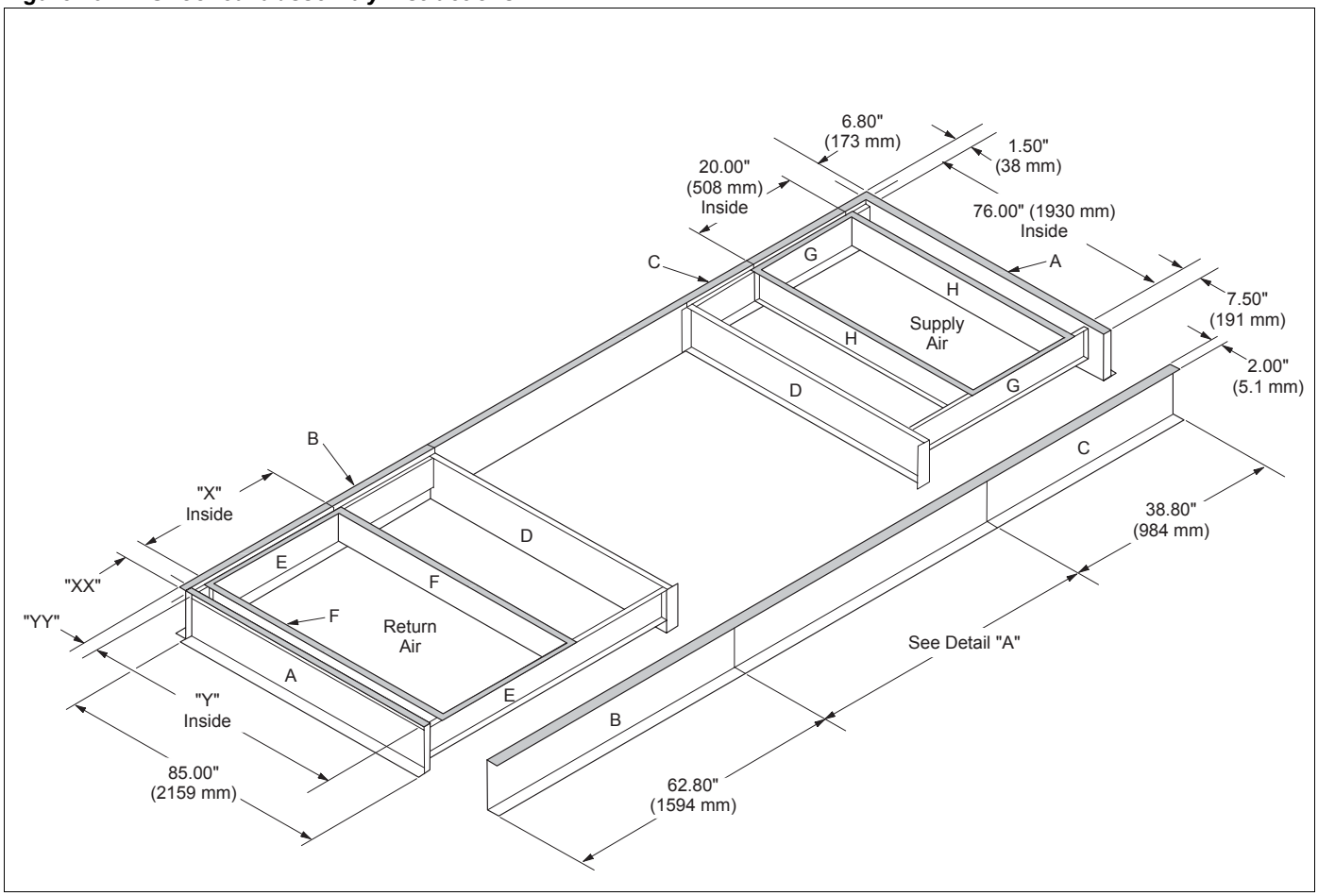
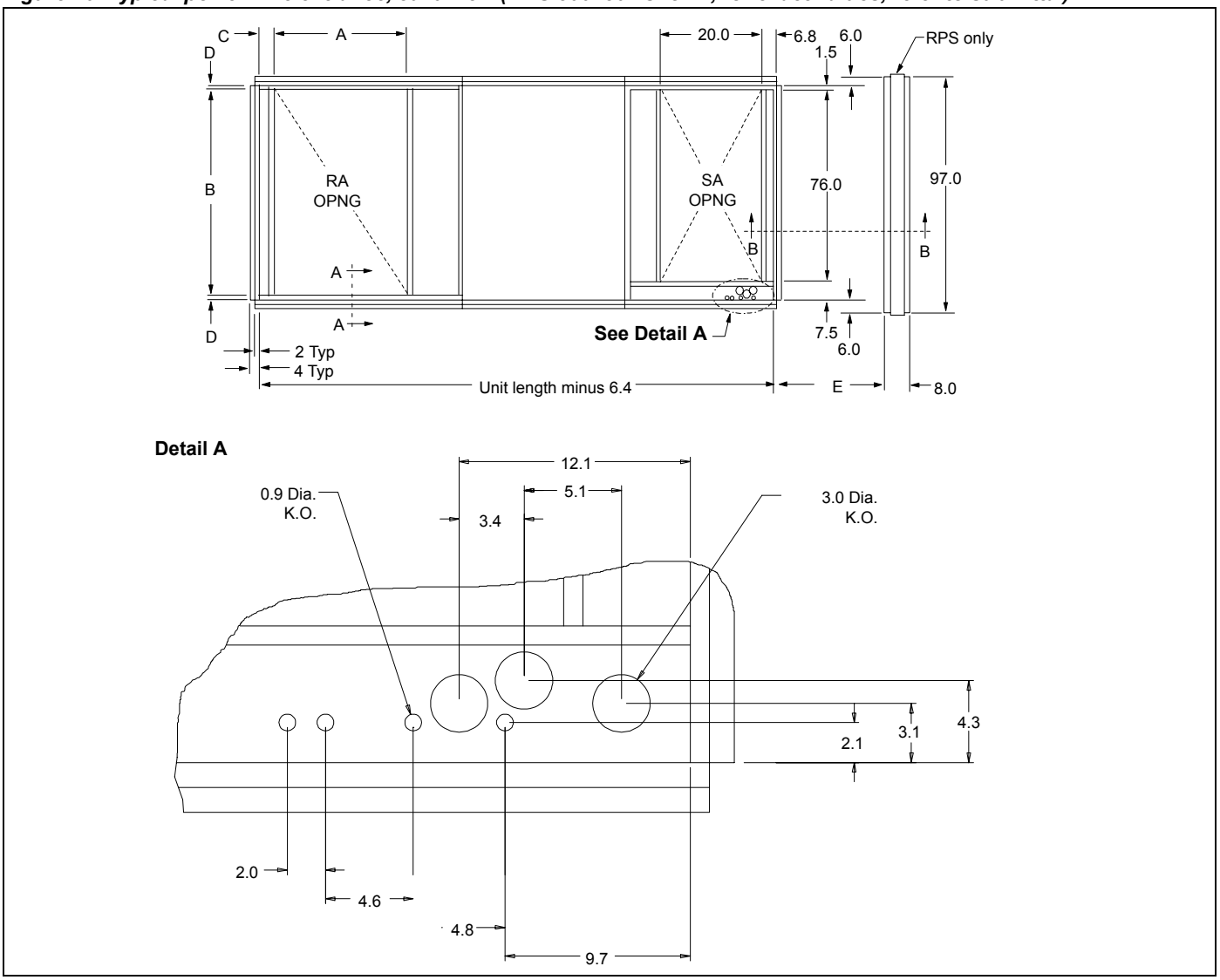


Table 3: RDS roof curb assembly instructions

Unit size	Fan	"X"		"Y"		"XX"		"YY"		Unit size	Return fan	X		Y		XX		YY	
		in	mm	in	mm	in	mm	in	mm			in	mm	in	mm	in	mm	in	mm
800–802C	None	24.0	610	82.0	2083	6.8	173	1.5	38	800–802C	None	24.0	610	82.0	2083	6.8	173	1.5	38
	(2) 15" FC	24.0	610	82.0	2083	6.8	173	1.5	38		(2) 15" FC	24.0	610	82.0	2083	6.8	173	1.5	38
	30" AF	30.0	762	76.0	1930	6.8	173	4.5	114		30" AF	30.0	762	76.0	1930	6.8	173	4.5	114
	40" AF	36.0	914	78.0	1981	14.8	376	3.5	89		40" AF	36.0	914	78.0	1981	14.8	376	3.5	89

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Figure 26. Typical power wire entrance, curb view (RDS 800–802 shown; for exact values, refer to submittal)



Post and Rail Mounting

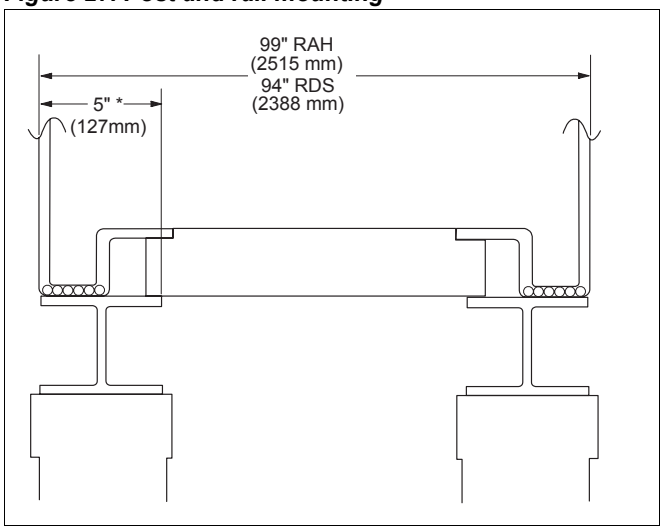
When mounting by post and rail, run the structural support the full length of the unit. Locate the structural member at the base of the unit as shown in Figure 27, assuring the I-beam is well supported by the structural member.

⚠ CAUTION

The unit must be level side to side and over the entire length. Equipment damage can result if the unit is not level.

If resilient material is placed between the unit and the rail, insert a heavy steel plate between the unit and the resilient material to distribute the load. Seal cabinet penetrations (electrical, piping, etc.) properly to protect against moisture and weather.

Figure 27. Post and rail mounting



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Rigging and Handling

Lifting brackets with 2" (51 mm) diameter holes are provided on the sides of the unit.

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:

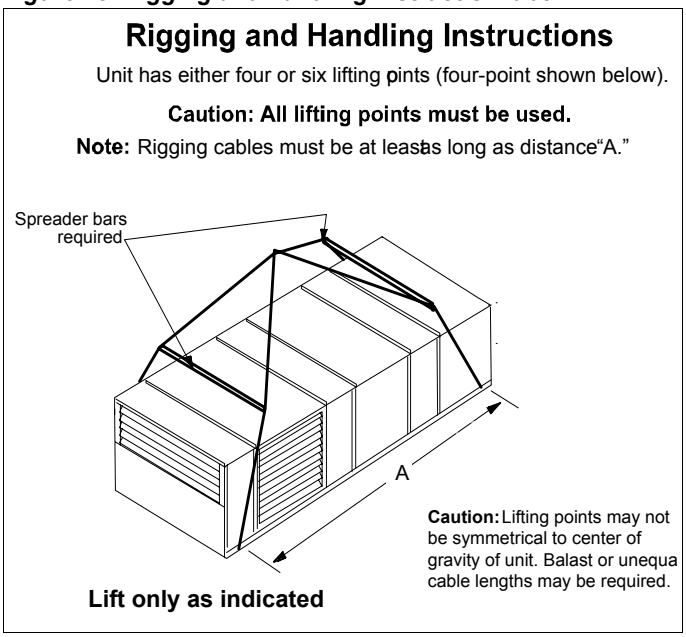
1. Support the unit well along the length of the base rail.
2. Level the unit (no twists or uneven ground surface).
3. Provide proper drainage around the unit to prevent flooding of the equipment.
4. Provide adequate protection from vandalism, mechanical contact, etc.
5. Securely close the doors.
6. If there are isolation dampers, make sure they are properly installed and fully closed to prevent the entry of animals and debris through the supply and return air openings.
7. Cover the supply and return air openings on units without isolation dampers.

Figure 28 shows an example of the rigging instruction label shipped with each unit.

⚠ WARNING

Use all lifting points. Improper lifting can cause severe personal injury and property damage.

Figure 28. Rigging and handling instruction label



⚠ CAUTION

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

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Lifting Points

To determine the required lifting cable lengths and whether four-or six-point lifting is required, use Tables 4 and 5 and Figure 29.

Referring toFigure 29, note that dimension A is the distance between the outer lifting points. The four outer rigging cables must be equal to or longer than dimension A. Dimension B shows the minimum distance between the outer and the inner lifting points for six-point lifting. Use this to roughly determine the required length of the middle cables for six-point lifting. Determine dimension A by subtracting dimensions X and Y from dimension Z (e.g., A = Z – X – Y).

- Where:
- Z = Total unit length in inches
  (refer to certified drawings for this dimension).
- X = Outdoor/return air section length (refer to Table 29 and Table 5 for this dimension).
- If A ≤ 288" (7315 mm), 4-point lifting is sufficient.
- If A > 288" (7315 mm), 6-point lifting is required.

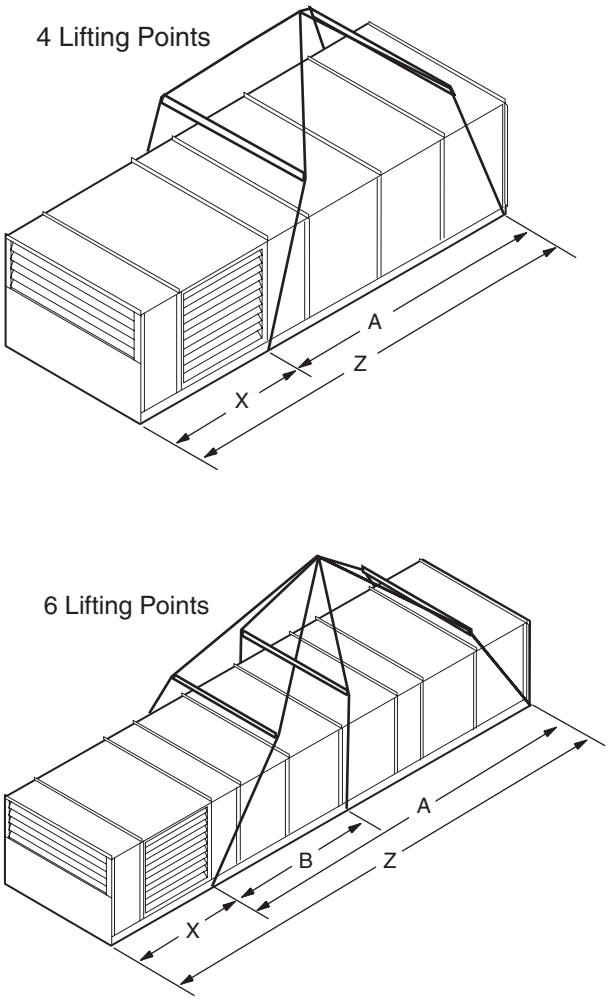
Table 4: RAH X dimension (see Figure 29)

Type of economizer section	047C	077C
100% OA	0	0
Plenum	48” (1219 mm)	72” (1829 mm)
0–30% OA	48” (1219 mm)	72” (1829 mm)
0–100% economizer	72” (1829 mm)	96” (2438 mm)
0–100% economizer with return fan	72” (1829 mm)	96” (2438 mm)

Table 5: RDS X dimension (see Figure 29)

Outdoor/return air section	800C	802C
100% OA	0	0
Plenum	40” (1016 mm)	52" (1321 mm)
0–30% OA	40” (1016 mm)	52" (1321 mm)
0–100% economizer	40” (1016 mm)	52" (1321 mm)
0–100% economizer with 15" return fan	62" (1575 mm)	—
0–100% economizer with 30" return fan	52" (1321 mm)	52" (1321 mm)
0–100% economizer with 40" return fan	—	80" (2032 mm)

Figure 29. Unit type RAH lifting points z



RDS 800: B Min. = 62" (1515 mm)
RDS 802: B Min. = 84" (2134 mm)
RAH 47: B Min. = 96" (2438 mm)
RAH 77: B Min. = 120" (3048 mm)

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Split Units

Although units typically ship from the factory as complete units, they can be factory split at the supply fan bulkhead and connected later on the roof. This configuration is ordered if the shipping length or a weight limitation prevents ordering a packaged unit.

A single nameplate is attached to the air handler section and power is supplied to both sections through the optional main control box as in a packaged unit.

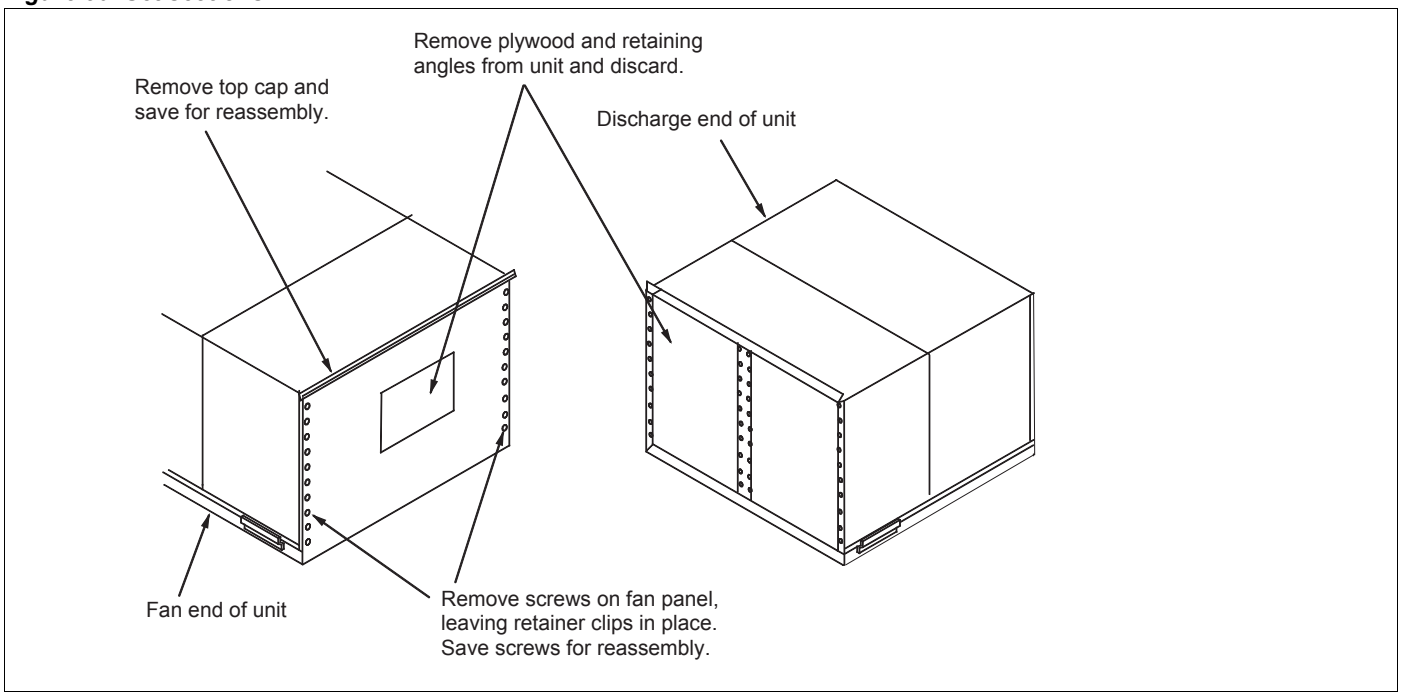
RAH Factory Split at Fan

Field reassembly of an RAH unit that has shipped split at the fan takes place in three phases: (1) setting the sections (2) mechanically recoupling the cabinet, and (3) reconnecting power and control wiring.

Phase I. Set sections

1. Remove top cap and save for Step 3.
2. Remove screws on fan panel, leaving retainer clips in place to secure bulkhead. Save screws for Step 9.
3. Remove plywood and retaining angles from unit and discard.
4. Carefully lower both sections of unit (fan end and discharge end) into place, making sure the roof curb engages the recesses in the unit base.

Figure 30. Set sections

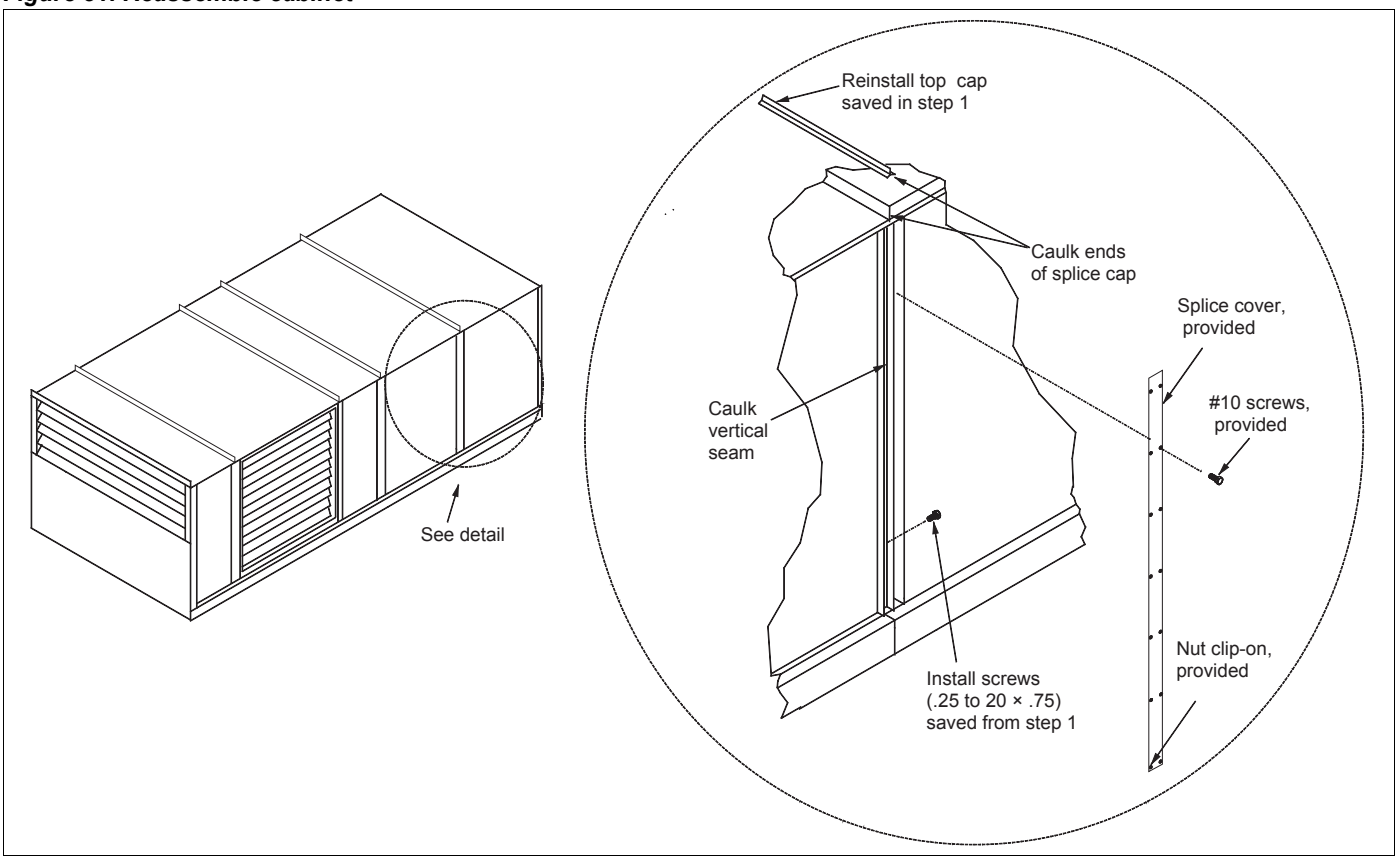


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Phase II. Reassemble cabinet (Figure 31)

1. Reinstall top cap removed in Phase I, Step 1.
2. Caulk (watertight) ends of splice cap.
3. Caulk (watertight) vertical seam.
4. Install #10 screws (provided).
5. Install screws (.25–20 ×.75) removed in Phase I, Step 2.
6. Install splice cover (provided).

Figure 31. Reassemble cabinet



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Phase III. Reconnect power and control wiring

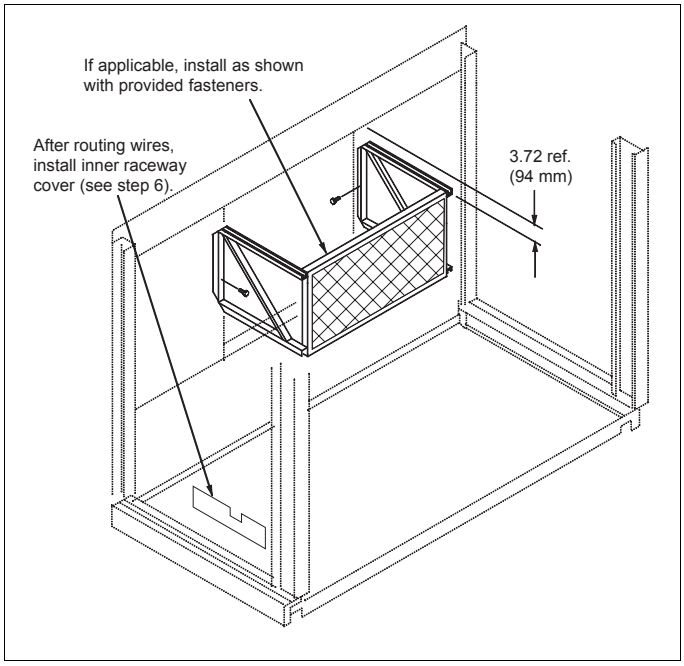
Once the sections are physically reconnected, the ends of the power harness are fed back through the unit base into the junction box, per the unit's electrical schematics.

⚠ CAUTION

Connect the power block correctly and maintain proper phasing. Improper installation can cause severe equipment damage.

1 Make electrical connections and reinstall inner raceway cover as shown in Figure 32.

Figure 32. Electrical connections and raceway cover installation



2 When power wire reconnection is complete, reinstall the inner raceway cover in the blank or heat section. Figure 32 shows a typical installation of the raceway cover.

3 Run the control harnesses by removing the external raceway covers on either side of the unit split.

4 Remove the excess harness length from the external raceway on the downstream side of the split; then route along the raceway through the bushed hole in the fan section and into the junction box where control wiring terminal blocks are provided for reconnection.

5 Make all electrical connections per the unit's electrical schematics.

6 Reinstall the external raceway covers after routing of the control wires is complete.

Field Refrigerant Piping and Charging of DX Coils

Units that ship from the factory with DX coils installed do not include refrigerant piping or refrigerant controls. The coil assembly is ready for field connections at the distributors and at the suction headers. Piping kits that provide the necessary liquid and hot gas piping and control components are available for field installation. Field-installed refrigerant piping may exit the unit cabinet at one of the following locations:

- Through the floor of the unit.
- Through the discharge and bulkhead of the unit.
- Through a cabinet door near the DX coil that is not required for service areas.

⚠ CAUTION

For any of the above cabinet penetrations, tightly seal the hole to prevent water or air leakage.

In preparing for field piping, the plastic plugs on the distributors must be removed and the copper caps at the suction header connections must be unsweated.

Follow piping design, sizing, and installation information presented in ASHRAE handbooks in the design and installation of interconnecting piping. The DX coil and condensing unit are intended to be set at the same elevation, as close as possible to each other to minimize refrigerant pressure drop. Design piping to prevent liquid refrigerant carryover to the compressor and to provide a continuous return of compressor oil from the system.

⚠ CAUTION

The pounds of refrigerant in the system may exceed the capacity of the condenser, depending on the amount of refrigerant in the liquid lines between the DX coil and the condensing unit.
Refer to condenser manufacturer for information about refrigerant capacity. Suitable means of containing the refrigerant is required.

⚠ CAUTION

To prevent liquid return and damage to the compressor on systems with optional hot gas bypass, it is important to locate the bypass solenoid valve at the condensing unit and not at the DX coil.

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Piping Recommendations

1. Use type K or L clean copper tubing. Thoroughly clean or braze all joints with high temperature solder.
2. Base piping sizes on temperature/pressure limitations as recommended in the following paragraphs. Under no circumstances should pipe size be based strictly upon coil or condensing unit piping connection size.
3. Do not exceed suction line piping pressure drop equivalent to 2°F (1°C), 3 psi (20.7 kPa) per 100 feet (30.5 m) of equivalent pipe length. After the suction line size is determined, check the vertical suction risers to verify that oil will be carried up the riser and back to the compressor. Pitch the suction line(s) in the direction of refrigerant flow and make sure they are adequately supported. Lines should be free draining and fully insulated between the evaporator and the compressor. Install a trap on the vertical riser to the compressor.
4. To determine the minimum tonnage required to carry oil up suction risers of various sizes, check the vertical suction risers using Table 6.
5. Insulate suction lines inside the unit cabinet to prevent condensation.

Table 6: Minimum tonnage (R-22) to carry oil up suction riser at 40°F saturated suction

Line size O.D.	Minimum tonnage
1 1/8"	1.5
1 3/8"	2.5
1 5/8"	3.8
2 1/8"	7.6
2 5/8"	13.10
3 1/8"	20.4
3 5/8"	29.7
4 1/8"	41.3

6. Size the liquid line for a pressure drop not to exceed the pressure equivalent of 2°F (1°C), 6 psi (41.4 kPa) saturated temperature.

Leak Testing

In the case of loss of the nitrogen holding charge, the unit should be checked for leaks prior to charging the complete system. If the full charge was lost, leak testing can be done by charging the refrigerant into the unit to build the pressure to approximately 10 psig and adding sufficient dry nitrogen to bring the pressure to a maximum of 125 psig. The unit should then be leak tested with halide or electronic leak detector. After making any necessary repair, the system should be evacuated as described in the following paragraphs.

⚠ WARNING

Do not use oxygen or air to build up pressure. Explosion hazard can cause severe personal injury or death.

Evacuation

After determining the unit is tight and there are no refrigerant leaks, evacuate the system. Use a vacuum pump with a pumping capacity of approximately 3 cu.ft./min. and the ability to reduce the vacuum in the unit to at least 1 mm (1000 microns).

1. Connect a mercury manometer or an electronic or other type of micron gauge to the unit at a point remote from the vacuum pump. For readings below 1 millimeter, use an electronic or other micron gauge.
2. Use the triple evacuation method, which is particularly helpful if the vacuum pump is unable to obtain the desired 1 mm of vacuum. The system is first evacuated to approximately 29" (740 mm) of mercury. Then add enough refrigerant vapor to the system to bring the pressure up to 0 pounds (0 microns).
3. Evacuate the system again to 29" (740 mm) of vacuum. Repeat his procedure three times. This method is most effective by holding system pressure at 0 pounds (0 microns) for a minimum of 1 hour between evacuations. The first pulldown removes about 90% of the noncondensables; the second removes about 90% of that remaining from the first pulldown. After the third pulldown, only 1/10 of 1% of noncondensables remains.

Table 7 on page 29 shows the relationship between pressure, microns, atmospheres, and the boiling point of water.

⚠ CAUTION

Before replacing refrigerant sensors or protective devices, see “Experience in the field has shown that R-407C systems can be “topped off” after a leak has been repaired and operate normally. There is no need, except in the case of a critically charged systems, to replace the entire charge after a leak has been repaired.” on page 109 for an important warning to prevent an abrupt loss of the entire charge.

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Table 7: Pressure-vacuum equivalents

Absolute pressure above zero		Vacuum below 1 atmosphere		Approximate fraction of 1 atmosphere	Boiling point of H2O at each pressure (°F)
Microns	PSIA	Mercury (mm)	Mercury (in.)		
0	0	760.00	29.921	—	—
50	0.001	759.95	29,920	1/15,200	–50
100	0.002	759.90	29.920	1/7,600	–40
150	0.003	759.85	29.920	1/5,100	–33
200	0.004	759.80	29.910	1/3,800	–28
300	0.006	759.70	29.910	1/2,500	–21
500	0.009	759.50	29.900	1/1,520	–12
1,000	0.019	759.00	29.880	1/760	1
2000	0.039	758.00	29.840	1/380	15
4,000	0.078	756.00	29.760	1/189	29
6000	0.117	754.00	29.690	1/127	39
8,000	0.156	752.00	29.600	1/95	46
10,000	0.193	750.00	29.530	1/76	52
15,000	0.290	745.00	29.330	1/50	63
20,000	0.387	740.00	29.130	1/38	72
30,000	0.580	730.00	28.740	1/25	84
50,000	0.967	710.00	27.950	1/15	101
100,000	1.930	660.00	25.980	2/15	125
200,000	3.870	560.00	22.050	1/4	152
500,000	9.670	260.00	10.240	2/3	192
760,000	14.697	0	0	1 Atmosphere	212

Charging the System

Units are leak tested at the factory and shipped with a nitrogen holding charge. If the holding charge has been lost due to shipping damage, charge the system with enough refrigerant to raise the unit pressure to 30 psig after first repairing the leaks and evacuating the system.

1. After all refrigerant piping is complete and the system is evacuated, it can be charged as described in the paragraphs following. Connect the refrigerant drum to the gauge port on the liquid shutoff valve and purge the charging line between the refrigerant cylinder and the valve. Then open the valve to the mid position.
2. If the system is under a vacuum, stand the refrigerant drum with the connection up, open the drum, and break the vacuum with refrigerant gas.
3. With a system gas pressure higher than the equivalent of a freezing temperature, invert the charging cylinder and elevate the drum above the condenser. With the drum in this position and the valves open, liquid refrigerant flows into the condenser. Approximately 75% of the total requirement estimated for the unit can be charged in this manner.
4. After 75% of the required charge enters the condenser, reconnect the refrigerant drum and charging line to the suction side of the system. Again, purge the connecting line, stand the drum with the connection side up, and place the service valve in the open position.

Important: At this point, interrupt the charging procedure and do prestart checks before attempting to complete the refrigerant charge.

Note: Stamp the total operating charge per circuit on the unit nameplate for future reference.

⚠ CAUTION

Adding refrigerant to the suction always risks liquid-related damage to the compressor.

Take special care to add refrigerant slowly enough to the suction to prevent damage. Adjust the charging tank hand valve so liquid leaves the tank but vapor enters the compressor.

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Refrigerant Charge

Factory-installed DX coils are designed to use R-22. The total charge per circuit is the sum of the following three values:

- Condenser section charge. Refer to manufacturer's data.
- Evaporator coil charge.
- Charge for length of interconnecting piping, installed by field.

Note: Factory-installed DX coils are intended for one refrigerant circuit on unit size 800 and two refrigerant circuits containing identical weights of refrigerant on all other sizes. The values shown in Table 8, Table 9 and Table 10 are for each circuit.

Note: The total operating charge per circuit should not exceed the pumpdown capacity per circuit.

Table 8: Approximate DX coil refrigerant charge per circuit

Unit size	DX Coil R-22 charge (lbs./circuit)	
	Flat coil	Staggered coil
047C	3 x no. of DX rows	3.5 x no. of DX rows
077C	5 x no. of DX rows	6.5 x no. of DX rows

Table 9: Approximate refrigerant charge per circuit

Unit size	Evaporator coil (lbs/ckt/coil row)
802	3.30
802C*	2.45

* The RDS 802C unit has two refrigerant circuits.

Table 10: Weight of refrigerant R-22 in copper lines (pounds per 100 feet of Type L tubing)

O.D. line size	Vol. per 100 ft. in cubic feet	Weight of refrigerant, lbs./100 feet			
		Liquid @ 100°F	Hot gas @120°F cond.	Suction gas (superheat to 85°F)	
				30°F	40°F
3/8"	0.054	3.84	0.202	0.052	0.077
1/2"	0.100	7.12	0.374	0.098	0.143
5/8"	0.162	7.12	0.605	0.158	0.232
7/8"	0.336	24.00	1.260	0.323	0.480
1 1/8"	0.573	40.80	2.140	0.550	0.820
1 3/8"	0.872	62.10	3.260	0.839	1.250
1 5/8"	1.237	88.00	4.620	1.190	1.770
2 1/8"	2.147	153.00	8.040	2.060	3.060
2 5/8"	3.312	236.00	12,400	3.180	4.720
3 1/8"	4.728	336.00	17.700	4.550	6.750
3 5/8"	6.398	456.00	24.000	6.150	9.140
4 1/8"	8.313	592.00	31.100	8.000	11.190

Unit Piping

Condensate Drain Connection

- The unit is provided with a 1.5" male NPT condensate drain connection. Refer to certified drawings for the exact location. For proper drainage, level the unit and drain pan side to side and install a P-trap
- Units may have positive or negative pressure sections. Use traps in both cases with extra care given to negative pressure sections. In Figure 33, dimension "A" should be a minimum of 8" (203 mm). As a conservative measure to prevent the cabinet static pressure from blowing or drawing the water out of the trap and causing air leakage, dimension A should be two times the maximum static pressure encountered in the coil section in inches w.c.
- 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 provide drainage to the main drain pan. Check that the copper tubes are in place and open before the unit is put into operation.
- On units with staggered cooling coils, the upper drain pan drains into the lower coil drain pan through a copper tube near the center of the drain pan. Check that this tube is open before putting the unit into operation and as a part of routine maintenance.

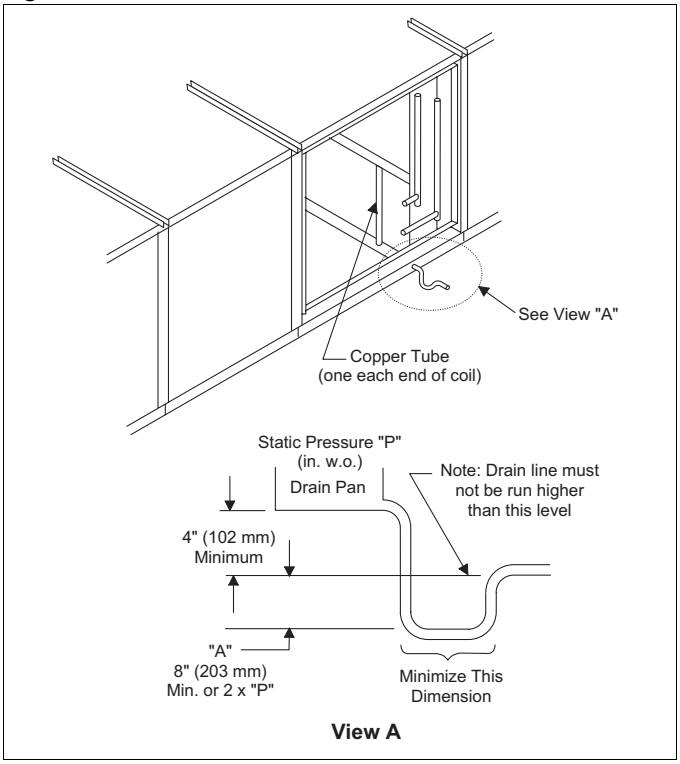
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- Because drain pans in any air conditioning unit have some moisture in them, algae, etc. will grow. Periodically clean to prevent this buildup from plugging the drain and causing the drain pan to overflow. Clean drain pans to prevent the spread of 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 33. Condensate drain connection



Gas Piping

See the “Installation” section of the gas-fired furnace installation manual, Bulletin No. IM 684 or 685.

Piping for Steam, Hot Water/ChIlled Water Coils

Factory-installed chilled water coils are installed in a coil section that can be designed to accept a factory-installed heating coil immediately upstream. The coil section can be ordered in either the draw-through or blow-through position. All chilled water piping can be done internal to the unit without requiring a piping vestibule (except on sizes 800–802 when heating coils are included in the cooling coil section).

Steam and hot water coils can be factory installed in either a heat section, or in the combination coil section. These sections can be located either in the draw-through or blow-through position. When a steam or hot water coil is installed in the heat section, all piping can be done internal to the unit without requiring a piping vestibule. Refer to Figure 35 and Figure 37 on page 33.

When a steam or hot water coil is installed in the combination coil section, the coil connections project to the inside surface of the door panel. Holes can be cut in the door panels to connect the piping to the coils, or an accessory piping vestibule can be added to the unit to provide piping space. Refer to the section on vestibule assembly instructions. The piping can then be routed back within the unit as shown in Figure 35 on page 32.

To avoid piping penetrations through the roof external to the curb, holes can be cut through the floor of the unit at the locations specified on the certified drawings.

⚠ CAUTION

Seal all holes in the unit floor to prevent water leakage into the building.

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Hot Water Piping

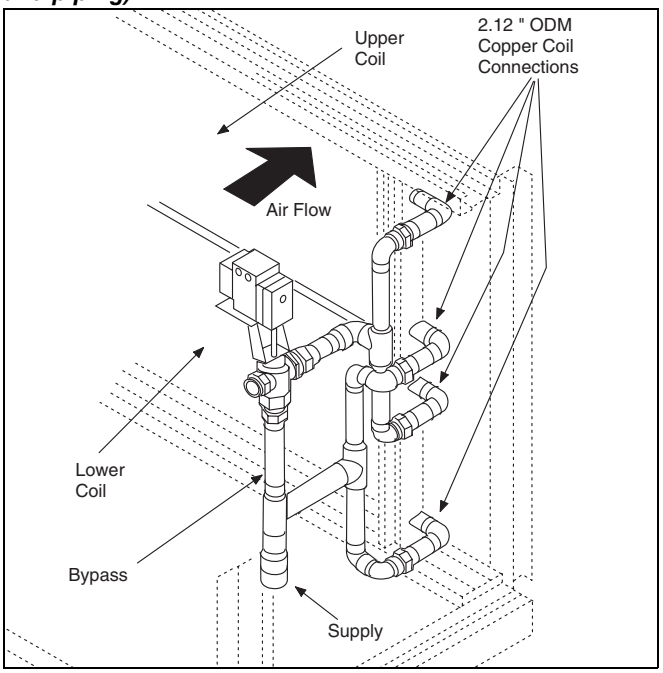
Hot water coils are provided without valves for field piping or piped with three-way valves and actuator motors.

With the factory piping and valve package, the two coils are piped in parallel and controlled through a single three-way valve. Field piping connections are of the same NPT size as the valve-male threads at the supply connection, female threads at the return connection.

Hot water coils are not normally recommended for use with entering air temperatures below 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 temperature conditions. Refer to the "Maintenance" section of this manual for more on winterizing coils. The hot water section consists of two stacked soils, as shown in Figure 34.

When no factory piping or valve is included, the coil connections are 1.625" ODM copper on 800 and 802C and 2.12" ODM copper on 047 and 077C. With the factory piping and valve package, the two coils are piped in parallel and controlled through a single three-way valve. Field piping connections are of the same NPT size as the valve-male threads at the supply connection, female threads at the return connection.

Figure 34. Hot water heat section (shown with factory valve and piping)



Note: The valve actuator spring returns to a stem up position upon power failure. This allows full flow through the coil.

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

Note: Factory-installed water valves and piping are bronze, brass, and copper. Dissimilar metals within the plumbing system can cause galvanic corrosion. To avoid corrosion, provide proper di-electric fittings as well as appropriate water treatment.

⚠ CAUTION

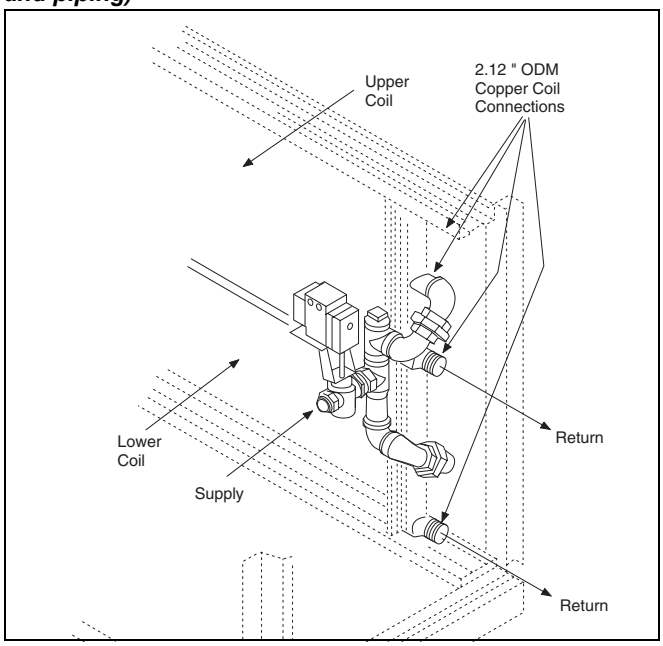
Coil freeze possible. Can damage equipment.
Follow instructions for mixing antifreeze solution used. Some products have higher freezing points in their natural state than when mixed with water. The freezing of coils is not the responsibility of McQuay International. Refer to "Winterizing Water Coils" on page 109.

Steam Coil Piping (All Units)

The steam heat section consists of two stacked coils pitched at 1/8" (3 mm) per foot (305 mm) as shown in Figure 35 to provide positive condensate removal. When no factory piping or valve is included, the coil connections are 2.5" male NPT iron pipe.

Note: The valve actuator spring returns to a stem up position upon power failure. This allows full flow through the coil.

Figure 35. Steam heat section (shown with factory valve and piping)



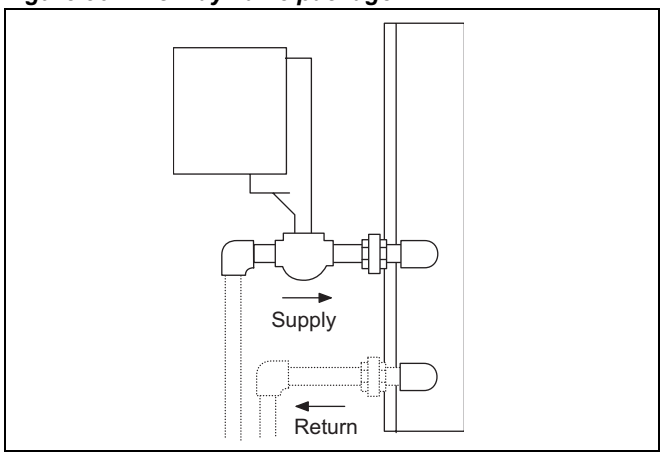
With the factory piping and valve package, the two coil supplies are piped in parallel and controlled through a single two-way valve. The field supply connection is of the same female NPT size as the valve. Field return connections are made at the 2.50" male NPT fittings on each of the two stacked coils.

Refer to the sections on steam coil piping and trap recommendations for additional information.

Note: The valve actuator spring returns to a stem up position upon power failure. This allows full flow through the coil.

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Figure 36. Two-way valve package



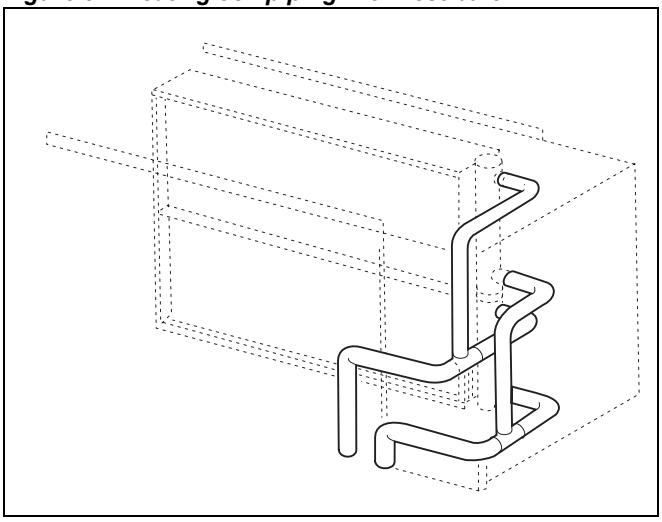
Steam Piping Recommendations

1. Be certain that adequate piping flexibility is provided. Stresses resulting from expansion of closely coupled piping and coil arrangement can cause serious damage.
2. Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to the trap.
3. Install vacuum breakers on all applications to prevent retaining condensate in the coil. Generally, the vacuum breaker is to be connected between the coil inlet and the return main. However, if the system has a flooded return main, the vacuum breaker to the atmosphere; the trap design should allow venting of the large quantities of air.
4. Do not drain steam mains or takeoffs through coils. Drain mains ahead of coils through a steam trap to the return line.
5. Do not attempt to lift condensate when using modulating or on-off control.
6. Pitch all supply and return steam piping down a minimum of 1" (25 mm) per 10 feet (3 m) of direction of flow.

Steam Trap Recommendations

1. Size traps in accordance with manufacturers' recommendations. Be certain that the required pressure differential will always be available. Do not undersize.
2. Float and thermostatic or bucket traps are recommended for low pressure steam. Use bucket traps on systems with on-off control only.
3. Locate traps at least 12" (305 mm) below the coil return connection.
4. Always install strainers as close as possible to the inlet side of the trap.
5. A single tap may generally be used for coils piped in parallel, but an individual trap for each coil is preferred.

Figure 37. Heating coil piping with vestibule



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Steam Coil Freeze Conditions

If the air entering the steam coil is below 35°F (2°C), note the following recommendations:

1. Supply 5 psi (34.5 kPa) steam to coils at all times.
2. Modulating valves are not recommended. Control should be by means of face and bypass dampers.
3. As additional protection against freeze-up, install the tap sufficiently far below the coil to provide an adequate hydrostatic head to ensure removal of condensate during an interruption on the steam pressure. Estimate 3 ft. (914 mm) for each 1 psi (7 kPa) of trap differential required.
4. If the unit is to be operated in environments with possible freezing temperatures, an optional freezestat is recommended. See “Freeze Protection” on page 85 for additional information.

Figure 38. Valve assembly

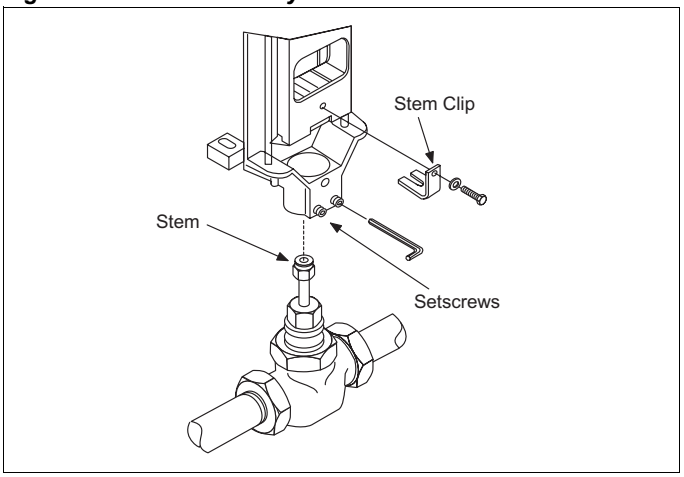
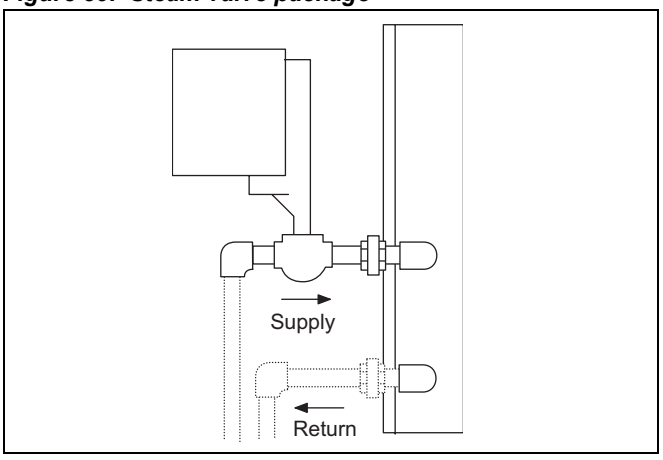


Figure 39. Steam valve package

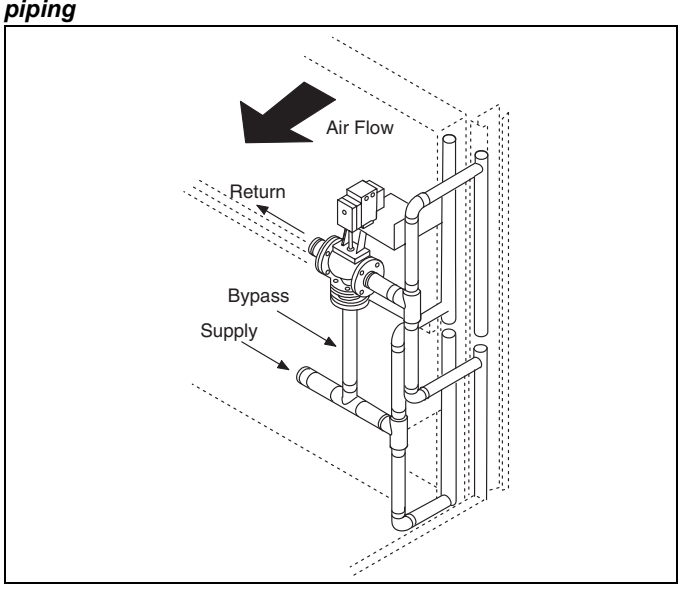


Chilled Water Piping

Chilled water coils are provided without valves for field piping, or piped with three-way valves with motor actuators. Table 11 provides information on units with factory installed piping and valve packages. The table also provides field sweat connection information for units not furnished with factory installed piping and valve packages.

With the factory piping and valve package, the coil assembly is controlled through a single three-way valve. When two coils are included in the assembly, they are piped in parallel. Field connections are male NPT, sized as shown in Table 11. Refer to Figure 40 for a typical cooling coil with factory valve and piping.

Figure 40. Chilled water coil (shown with factory valve and piping



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Table 11: Piping connection sizes/valve size options for chilled water piping

Cabinet size	Application code	Coil size Hx 83" (2108 mm) long	Face area sq. ft. (sq. m)	Available rows (available with 8, 10, 12 fins/in)	Available circuiting									
					5WH		5WL		5WS		5WM		5WD	
					Columns (see next page for explanation)									
					1	2	1	2	1	2	1	2	1	2
047C	Blow-thru or draw-thru small coil section	33 + 33 (2 coils) (838 + 838 mm)	38.0 (3.53 m²)	3	D	R	D	Q	—	—	A	Q	A	P
				4	D	R	D	Q	B	Q	B	Q	B	P
				5	D	R	D	Q	—	—	B	Q	A	P
				6	D	R	D	Q	B	Q	B	Q	A	P
				8	D	R	D	Q	B	Q	B	Q	B	P
	Blow-thru or draw-thru large coil section	39 + 39 (2 coils) (991 + 991 mm)	45.0 (4.18 m²)	3	D	R	C	Q	—	—	A	Q	A	P
				4	D	R	C	Q	C	Q	C	Q	B	P
				5	D	R	C	Q	—	—	C	Q	A	P
				6	D	R	C	Q	C	Q	C	Q	A	P
				8	D	R	C	Q	C	Q	C	Q	B	P
	Face and bypass section with small coil	48 (1219 mm)	27.7 (2.57 m²)	3	F	U	E	T	—	—	A	S	A	S
				4	F	U	E	T	C	S	C	S	C	S
				5	F	U	E	T	—	—	C	S	A	S
				6	F	U	E	T	C	S	C	S	A	S
				8	F	U	E	T	C	S	C	S	C	S
	Face and bypass section with large coil	39 + 39 (2 coils) (991 + 991 mm)	45.0 (4.18 m²)	3	D	R	C	Q	—	—	A	Q	A	P
				4	D	R	C	Q	C	Q	C	Q	B	P
				5	D	R	C	Q	—	—	C	Q	A	P
				6	D	R	C	Q	C	Q	C	Q	A	P
				8	D	R	C	Q	C	Q	C	Q	B	P
077C	Blow-thru or draw-thru small coil section	45 + 45 (2 coils) (1143 + 1143 mm)	51.9 (4.82 m²)	3	C	R	C	Q	—	—	A	P	A	P
				4	C	R	C	Q	C	P	B	P	B	P
				5	C	R	C	Q	—	—	B	P	A	P
				6	C	R	C	Q	C	P	B	P	A	P
				8	C	R	C	Q	C	P	B	P	B	P
	Blow-thru or draw-thru large coil section	63 + 63 (2 coils) (1600 + 1600 mm)	72.6 (6.74 m²)	3	B	Q	B	P	—	—	A	P	A	P
				4	B	Q	B	P	B	P	B	P	B	P
				5	B	Q	B	P	—	—	B	P	A	P
				6	B	Q	B	P	B	P	B	P	A	P
				8	B	Q	B	P	B	P	B	P	B	P
	Face and bypass section with small coil	63 (1600 mm)	36.3 (3.37 m²)	3	E	T	C	S	—	—	A	S	A	S
				4	E	T	C	S	C	S	C	S	C	S
				5	E	T	C	S	—	—	C	S	A	S
				6	E	T	C	S	C	S	C	S	A	S
				8	E	T	C	S	C	S	C	S	C	S
	Face and bypass section with large coil	54 + 54 (2 coils) (1372 + 1372 mm)	62.3 (5.74 m²)	3	C	R	C	Q	—	—	A	P	A	P
				4	C	R	C	Q	B	P	B	P	B	P
				5	C	R	C	Q	—	—	B	P	A	P
				6	C	R	C	Q	B	P	B	P	A	P
				8	C	R	C	Q	B	P	B	P	B	P
800 or 802	Blow-thru or draw-thru cooling only coil section	48 + 78 (1220 + 1981 mm)	26.0 (2.42 m²)	3	G	T	G	T	—	—	—	—	—	—
				4	G	T	G	T	G	T	—	—	—	—
				5	G	T	G	T	—	—	—	—	—	—
				6	G	T	G	T	G	T	—	—	—	—
	Blow-thru or draw-thru unit coil section	48 + 78 (1220 + 1981 mm)	26.0 (2.42 m²)	3	G	T	G	T	—	—	—	—	—	—
				4	G	T	G	T	G	T	—	—	—	—
				5	G	T	G	T	—	—	—	—	—	—
				6	G	T	G	T	G	T	—	—	—	—
	Face and bypass section with small coil	30 + 79 (763 + 2006 mm)	16.5 (2.57 m²)	3	—	L	—	M	—	—	—	N	—	N
				4	—	L	—	M	—	M	—	N	—	N
				5	—	L	—	M	—	—	—	N	—	N
				6	—	L	—	M	—	M	—	N	—	N
				8	—	L	—	M	—	M	—	N	—	N
				10	—	L	—	M	—	—	—	N	—	N
	Blow-thru or draw-thru contractor coil section	36 + 79 (915 + 2006 mm)	19.8 (4.18 m²)	3	—	L	—	M	—	K	—	N	—	N
				4	—	L	—	M	—	—	—	N	—	N
				5	—	L	—	M	—	K	—	N	—	N
				6	—	L	—	M	—	K	—	N	—	N
				8	—	L	—	M	—	K	—	N	—	N
				10	—	L	—	M	—	K	—	N	—	N

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Table Available Circuiting Legend

Column 1:

These units are available with a factory installed package consisting of a three-way water valve and connecting piping.

A = This combination is not available with a factory-installed piping and valve package.

B = 300, 2.50, or 200 inch three-way valves can be specified

C = 300, 2.50, 2.00, or 150 inch three-way valves can be specified

D = 250, 200, or 150 inch three-way valves can be specified

E = 250, 200, 150, or 1.25 inch three-way valves can be specified

F = 200, 1.50, or 125 inch three-way vales can be specified

G = 1.25, 1.50, 2.00 or 2.50 inch three-way valves can be specified

Field supply and return female NPT connection sizes are the same as the valve size.

Column 2:

The following letters designate units that are not furnished with the factory installed piping/valve package. Required are field sweat connections, at one or two coils, to male copper tubing for the supply and return water piping.

K = A single 2.00 inch NPT supply and return if fin height is 21–30 inches and 2.50 inches of fin height is 30–36 inches.

L = A single 1.50 inch NPT supply and return

M = A single 2.00 inch NPT supply and return if fin height is 21–30 inches

N = A single 2.50 inch NPT supply and return

P = Two 3.12 inch O.D. supply and two 3.12 O.D. return connections

Q = Two 2.62 inch O.D supply and two 2.62 O.D. return connections

R = Two 2.12 inch O.D. supply and two 2.12 O.D. return connections

S = One 3.12 inch O.D supply and one 3.12 O.D. return connections

T = One 2.62 inch O.D supply and one 2.62 O.D. return connections

U = One 2.12 inch O.D supply and one 2.12 O.D. return connections

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Vestibule Assembly Instructions

An accessory vestibule is available to provide additional piping space for coils installed in a four-foot section. A vestibule is required to maintain door access on a combination heating and cooling section. Assemble the vestibule to the unit part by part as shown in Figure 41.

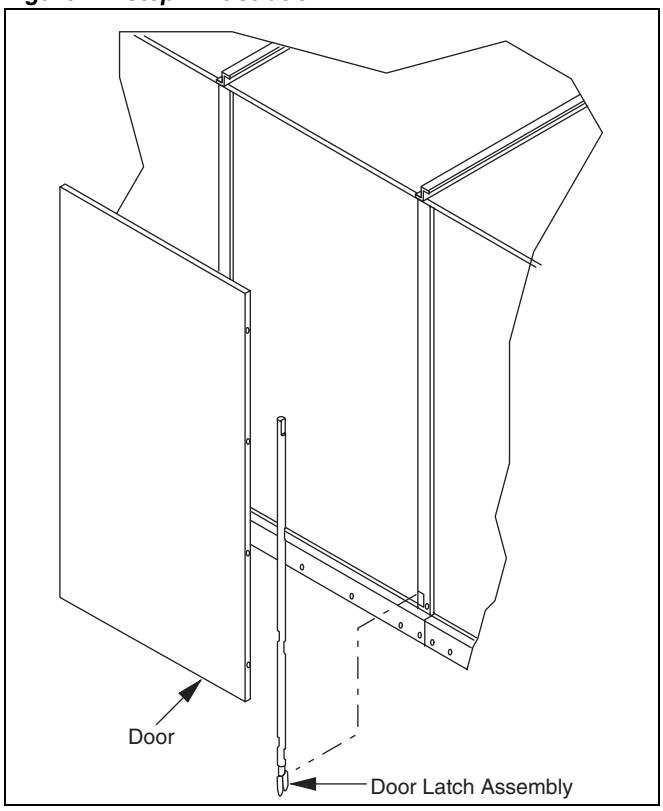
Note: The door, hinge, and latch assemblies from the unit are used on the vestibule.

Step 1

Remove door from section where vestibule is to be located by removing screws holding hinges to upright support (leave hinges on door). Set door aside and save for Step 4.

- Remove door latch assembly from other side upright support. Use offset Phillips screwdriver or a wrench to remove screws holding latch assembly in place. Save door latch assembly, screws and bushings for Step 4.

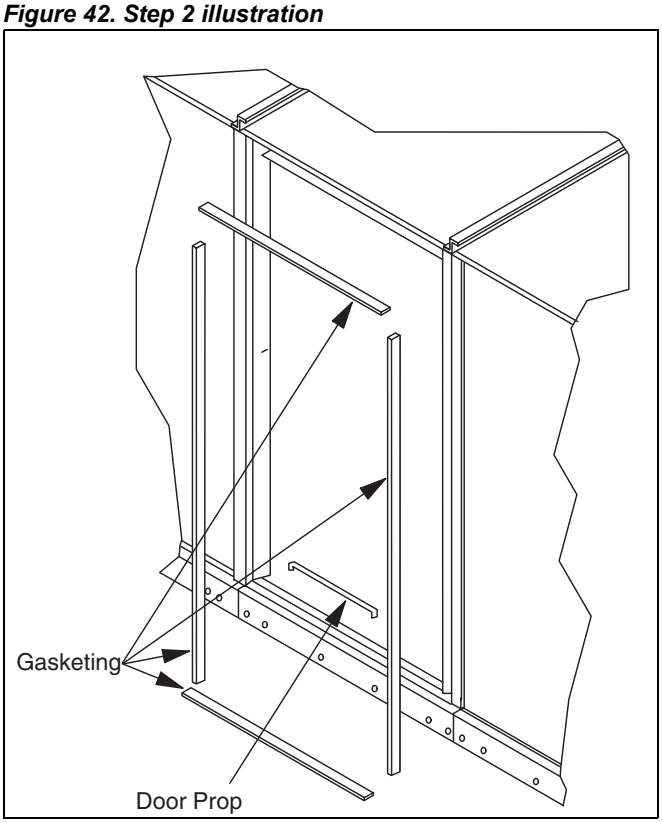
Figure 41. Step 1 illustration



Step 2

Remove gasketing around door flange and save for use on vestibule. See Step 4. Remove door and save for Step 4.

Figure 42. Step 2 illustration

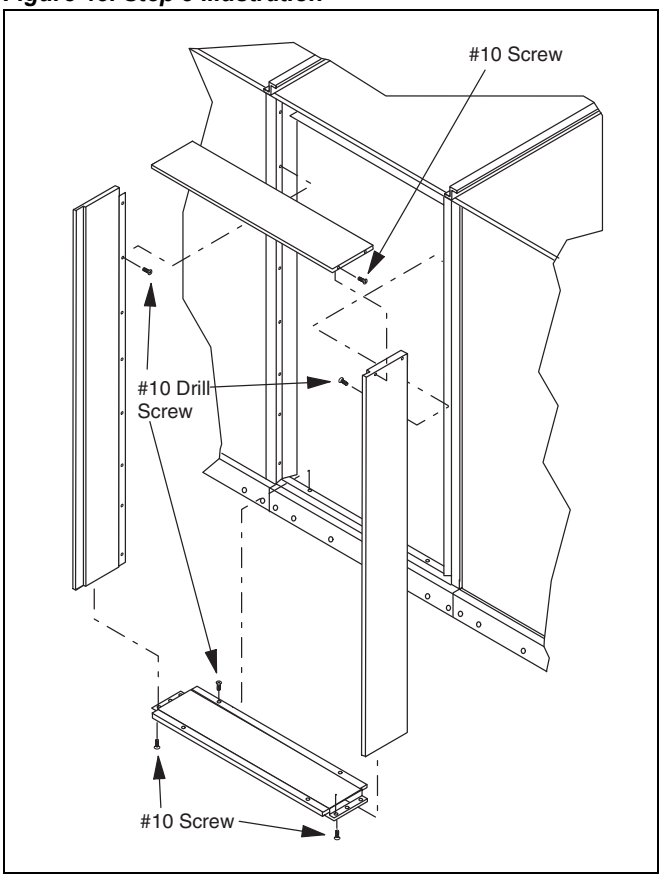


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Step 3

1. Assemble side panels A and B to uprights using #10 drill screws supplied. Make certain side panels are flush against uprights before securing into place.
2. Fasten bottom panel D to base channel using #10 drill screws and to side panels A and B using #10 screws supplied.
3. Set top panel C in place and fasten to side panels A and B using #10 screws and to top panel using #10 screws supplied.

Figure 43. Step 3 illustration

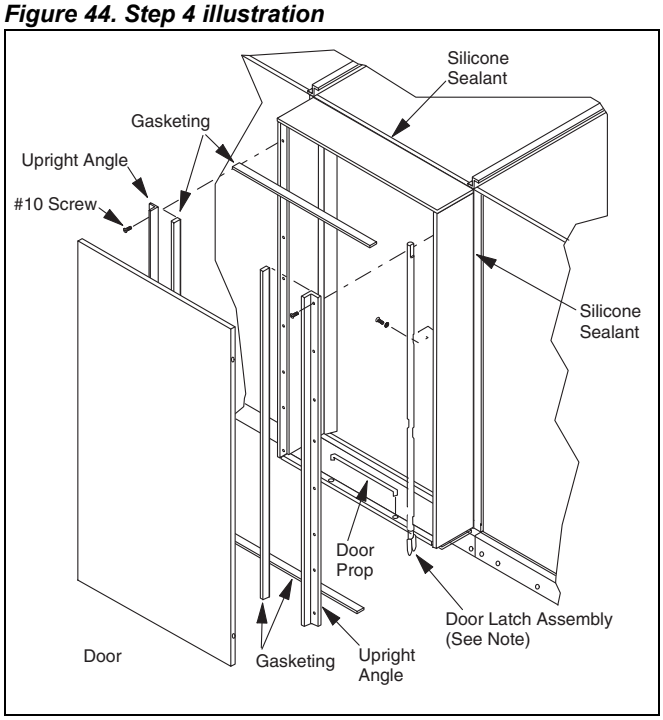


Step 4

1. Reassemble access door to vestibule by screwing hinges into side panel using screws saved from Step 1. (Access door must be attached to the vestibule in the same opening direction as it was on the unit.)
2. Remove and discard latch handle locking screws and retaining washer. Fasten door latch assembly to side panel using screws and bushings saved from Step 1. (Latch must be fastened on the same side as when located on the unit.)
3. Fasten upright angles to vestibule using #10 screws supplied.
4. Seal between unit and vestibule with silicone sealant along top and sides as shown.

Note: Any holes cut in the floor of the unit must be sealed to prevent water leakage.

Figure 44. Step 4 illustration



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Damper Assemblies

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

Economizer Dampers

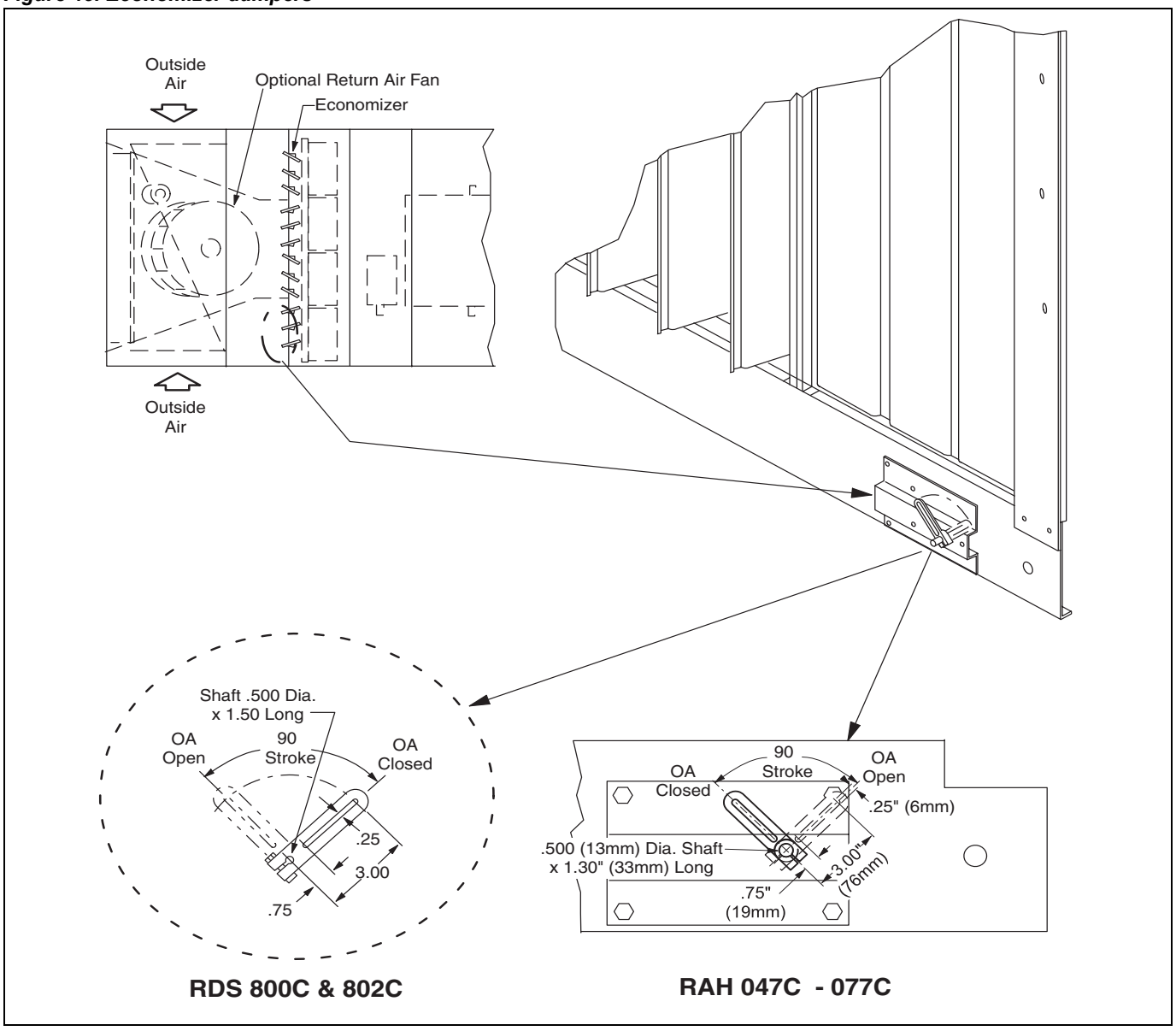
Outside air intake is provided on both sides of the unit, and the return air path is at the center of the damper set. As the single actuator modulates the outside air dampers open, the return air dampers close. Exhaust air exits the unit through the gravity relief dampers provided at the end of the economizer section.

The outside air return air damper assembly (economizer) comes with manually adjustable linkage. This adjustable linkage also can be used for connecting a damper operator.

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 (see Figure 45). Access to the actuator and linkage is from the filler section. 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. The unit ships with a shipping bolt securing the linkage crankarm. Remove shipping bolt before use.

Note: For good airflow control, adjust linkages so damper blades do not open beyond 70 degrees. Opening a damper blade beyond 70 degrees has little effect on its airflow.
Do not “over close” low leak damper blades. The edge seal should just lightly contact the adjoining blade. The blades will lock up if they are closed so far the seal goes over center.

Figure 45. Economizer dampers



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Intake Hood Damper (0% to 100% outside air, RAH 47–77 only)

Units requiring 100% outside air are provided with a rain hood and dampers that can be controlled by a single actuator. The actuator provides two-position control for opening the dampers fully during unit operation and closing the dampers during the off cycle. No unit mounted exhaust dampers are provided.

Intake Hood Damper (0% to 30% outside air)

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. This setting is made at the linkage rod on units with manually adjustable linkages.

On units provided with MicroTech II controls, the damper position may be set at the controller keypad. During unit operation, the two-position actuator drives the damper to the position set on the keypad. During the off cycle, the damper is automatically closed.

No unit-mounted exhaust dampers are provided with this option.

Figure 46. Intake hood damper, 0% to 30% outside air

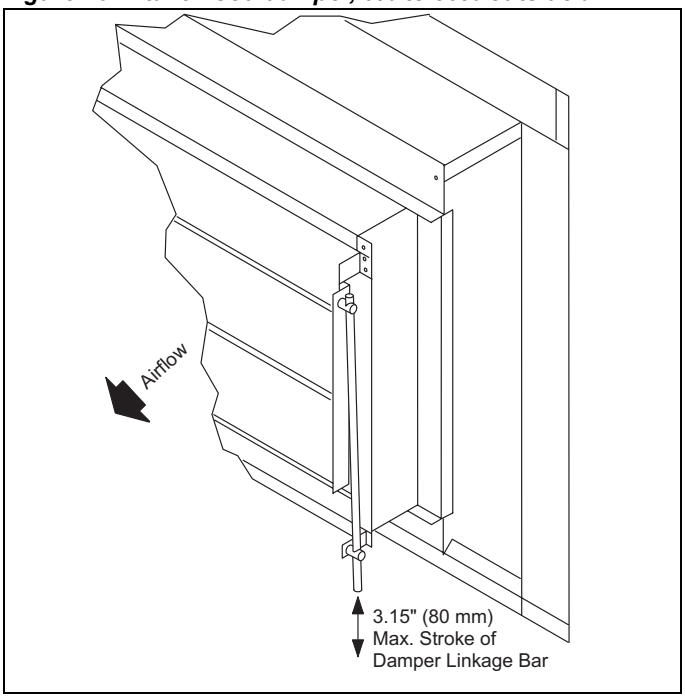
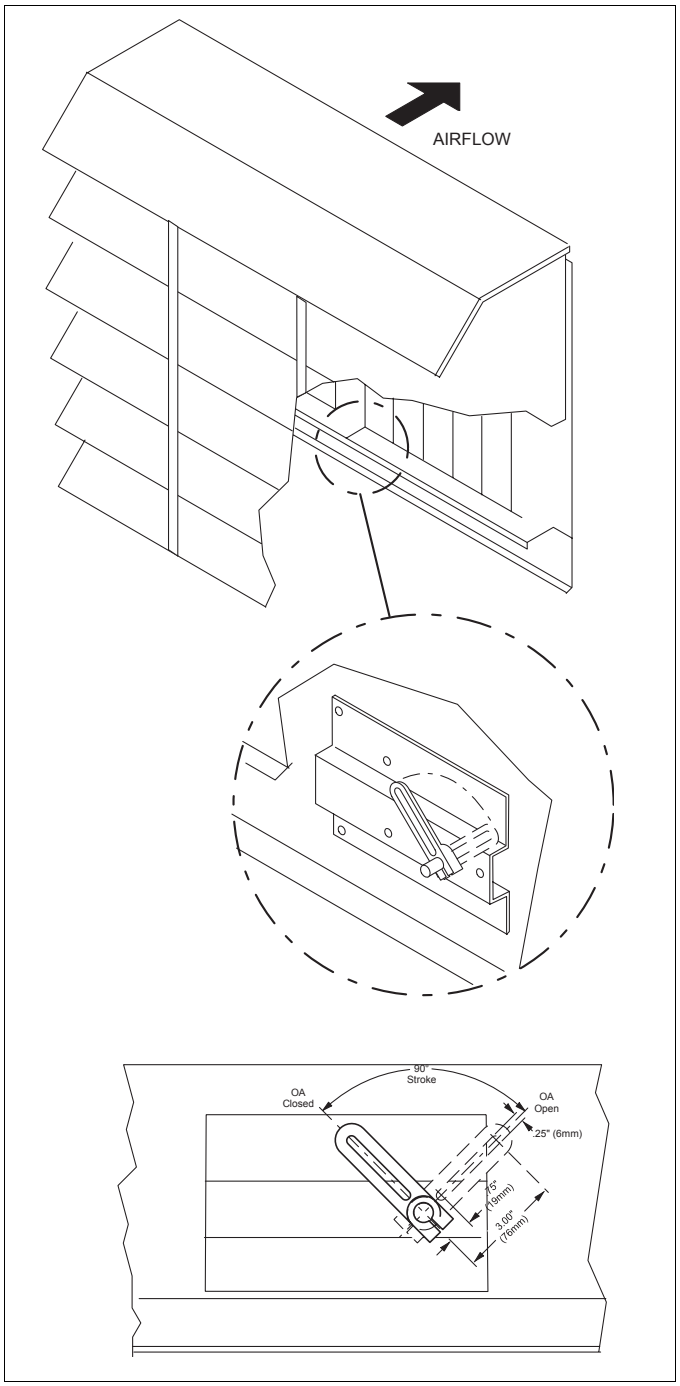


Figure 47. Intake hood damper adjustment, 0% to 100% outside air



Note: Figure 46 shows the RAH 47–77 (The linkage is on the RH side). The RDS 800–802 are the same except the linkage is on the LH side.

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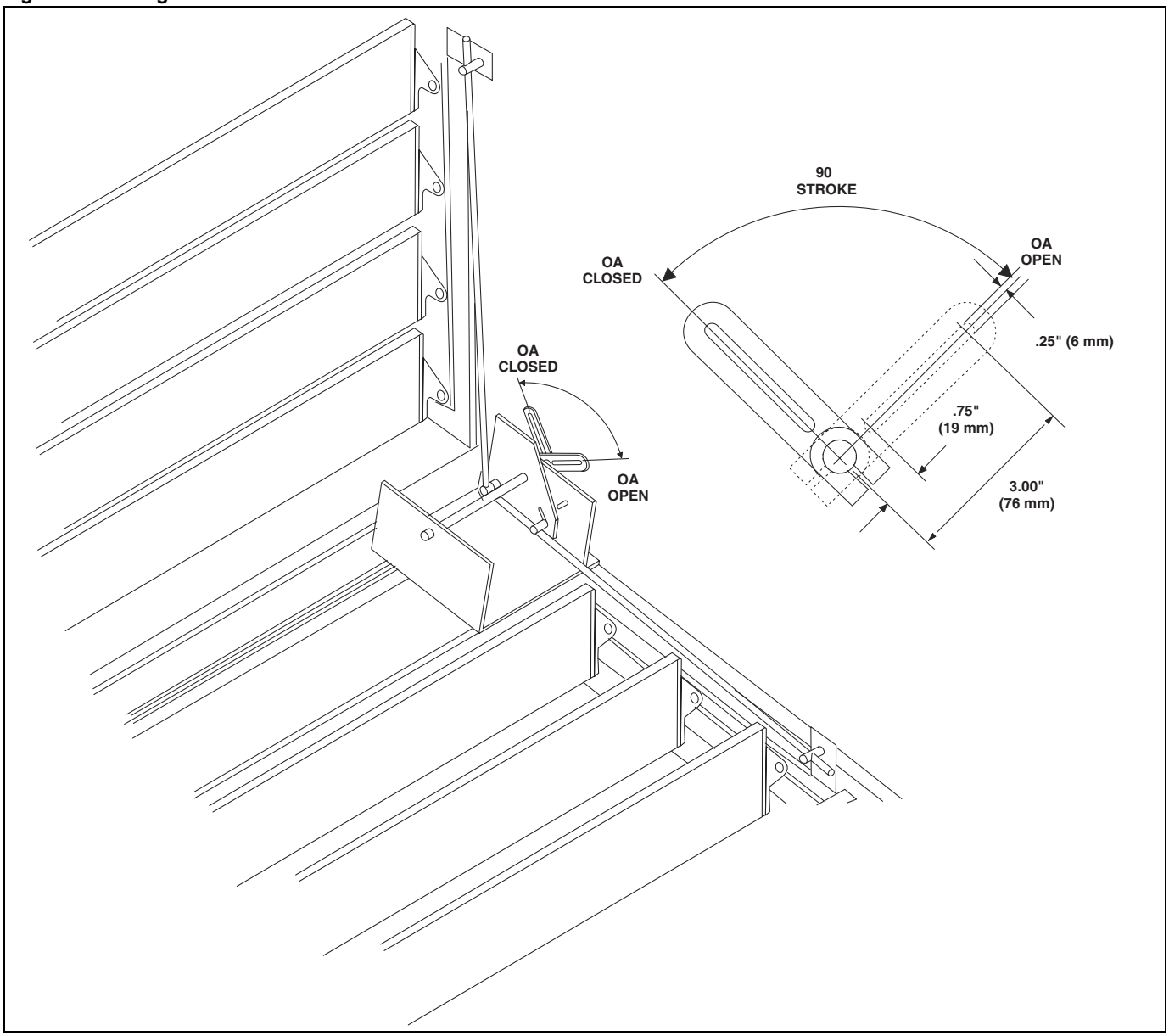
Mixing Box (RAH 47–77 only)

This section uses an outside air damper and a return air damper. Using these dampers allows outside air to blend with return air. Synchronized operation of the dampers is accomplished by interconnecting rods. As one damper section opens, the other section is closed. A total of 100% cfm is always drawn from this section. Damper positioning can be manually or automatically adjusted. With a field-installed controller, automatic operation can be obtained.

These dampers provide a similar function to economizer dampers. This option differs from an economizer in that no unit mounted exhaust dampers are provided.

Note: For good airflow control, adjust linkages so damper blades do not open beyond 70 degrees. Opening a damper blade beyond 70 degrees has little effect on its airflow. Do not “over close” low leak damper blades. The edge seal should just lightly contact the adjoining blade. The blades lock up if they are closed so far that the seal goes over center.

Figure 48. Mixing box



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Face and Bypass Dampers

Face and bypass dampers are available in a flat arrangement for use with heating coils and standard face area cooling coils, as well as a staggered arrangement for large face area cooling coils. The damper sets are linked through a jack shaft for connection to a single actuator (factory or field installed).

Figure 49. Face and bypass dampers, RDS 800–802 only

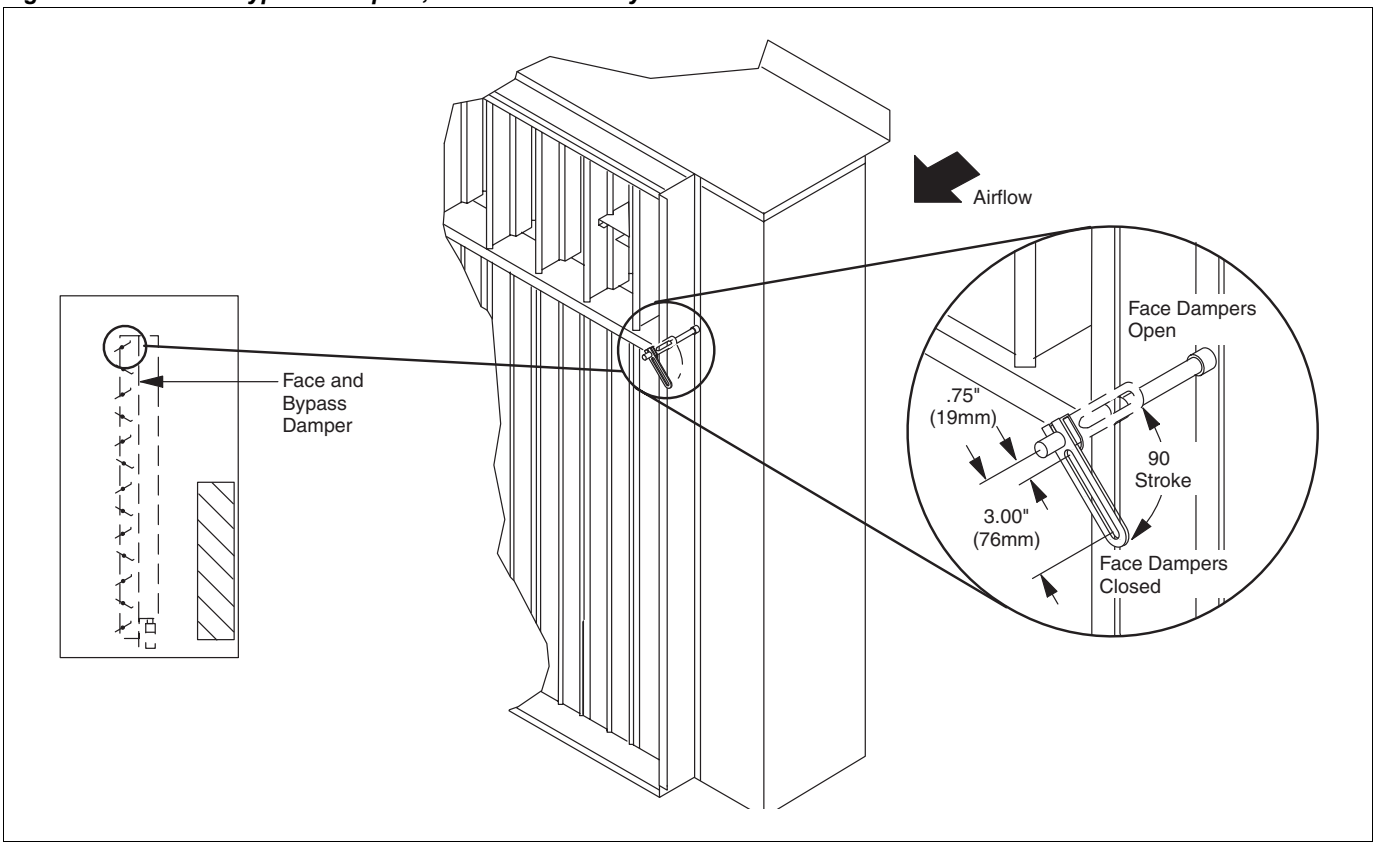
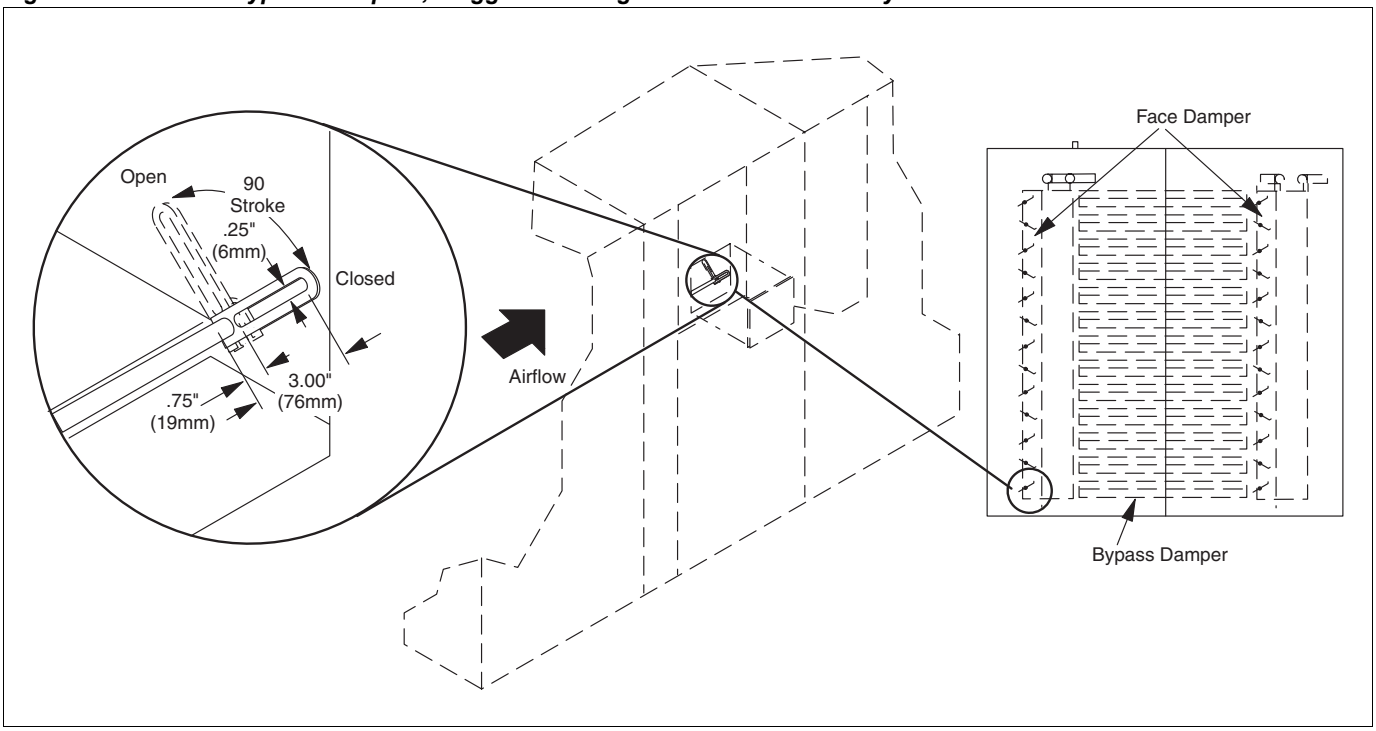
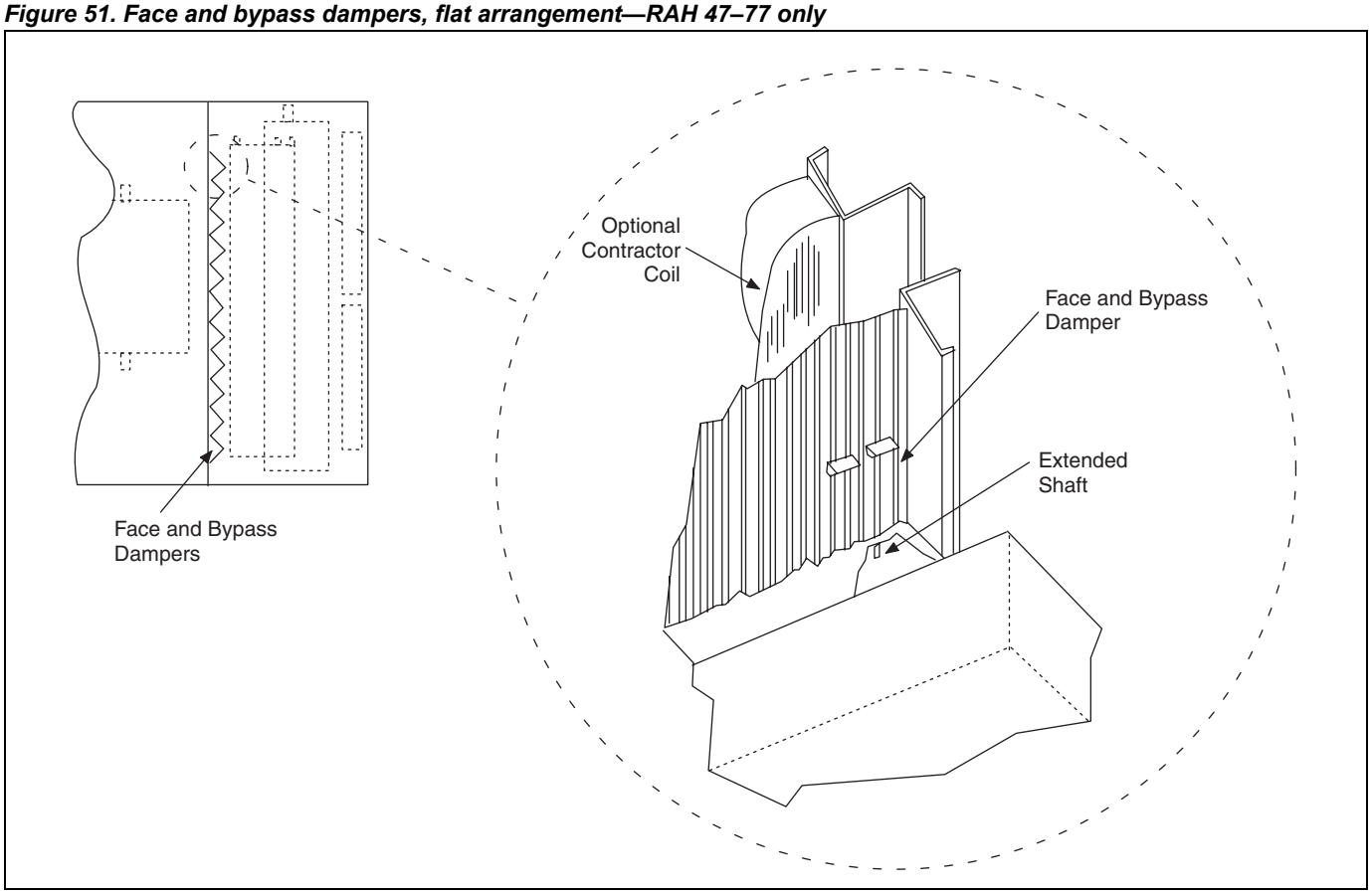


Figure 50. Face and bypass dampers, staggered arrangement–RAH 47–77 only



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Figure 51. Face and bypass dampers, flat arrangement—RAH 47–77 only



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.

Recaulk field-assembled options such as external piping or vestibules per the installation instructions provided with the option.

⚠ 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.

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Installing Ductwork

On bottom-supply/bottom-return units if a McQuay roof curb is not used, installing contractor should make an airtight connection by attaching field fabricated duct collars to the bottom surface of either the roof curb's duct flange or the unit's duct opening. Do not support the total weight of the duct work from the unit or these duct flanges. See Figure 52.

Units with optional back return, side discharge, or end discharge all have duct collars provided. To expose the discharge duct collars on a side discharge unit, remove the plenum section access door and the door gasketing.

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.

⚠ WARNING

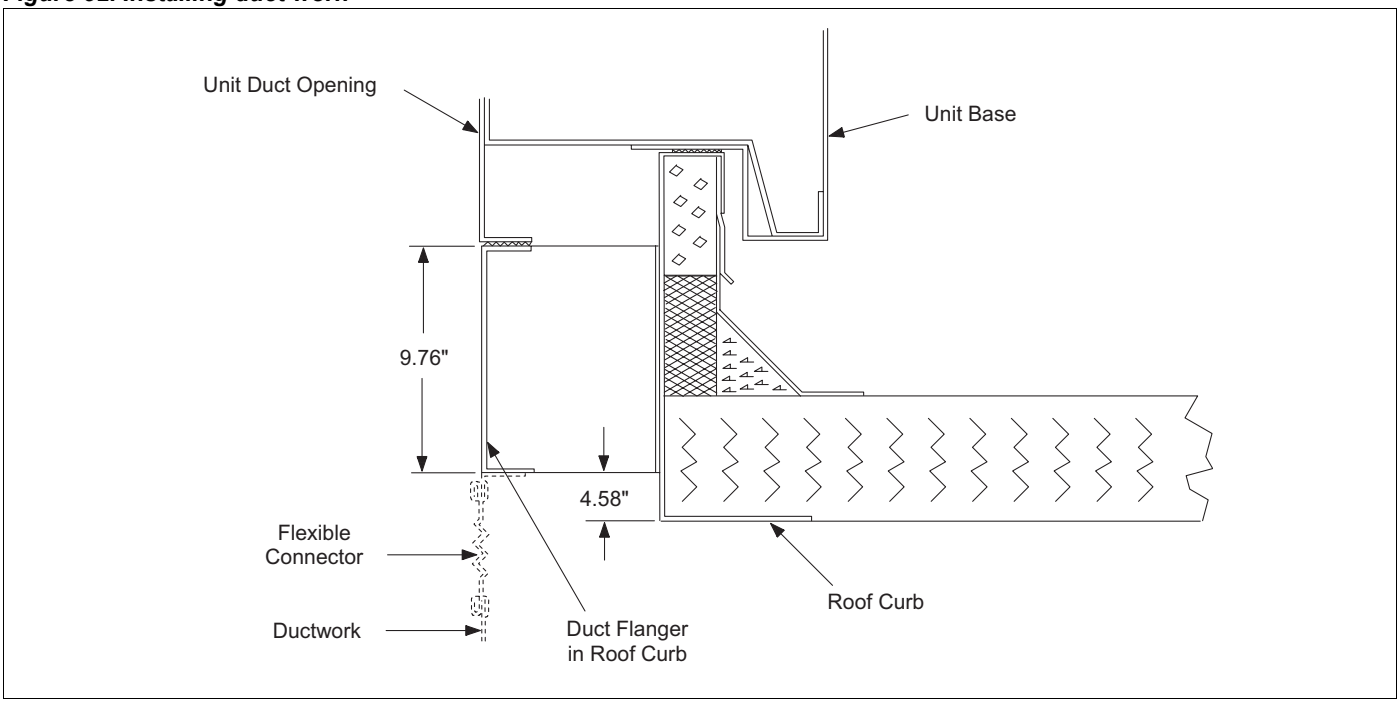
Mold can cause personal injury. Materials such as gypsum wall board can promote mold growth when damp. Such materials must be protected from moisture that can enter units during maintenance or normal operation.

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

NOTICE

Installer must provide access in the ductwork for plenum-mounted controls.
Once duct work is installed in units with side discharge, access to plenum-mounted components is difficult.

Figure 52. Installing duct work



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Installing Duct Static Pressure Sensor Taps

For all VAV units, duct static pressure taps must be field installed and connected to the pressure sensors in the unit. Sensor SPS1 is standard; additional sensor SPS2 is optional. These sensors are located in the main control panel (see “Control Panel” on page 8).

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. McQuay recommends ¼" plastic 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 54).
7. Locate the reference pressure (LO) tap somewhere near the duct pressure tap within the building (see Figure 53). If the reference tap is not connected to the sensor, unsatisfactory operation will result.
8. Route the tubes between the curb and the supply duct, and feed them into the unit through the knockout in the bottom of the control panel (see Figure 53). Connect the tubes to appropriate barbed fittings in the control panel. (Fittings are sized to accept ¼" plastic tubing.)

Figure 53. Static pressure tubing entrance location

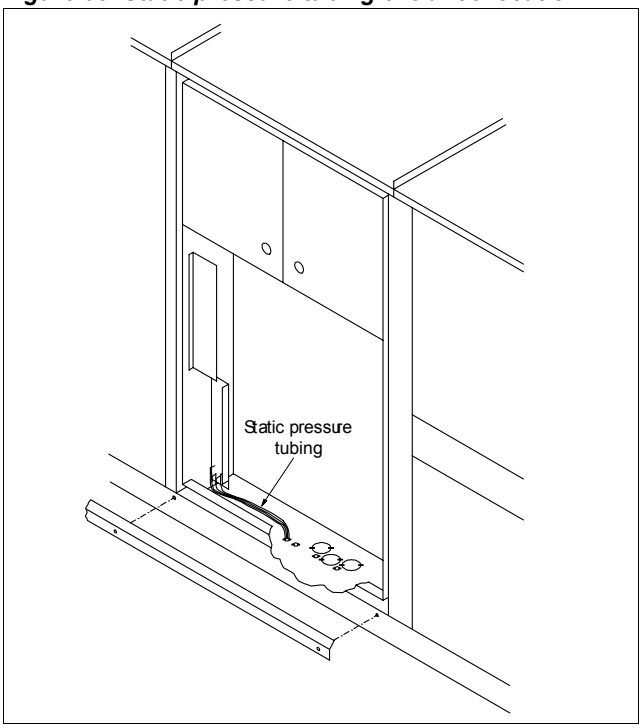
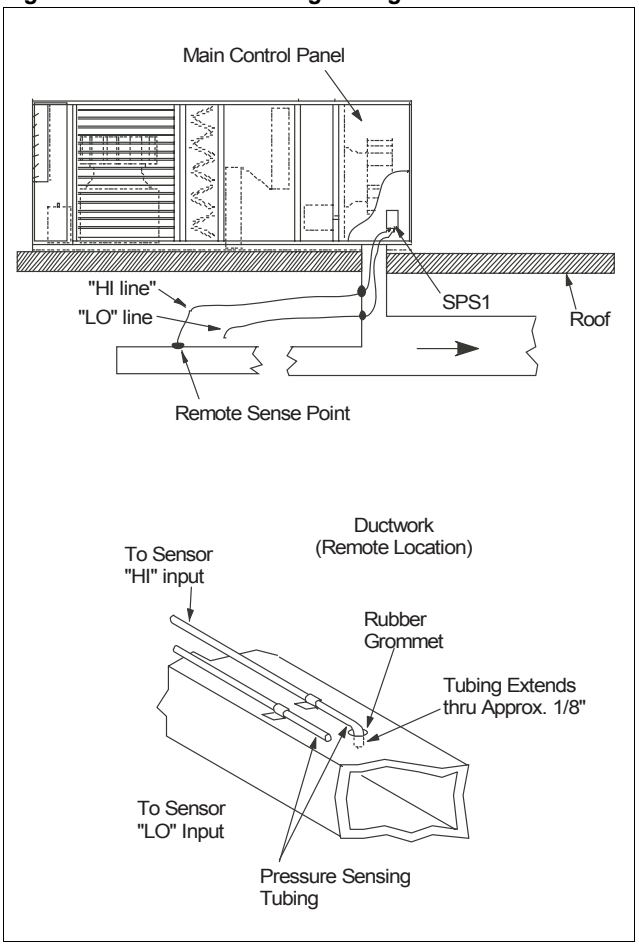


Figure 54. Pressure sensing tubing installation



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Installing Building Static Pressure Sensor Taps

If a unit has direct building static pressure control capability, you must field install and connect static pressure taps to pressure sensor SPS2 in the unit. This sensor is located at the bottom of the main control panel next to terminal block TB2 (see “Control Panel Locations” in the “Unit Description” section of this manual).

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 (HI) 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 between the curb and the supply duct and feed it into the unit through the knockout in the bottom of the control panel (see Figure 53). Connect the tube to the ¼-inch HI fitting for sensor SPS2.
5. Locate the reference pressure (LO) 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 edge of the control wiring raceway cover (see Figure 53 on page 45). Cut this “mouse hole” in the vertical portion of the edge. Seal the penetration to prevent water from entering. Connect tube to the ¼-inch LO fitting for sensor SPS2.

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 (HI) and reference pressure (LO) taps, or tag the tubes.
3. Regardless whether the controlled space is positive or negative with respect to its reference, locate the HI pressure tap in the controlled space. (The setpoint can be set between -0.2 and 0.2" w.c.)
4. Locate the reference pressure (LO) 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 (see Figure 53).
7. Connect the tube to the ¼-inch HI fitting for sensor SPS2.

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Electrical Installation

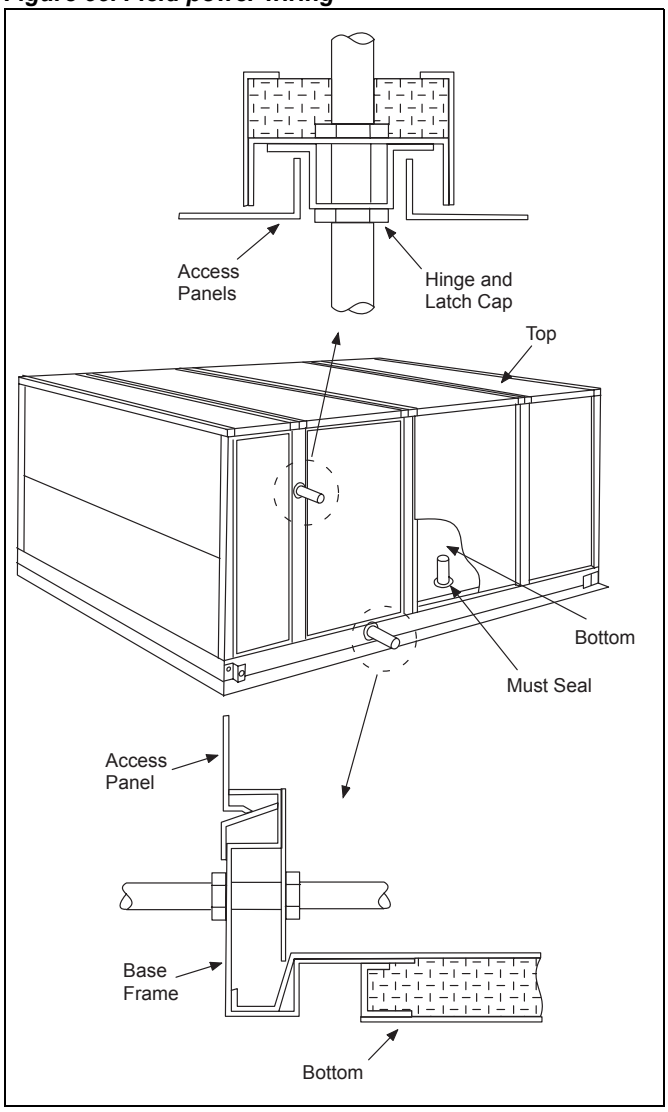
Field Power Wiring

All of the unit side panels are hinged. Do not mount disconnect switches and/or motor starters on panels that provide access to internal components. Wiring conduits can penetrate the cabinet bottom, base frame, or through the hinge and latch cap without interfering with the access panels.

Note: All holes cut into the unit must be sealed to prevent water leakage.

Seal conduits connecting the unit to external panels, which will be exposed to relative humidity and air pressure differentials. Ground the motor using copper or other corrosion resistant conductor.

Figure 55. 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. An open fuse, tripped circuit breaker, or Manual Motor Protector (MMP) indicates a short, ground, or overload. Before replacing a fuse, circuit breaker, MMP, or restarting a fan motor, identify the trouble and correct.

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 allowable overcurrent protection (MROPD) appears on the unit nameplate.

All RDS and RAH Units

All units are provided with internal power wiring for single or dual 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 3" knockouts in the bottom of the main control panel. Refer to the unit nameplate to determine the number of power connections. See Figure 56 and Table 13 on page 49.

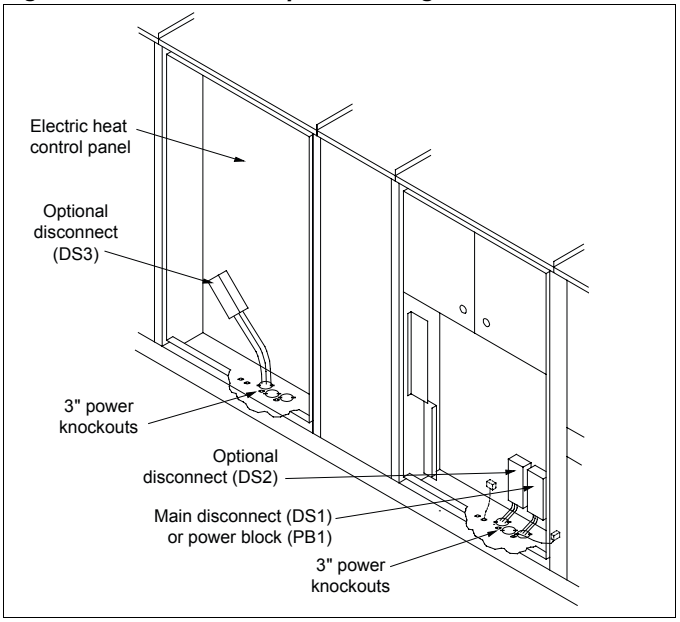
⚠ WARNING

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.

If the unit has a factory mounted disconnect switch, generally the switch must be turned off to open the main control panel door. However, the door can be opened without disconnecting power by following the procedure covered on page 110. If this is done, use caution since power is not removed from the unit or the controller.

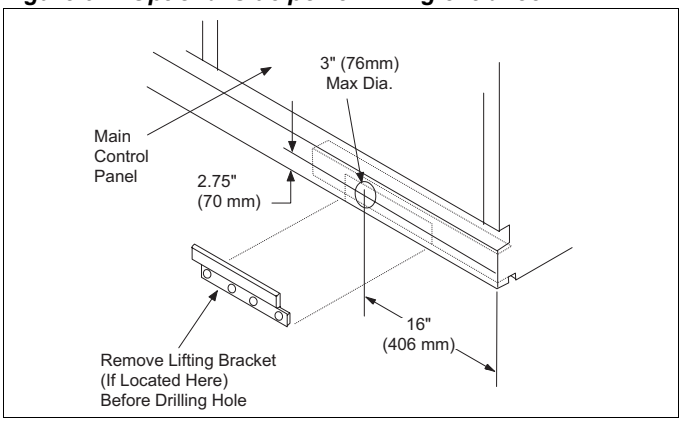
Note: To wire entry points, refer to certified drawings for dimensions.

Figure 56. RDS and RAH power wiring connections



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Figure 57. Optional side power wiring entrance



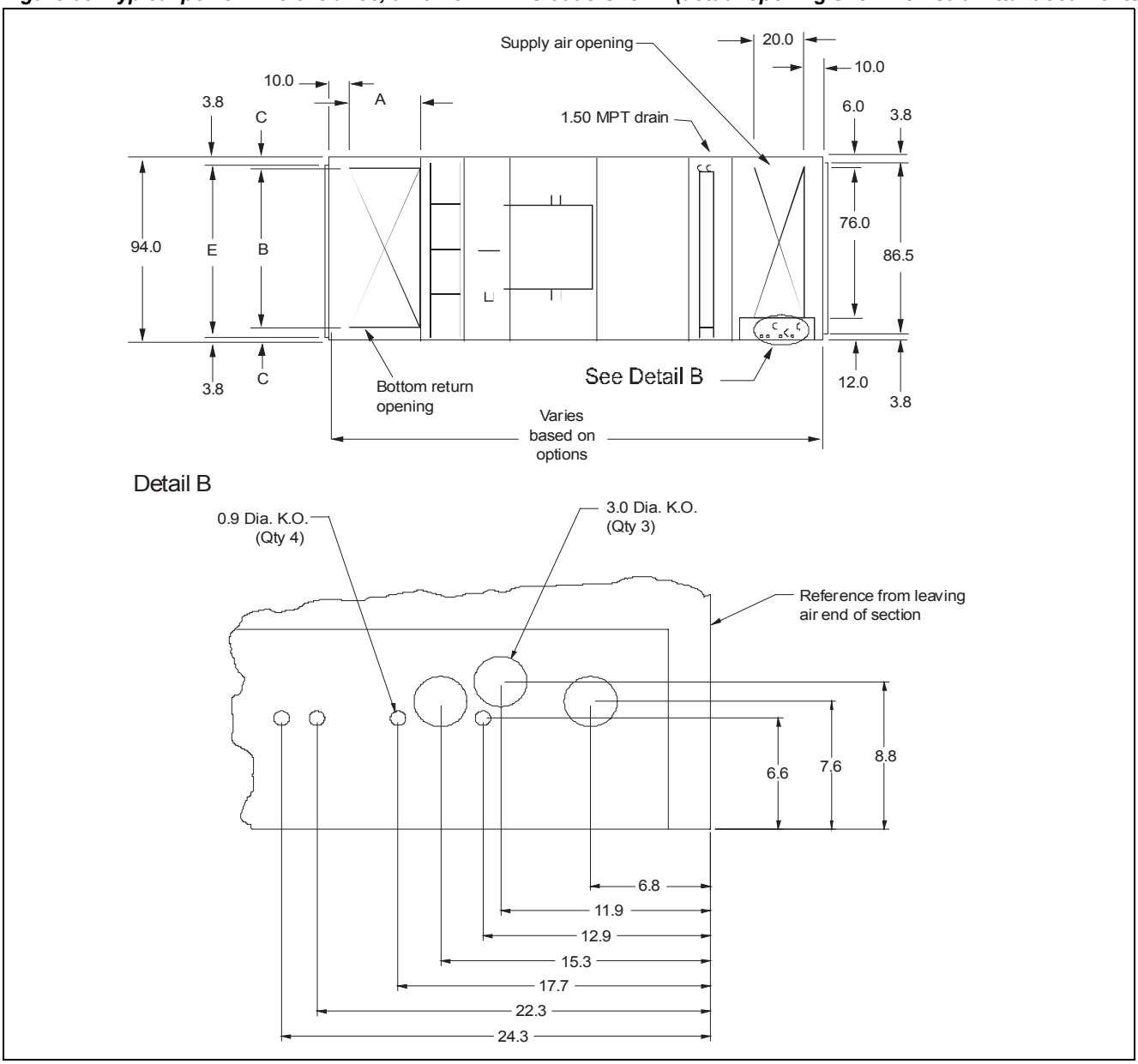
- The preferred entrance for power cables is through the bottom knockouts provided on the unit. If side entrance is the only option, a drilling location is provided.

⚠ CAUTION

Wires are located in base rail. Move wires before drilling hole through base rail.

The drilling dimensions must be followed exactly to prevent damage to the control panel. The dimensions provided are the only possible point of side entrance for the power cables.

Figure 58. Typical power wire entrance, unit view—RDS 800C shown (actual opening shown on submittal documents)



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All Units

The minimum circuit ampacity (wire sizing amps) is shown on the unit nameplate. Refer to Table 13 on page 49 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 for each disconnect or power block. Size grounding conductor in accordance with Table 250-95 of the National Electrical Code.
- In compliance with the National Electrical Code, an electrically isolated 115V circuit is provided in the unit to supply the factory mounted service receptacle outlet and optional unit lights. This circuit is powered by a field connected 15A, 115V power supply. Leads are brought in through a 7/8" knockout in the bottom of the main control panel, near the power wire entry point.

Table 12: Multiple point power connection options

Number of electrical circuits	Disconnect designation	Load	Location (see Figure 8 on page 8)
2	DS2	Supply and return fan motors plus controls	Main control panel
	DS1	Balance of unit	Main control panel
2	DS3	Electric heat	Electric heat control panel
	DS1	Balance of unit	Main control panel

Table 13: Recommended 3-phase power wiring to ensure disconnects and power blocks mate with power wiring

Wire gauge	Qty./ pole	Insulation rating (°C)	No. of conduits	Conduit (trade size, in.)	For MCA up to (amps)
10	1	75	1	1/2	35
8	1	75	1	3/4	50
6	1	75	1	1	65
4	1	75	1	1 1/4	85
3	1	75	1	1 1/4	100
2	1	75	1	1 1/4	115
1	1	75	1	1 1/4	130
1/0	1	75	1	1 1/2	150
2/0	1	75	1	2	175
3/0	1	75	1	2	200
4/0	1	75	1	2	230
250	1	75	1	2 1/2	255
300	1	75	1	2 1/2	285
350	1	75	1	3	310
400	1	75	1	3	335
500	1	75	1	3	380
3/0	2	75	2	2	400
4/0	2	75	2	2	460
250	2	75	2	2 1/2	510
300	2	75	2	2 1/2	570
350	2	75	2	3	620
400	2	75	2	3	670
500	2	75	2	3	760
250	3	75	3	2 1/2	765
300	3	75	3	2 1/2	855
350	3	75	3	3	930

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.

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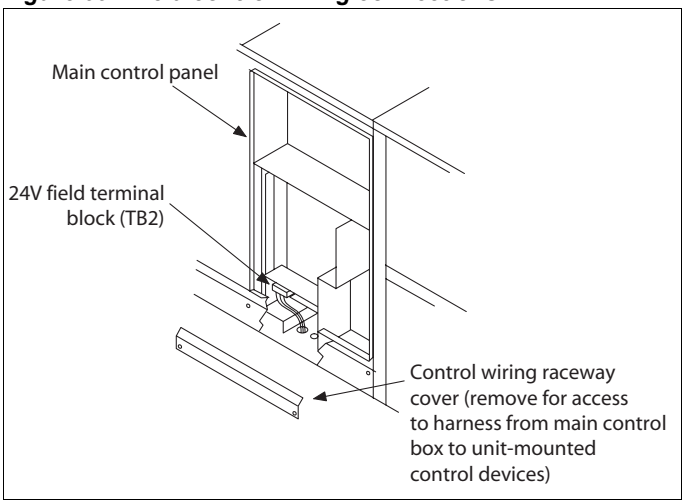
Field Control Wiring

Units are available with several control arrangements which may require low voltage field wiring. Detailed descriptions of various field control wiring options and requirements are included in the “Field Wiring” section of Bulletin No. IM 696, “MicroTech II Applied Rooftop Unit Controller.” Refer to the unit wiring diagrams for additional installation information.

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

All field control wiring connections are made at the class II terminal block TB2, which is located in the main control panel. Field wiring connections to the 115 volt receptacle and lights are made at terminal block TB7, which is located also in the main control panel. Refer to Figure 59 and “Control Panel” on page 8**.** Two 7/8" knockouts are provided for wire entry.

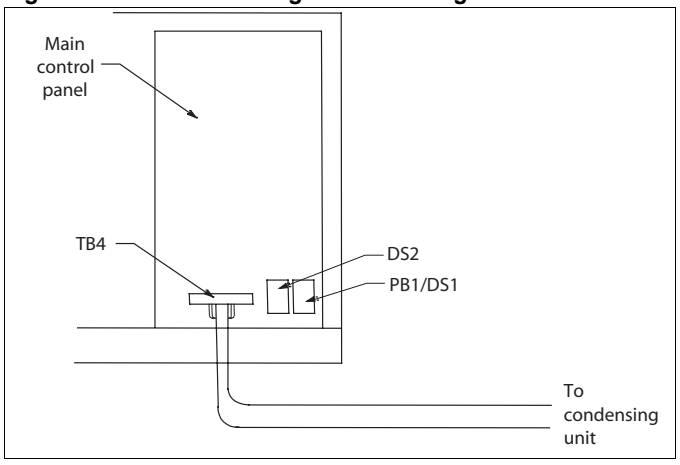
Figure 59. Field control wiring connections



Interconnecting wiring enters the air handler unit through 7/8" knockouts in the bottom of the main control panel. The interconnecting wiring is connected to TB4 in the air handler unit. Refer to Figure 60. A 7/8" knockout is also available in the end of the unit base as shown in Figure 59.

Note: If a single conduit containing 24V and 115V wiring is run above the roof line between the air handler and condensing units, install the 24V wiring as an NEC Class I wiring system.

Figure 60. Interconnecting control wiring



⚠ WARNING

Electrical shock hazard. Can cause severe injury or death.
Connect only low voltage NEC Class II circuits to terminal block TB2.
Reinstall and secure all protective deadfront panels when the wiring installation is complete.

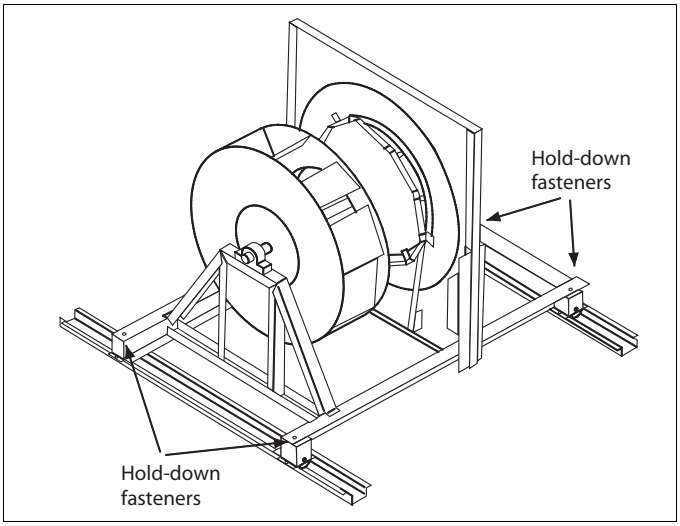
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Preparing Unit for Operation

⚠ WARNING

Moving machinery hazard. Can cause severe injury or death. Before servicing equipment, disconnect power and lock off. More than one disconnect may be required to de-energize unit.

Figure 61. RAH spring mount hold down fasteners



Spring Isolated Fans

Releasing Spring Mounts

The optional spring-mounted supply and return fans are locked down for shipment. Hold-down fasteners are located at each spring mount. Remove these fasteners before operating the fans. Figure 62 shows a typical spring mount. Note that the 3/8" hold-down bolt securing the fan base to the unit cross channel must be removed.

After removing the hold-down fasteners, rock the fan assembly by hand to check for freedom of movement.

Figure 62. Spring mounted hold-down fasteners, all units

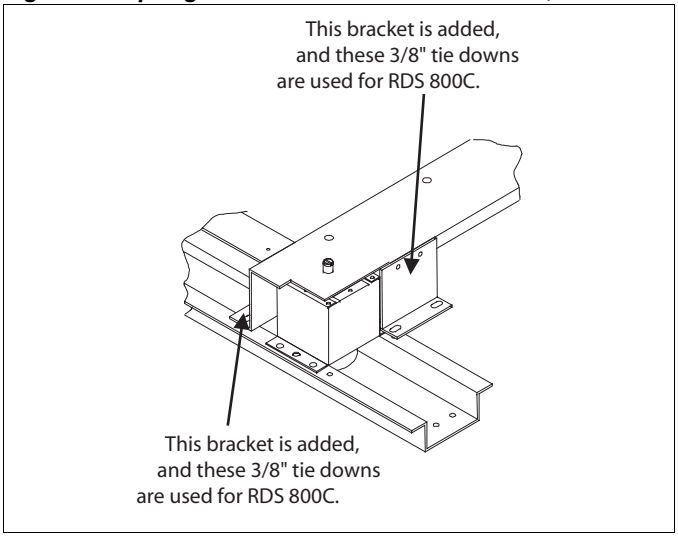
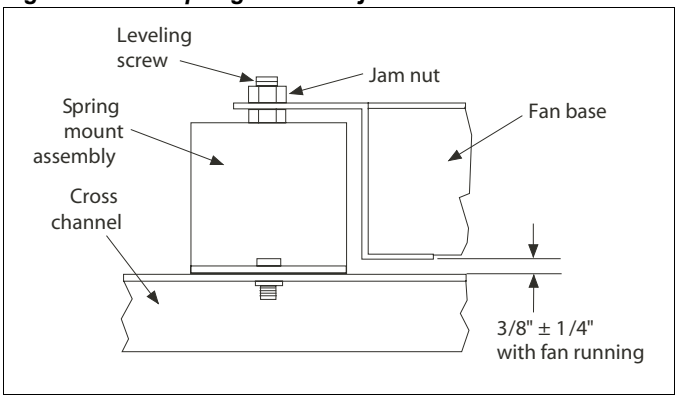


Figure 63. Fan spring mount adjustment



* Grossly out-of-adjustment thrust restraints can affect this dimension. Recheck after thrust restrains are adjusted.74

Adjusting Spring Mounts

During operation, all fans should ride level, with the bottom of the fan base approximately 3/8" (10mm) above the top of the unit's cross channel. Unhoused single-width "plug" fans will also ride at this level when at rest.

⚠ WARNING

Moving machinery hazard. Can cause severe injury or death. Start the fans for the first time according to the "Check, Test, and Start Procedures" on page 94. If this is not done, equipment damage, severe personal injury, or death can occur.

- When not operating, housed double-width fans ride lower at the discharge end of the fan base than at the motor end. When the fan is operating against a static pressure, it should run level. If not, level the assembly as follows (see Figure 63):

1. Loosen the 1 5/16" jam nut above the fan base.
2. Using a large, straight blade screwdriver, turn the 5/8" leveling screw clockwise to lower the fan base, counterclockwise to raise the fan base.
3. When properly adjusted, retighten the jam nut.

Relief Damper Tie-Down

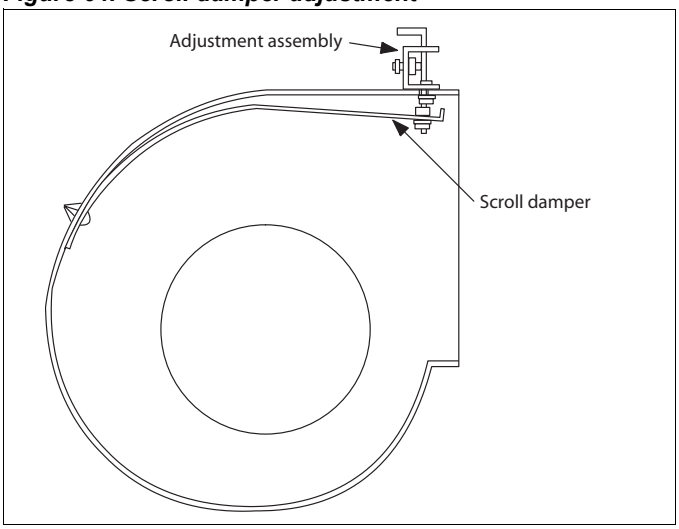
Economizer sections with a 30" or 40" return fan have a relief damper that is tied down for shipping. Remove the two brackets and two screws before operation to allow free movement of dampers. Access is from inside the economizer section.

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Adjusting Scroll Dampers

Two sets of scroll dampers are provided in the housing of the twin 15" x 6" supply fan to allow control of air volume to each fan wheel. At the factory, these dampers are fully closed, unrestricting airflow. If fan paralleling occurs, correct it by loosening the adjustment screw on top of the fan housing (see Figure 64) and slightly lowering the rod until air distribution between the fans is even.

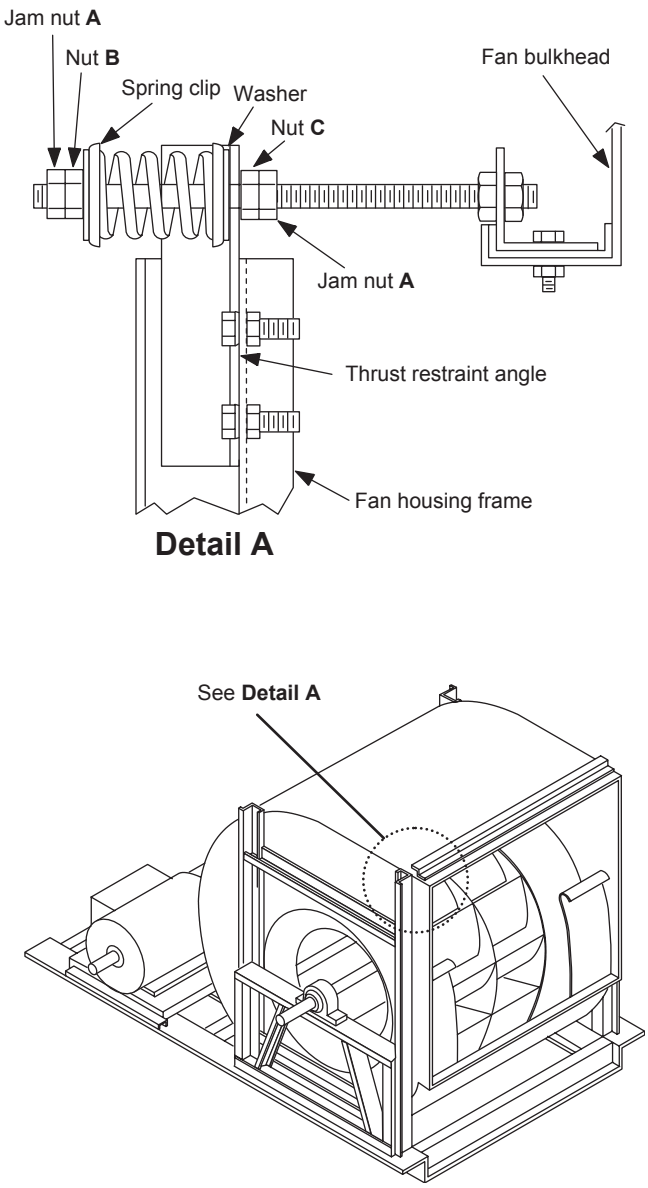
Figure 64. Scroll damper adjustment



Adjusting Supply Fan Thrust Restraints

Thrust restraints are provided when housed double-width fans are mounted on springs. After the spring mounts are adjusted for level operation when the fan is running, check the thrust restraints. With the fan off, set the adjustment nuts so the spring is slightly compressed against the angle bolted to the fan housing frame. Refer to Figure 65. When the fan is turned on, the fan moves back to a level position and the thrust restraint springs compresses.

Figure 65. Thrust restraint adjustment



Thrust restraint adjustment (with fan off)

1. Loosen jam nuts **A**.
2. Turn nut **C** until spring cup and washer contact thrust restraint angle.
3. Turn nut **B** until spring is compressed by two turns of nut **B**.
4. Tighten jam nuts **A**.

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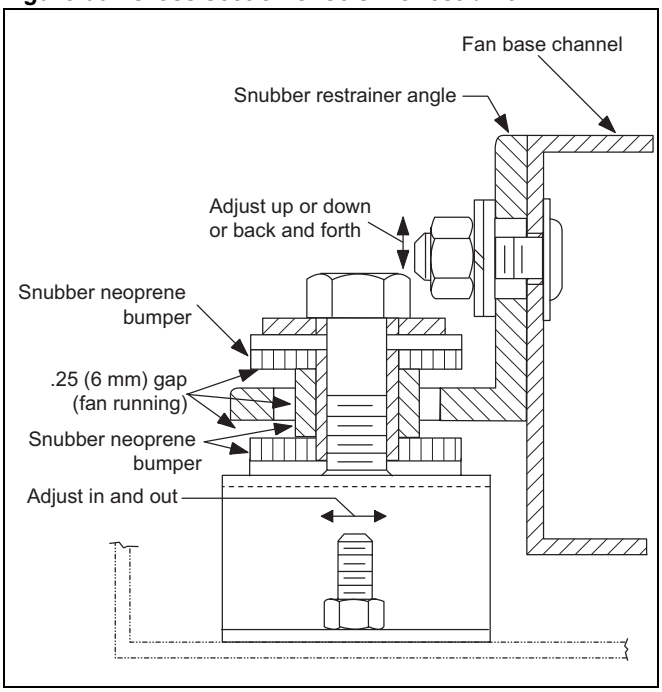
Adjusting Seismic Restraints

Spring-mounted supply air and return air fans can be ordered with factory-installed seismic restraints. The system consists of four snubbers, one located next to each spring isolator. These snubbers allow free movement of the fan assemblies during normal operation because normal operation does not cause fan movements that exceed .25" (6 mm). However, if an abnormal condition occurs, they restrain the fan assembly and limit movement to .25" (6 mm) in any direction.

The position the fan assumes during normal operation is determined by actual job site airflow and static pressure. Therefore, for proper operation, field adjust the seismic restraints as part of the normal “Check, Test and Start” procedure. When the fan is operating in a normal manner, there should be no contact between the snubber restrainer angle and the snubber neoprene bumper. However, in a “seismic event,” the snubber limits movement of the spring mounted fan assembly to .25" (6 mm) in any direction, thereby helping to prevent the fan from being tossed about and damaged, or causing damage.

When a seismic restraint is properly adjusted and the fan is operating normally, the neoprene center bumper is centered within the 2" (51 mm) diameter hole in the restrainer angle, and the restrainer angle is centered vertically between the flanges of the neoprene center bumper. This results in .25" (6 mm) clearance in all directions. When the fan is turned off, the restrainer angle may come to rest on the neoprene center bumper.

Figure 66. Cross section of seismic restraint



The seismic restraint is adjustable in all directions. Vertical slots in the restrainer angle and horizontal slots in the blower base allow the restrainer angle to be adjusted up and down and back and forth. The neoprene center bumper is mounted on a slotted hole allowing in and out adjustment.

Removing the neoprene center bumper bolt allows removal, disassembly, and replacement of the neoprene components.

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Sequences of Operation

The following sequences of operation are for a typical “C” vintage applied rooftop unit equipped with MicroTech II, an economizer, 3 to 1 turn down burner, variable frequency drives (VFD), a return air fan and an external time clock. These sequences describe the ladder wiring diagram logic in detail; refer to “Wiring Diagrams” on page 57 as you read them. Note that your unit’s sequences of operation may vary from those described here. Refer to the wiring diagrams supplied with the unit for exact information.

For detailed description of operation information relating to the MicroTech II controller's software, refer to the appropriate operation manual (see Table 1 on page 1). These manuals describe the various setpoints, parameters, operating states, and control algorithms that affect rooftop unit operation.

Power-up

When primary power is connected to the unit, 115VAC power is fed through control circuit transformer T1 and control circuit fuse F1C (line 168) to compressor crankcase heaters HTR-1, HTR-2, HTR-3 and HTR-4 (lines 815, 848, 820, and 853).

When system switch S1 (line 203) is closed, low voltage transformers T2 (line 203), T3 (line 301)and T9 (line 802) energize, and 115VAC power is supplied to the following:

- Smoke detectors (lines 265 and 267)
- Economizer actuator ACT3 (line 313)
- M30A to energize the supply fan VFD (line 426)
- M40A to energize the return fan VFD (line 430)
- Heating control panel (line 603)
- Compressor circuit switches CS1 and CS2 (lines 805 and 838)

Transformer T2 supplies 24VAC power to terminals 24V and COM on the main control board MCB (lines 207 and 208). Transformer T2 supplies 24VAC power to the following:

- Switch S7 On-Auto-Off (line 217)
- Enthalpy sensor OAE (line 250)
- External time clock contacts (line 215)
- External exhaust fan status contacts (line 257, VAV only)
- Airflow interlock switch PC7 (line 228)
- Dirty filter switches PC5 and PC6 (lines 242 and 247)
- Duct high limit switch DHL (line 260, VAV only)
- Gas furnace alarm relay R24 (line 225)
- Freezestat switch FS1 (line 231, hot water or steam heat only)
- Smoke detectors SD1 and SD2 (line 237)

When the field supplied Cool Enable switch is in the OFF position, field wiring terminal TB2 105 de-energizes (line 220). Binary input MCB-BI3 de-energizes and the cooling is disabled. When the field supplied Heat Enable switch is in the OFF position, field wiring terminal TB2 106 de-energizes (line 223). Binary input MCB-BI4 de-energizes and the heating is disabled.

Note: Unit ships with factory installed jumpers between TB2 101 and 105 and between 101 and 106.

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Fan Operation

When the main control board (MCB) commands the supply and return fans to start, the unit enters the Startup operating state. As a result, a 3-minute timer is set, output MCB-BO3 (line 307) energizes, and relay R26 energizes (line 306).

After the 3-minute timer expires, the unit enters the Recirc operating state. As a result, output MCB-BO1 energizes relay R67 (line 401). This gives a start signal to supply fan drive AFD10 (line 445). Four seconds after MCB-BO1 is energized, output MCB-BO2 energizes relay R68 (line 404). This gives a start signal to return fan drive AFD20 (line 445).

Within 120 seconds after the fans start, the controller expects airflow switch PC7 (line 228) to close and thus energize binary input MCB-BI6. (If MCB-BI6 does not energize, the controller assumes the fans did not start. It then shuts down the unit and generates an alarm.)

During the Recirc operating state, the outside air damper is held closed. The controller does this by energizing output MCB-BO5 (line 318). On VAV units, output MCB-BO12, the VAV box output, is also de-energized (line 309) during the Recirc state.

The supply fan adjustable frequency drive (AFD10) is modulated to maintain the duct static pressure setpoint. When energized, output MCB-BO14 (line 407) drives AFD10 toward increased capacity; MCB-BO13 (line 405) drives it toward decreased capacity.On VAV units or CAV units equipped with return fan capacity control, the adjustable frequency drive (AFD20) is modulated to maintain an acceptable building static pressure (using either VaneTrol logic or direct measurement of building pressure; see the appropriate OM for more information). When energized, output MCB-BO16 (line 409) drives AFD20 toward increased capacity; MCB-BO15 (line 411) drives them toward decreased capacity.

Note: If the inverter bypass switch S4 (lines426 and 430) is in the bypass position, MMP30 and MMP40 (line 132 and 144) protect the fans from excessive current draw. If either the supply or return fan is drawing excessive current, one of the MMPs triggers an auxiliary contacts (line 426) and open the circuit, causing both fans to stop.

Economizer Operation

When the outdoor air is suitable for free cooling, the switch in enthalpy sensor OAE is in position “3” (line 252) energizing binary input MCB-BI11. When MCB-BI11 energizes, the economizer is enabled. (Note: If selected from the keypad, the enthalpy decision can be made based on outdoor temperature. In that condition, if the outdoor air temperature is less than or equal to the changeover set point, the economizer is enabled.) If cooling is required, the economizer dampers (ACT3) are modulated to maintain the discharge air temperature setpoint. When energized, output MCB-BO6 drives the outdoor air dampers toward the open position; MCB-BO5 drives them toward the closed (line 318).If the outdoor air dampers are wide open and more cooling is required, the dampers hold their positions and mechanical cooling is activated (see below).

When the outdoor air is not suitable for free cooling, the switch in enthalpy sensor OAE is in position “1,” de-energizing binary input MCB-BI11 (Alternatively, the outdoor air temperature is above the changeover setpoint plus the economizer changeover differential). When the economizer is disabled, the dampers are held at their minimum position.

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Heating

Gas Furnace, Modulating Burner (3 to 1 turn down)

Refer to “Standard Mod, furnace control (1000 MBH)” on page 78 as you read this sequence of operation. Note that the gas furnace wiring diagrams supplied with the units include a detailed sequence of operation. Refer to the wiring diagram supplied with the unit for exact wiring and sequence of operation information.

When system switch S1 is closed, 115 VAC power is supplied to the furnace control circuit. If burner switch S3 and safeties HL22, HL23 are closed (line 603), terminal 5 (line 609) on the flame safeguard control (FSG) energizes as does the modulating gas valve VM1. If heating is enabled (MCB-BI4 is energized—line 223) and heating is required, the MCB-BO11 energizes relay R20 (line 413). The normally open R20 contacts (line 603) close, and if manual burner switch S3 and safeties HL22, HL23, FLC (high limit switch) (line 603), LP5, and HP5 are closed (optional, not shown on page 78), terminal 6 (line 618) on the flame safeguard control (FSG) energizes. FSG energizes terminal 4 to start the blower motor (BM) (line 609) through contactor M29 on large burners. If the blower is operational, air switch AS (line 621) closes and makes electrical continuity from FSG terminal 6 to 7. After a 90-second prepurge period, FSG terminals 8 (line 613) and 10 (line 621) energize. As a result, ignition transformer IT and pilot gas valve GV1 energize. The pilot flame ignites and is detected by FSG through flame rod FD (line 612). Upon detection of pilot flame after the 10-second trial for ignition period, the FSG de-energizes terminal 10 and energizes terminal 9 to energize main gas valves GV2 and GV3 (lines 617, 619) and low fire start relay R23 (line 624). The R23 contacts (lines 632 and 633) allow the MCB to modulate gas valve actuator VM1 as required to satisfy the heating demand.

Whenever the burner is operating, its firing rate is determined by the position of gas valve actuator VM1. This actuator modulates the butterfly gas valve and combustion air damper, thus varying the furnace firing rate between 33% and 100% of full capacity. When the MCB-BO10 energizes (line 634), VM1 modulates toward open and the firing rate increases. When MCB-BO9 energizes (line 633), VM1 modulates toward closed and the firing rate decreases. When both MCB-BO10 and MCB-BO9 are open, VM1 holds its position and the firing rate remains constant.

When heating is no longer necessary, MCB-BO11 opens, de-energizing relay R20 and opening its contacts (line 603). As a result, the flame safeguard control de-energizes, all gas valves close, the combustion air blower motor stops, and gas valve actuator VM1 closes. If the furnace is warm enough to close it, the FLC fan controls switch (line 602) overrides supply fan start/stop output MCB-BO1 through R25 (line 402) and keeps the supply fan running until the furnace cools down (this might happen during night setback operation).

If the furnace overheats, the FLC high limit control (line 603) cycles the burner, preventing the furnace temperature from exceeding the limit control’s setpoint. When the furnace cycles off, low fire start relay R23 de-energizes. The normally closed R23 contacts (line 633) cause VM1 to drive to its minimum position, overriding MicroTech II control of VM1 via MCB-BO10 and MCB-BO9. Because relay R23 de-energizes whenever GV2 de-energizes, the burner always starts at low fire.

Safety Lockout

If the pilot flame does not ignite or the flame safeguard fails to detect its flame within 10 seconds, the flame safeguard control enters the “safety lockout” state. FSG terminals 4, 8,9 and 10 de-energize and the burner shuts down. FSG terminal 3 energizes relay R24 (line 610). The R24 contacts (line 225) signal the controller that the problem exists by energizing the input to MCB-BI5. If a safety lockout occurs, manually reset the flame safeguard control.

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Wiring Diagrams

Legend

ID	Description	Standard location
ACT3, 4	Actuator motor, economizer	Economizer section
ACT5	Actuator motor, discharge isolation damper	Discharge section
ACT6	Actuator motor, return air isolation damper	Return section
ACT7	Actuator motor, heat face/ bypass	Coil section, heat
ACT8	Actuator motor, cool face/ Bypass	Coil section, cool
ACT10, 11	Actuator motor, exhaust dampers	Return section
ACT12	Actuator motor, enthalpy wheel bypass damper	Energy recovery section
AFD10	Adjustable frequency drive, supply fan	AFD/supply fan section
AFD11	Adjustable frequency drive, evap cond. fans	Main/RCE control box
AFD20	Adjustable frequency drive, return/exhaust fan	AFD/ret. ex. fan section
AFD60	Adjust. freq. drive, energy recovery wheel(s)	Energy recovery section
AS	Airflow switch, burner blower	Gas heat box
BM	Burner blower motor	Heat section, gas
C10	Power factor capacitors, supply fan	Supply Fan section
C20	Power factor capacitors, return fan	Return section
CB10	Circuit breaker, supply fan	Main control box
CB11	Circuit breaker, evaporative condenser fan(s)	Main/cond. control box
CB20	Circuit breaker, return/ exhaust fan	Main control box
CB60	Circuit breaker, energy recovery wheel	Main control box
CCB1, 2	Compressor control boards, refrig. circuits	Main control box
CPC	Circuit board, main, micro controller	Main control box
CPR	Circuit board, expansion, micro controller	Main control box
DAT	Discharge air temperature sensor	Discharge section
DFLH	Design flow lefthand sensor	Return section
DFRH	Design flow righthand sensor	Return section
DHL	Duct hi-limit	Main control box
DS1	Disconnect, total unit or cond/ heat	Main control box
DS2	Disconnect, SAF/RAF/controls	Main control box
DS3	Disconnect, electric heat	Electric heat box
EAT	Exhaust air temperature sensor	Energy recovery section
EFT	Entering fan air temperature sensor	Supply fan section
EHB1	Staged electric heat board	Main control box
ERB1	Energy recovery board	Main control box
ERM1	Energy recovery wheel motor #1	Energy recovery section
ERM2	Energy recovery wheel motor #2	Energy recovery section
F1A, B	Fuse, control circuit transformer (T1), primary	Main control box
F1C	Fuse, control circuit transformer (T1), secondary	Main control box
F2	Fuse, control circuit transformer (T2), primary	Main control box
F3	Fuse, burner blower motor	Main control box
FB31–40	Fuseblock, electric heat (top bank)	Electric heat box
FB41–50	Fuseblock, electric heat (bot. bank)	Electric heat box
FD	Flame detector	Heat section, gas
FLC	Fan limit control	Heat section, gas
FP1, 2	Frost protection, refrig. circuits	Coil section, cool
FS1, 2	Freezestat control	Coil section, heat/cool
FSG	Flame safeguard	Gas heat box
GCB1	Generic condenser board, refrig. circ.	Main control box
GFR1, 2	Ground fault relay	Main control box
GFS1, 2	Ground fault sensor	Main control box
GRD	Ground	All control boxes
GV1	Gas valve, pilot	Heat section, gas
GV2	Gas valve, main/safety	Heat section, gas
GV3	Gas valve, redundant/safety	Heat section, gas
GV4–8	Gas valve, main, hi turn down	Heat section, gas
HL1–10	Hi-limits, pwr, elec heaters (top bank)	Heat section, electric
HL11–20	Hi-limits, pwr, elec heaters (bot. bank)	Heat section, electric
HL22	Hi-limits, gas heat (pre-filters)	Supply fan section
HL23	Hi-limits, gas heat (final filters)	Final filter section
HL31–40	Hi-limits, ctl. elec heaters (top bank)	Heat section, electric
HL41–50	Hi-limits, ctl. elec heaters (bot. bank)	Heat section, electric
HP5	Hi-pressure controls, gas	Heat section, gas
HS1	Heat switch, electric heat shutdown	Main control box
HS3	Heat switch, electric heat deadfront interlock	Electric heat box
HTR65	Heater, sump	Evap. condenser section
HTR66	Heater, vestibule	Evap. condenser vestibule
HUM1	Humidstat sensor	Energy recovery section
IT	Ignition transformer	Gas heat box
LAT	Leaving air temperature sensor	Energy recovery section
LP5	Low-pressure control, gas	Heat section, gas
LR10	Line Reactor, supply fan	Inverter bypass box
LR20	Line reactor, return/exhaust fan	Inv. bypass/main cont. box
LS1, 2	Limit switch, low fire, high fire	Gas heat box
LT10–23	Light, cabinet sections	Supply fan section

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ID	Description	Standard location
M10	Contactor, supply fan	Main control box
M20	Contactor, return fan	Main control box
M29	Contactor, burner motor	Gas heat box
M30	Contactor, reversing, invertor bypass, supply fan	Inverter bypass box
M31–39	Contactor, electric heat (top bank)	Electric heat box
M40	Contactor, reversing, Invertor Bypass, Return Fan	Inverter bypass box
M41–50	Contactor, electric heat (bot. bank)	Electric heat box
M60	Contactor, energy recovery wheel	Main control box
MCB	Microprocessor circuit board	Main control box
MJ	Mechanical Jumper	All control boxes
MMP1–8	Manual motor protector, compressors	Main/cond. control box
MMP10	Manual motor protector, supply fan	Main control box
MMP11–18	Manual motor protector, cond. fans, ckt#1	Main/cond. control box
MMP20	Manual motor protector, return fan	Main control box
MMP21–28	Manual motor protector, cond. fans, ckt#2	Main/cond. control box
MMP30	Manual motor protector, invrtr. bypass, sup. fan	Inverter bypass box
MMP40	Manual motor protector, invrtr. bypass, ret. fan	Inverter bypass box
MMP51, 52, 53	Manual motor protector, exhaust fan(s)	Prop exhaust box
MMP60	Manual motor protector, energy recovery wheel	Main control box
MP1–6	Motor protector, compr.#1-6	On compressors
OAE	Outside air enthalpy sensor	Economizer section
OAT	Outside air temperature sensor	Economizer section
PB1, 2	Power block, power distribution	Main control box
PB3	Power block, power distribution, electric heat	Electric heat box
PB9, 10	Power block, supply fan	Junction box, split unit
PB11, 12	Power block, power distribution	Main control box
PB19, 20	Power block, return/exhaust fan	Junction box, split unit
PC5	Pressure control, clogged filter	Pre filter section
PC6	Pressure control, clogged final filter	Final filter section
PC7	Pressure control, proof airflow	Supply fan section
PC8	Pressure control, minimum airflow	Coil section, cool
PM1	Phone modem	Main control box
PVM1, 2	Phase voltage monitor	Main control box
R20	Relay, Heat, gas/ steam/ hot water	Gas heat/main cont. box
R21, 22	Relay, heat, gas (hi-turn down)	Gas heat box
R23	Relay, heat, gas & electric	Gas/electric heat box
R24	Relay, heat alarm, gas	Main control box
R25	Relay, heat, gas, start supply fan inverter	Main control box

ID	Description	Standard location
R26	Relay, isol/exh. dampers, open/close	Main control box
R28	Relay, isolation damper, safety	Main control box
R29	Relay, remote fire alarm	Main control box
R30	Relay, cool valve with face bypass	Main control box
R45	Relay, UV lights	Main control box
R46, 47	Relay, supply fan inverter, incr/ decr	Main control box
R48, 49	Relay, return fan inverter, incr/ decr	Main control box
R58,59	Relay, heat wheel inverter, incr/ decr	Main control box
R60	Relay, energy recovery wheel, enable	Main control box
R61	Relay, smoke detector, discharge air	Main control box
R62, 63, 65	Relay, use on specials	Main control box
R66	Relay, smoke detector, return air	Main control box
R67	Relay, supply fan, enable	Main control box
R68	Relay, return fan, enable	Main control box
R69	Relay, Inv. bypass VAV box interlock	Main control box
R70–79	Relay, use on specials	Main control box
RAE	Return air enthalpy sensor	Return section
RAT	Return air temperature sensor	Return section
REC1	Receptacle, main box	Main control box
REC3	Receptacle, field power, 115V	Discharge bulkhead
REC10–23	Receptacle, cabinet sections	Cabinet sections
S1	Switch, system on/off	Main control box
S3	Switch, furnace on/off	Gas heat box
S4	Switch, inverter bypass, on/ off	Main control box
S7	Switch, local on/auto/off to controller	Main control box
S10–23	Switches, cabinet section lights	Cabinet sections
S40–45	Switches, door interlock, UV lights	Cabinet sections
SD1	Smoke detector, supply	Discharge section
SD2	Smoke detector, return	Return section
SPS1, 2	Static pressure sensors, duct/ building	Main control box
SR1-3	Sequencing relays, electric heat	Electric heat box
T1	Transformer, main control (line/ 115VAC)	Main control box
T2	Transformer, control input (115/ 24VAC)	Main control box
T3	Transformer, control output (115/24VAC)	Main control box
T4	Transformer, exh. damper actuator (115/12VDC)	Main control box
T5	Transformer, electric heat	Electric heat box
T6	Transformer, dew point controller (115/24VAC)	Main control box

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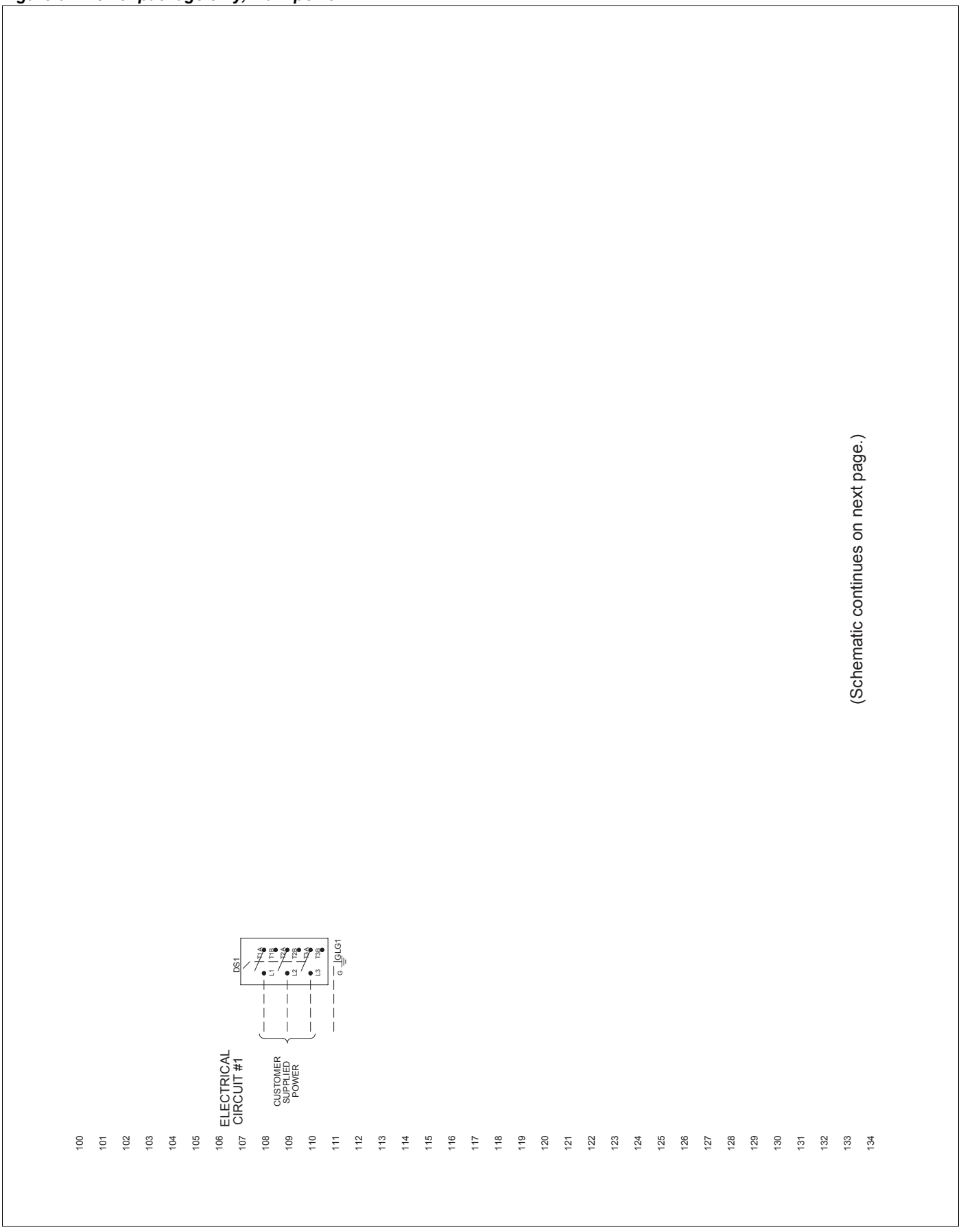
ID	Description	Standard location
T9	Transformer, refrig. circuit 24V	Main control box
TB1	Terminal block, internal	Main control box
TB2	Terminal block, field	Main control box
TB3	Terminal blocks, factory	Main control box
TB4	Terminal block, RFS, field	Main control box
TB7	Terminal block, 115V convenience outlet, field	Main control box
TB11	Terminal block, heat	Heat control box
TB25, 26, 27, 28	Terminal block, split unit junction box	Junction box, split unit
TD5–8	Time delay, part winding, compr #1 - 4	Main control box
TD10	Time delay, hi turn down burner	Gas heat box
TR1, 2	Transducer, pressure	Main control box
UV	Ultra-violet light(s)	Coil/discharge section
VM1	Valve motor #1, heating	Gas heat box/ heat section
VM5	Valve motor #5, cooling	Coil section, cool
VV1	Vent valve, gas heat	Heat Section, Gas
ZNT1	Zone temp. sensor, setback	Field installed

General Notes

1. Field wiring
2. Factory wiring
3. Shielded wire/cable
4. Main control box terminals
5. Auxilliary box terminals
6. Field terminals
7. Plug connector
8. 200/ H200 — Wire/harness number
9. WN7 — Wire nut/ID

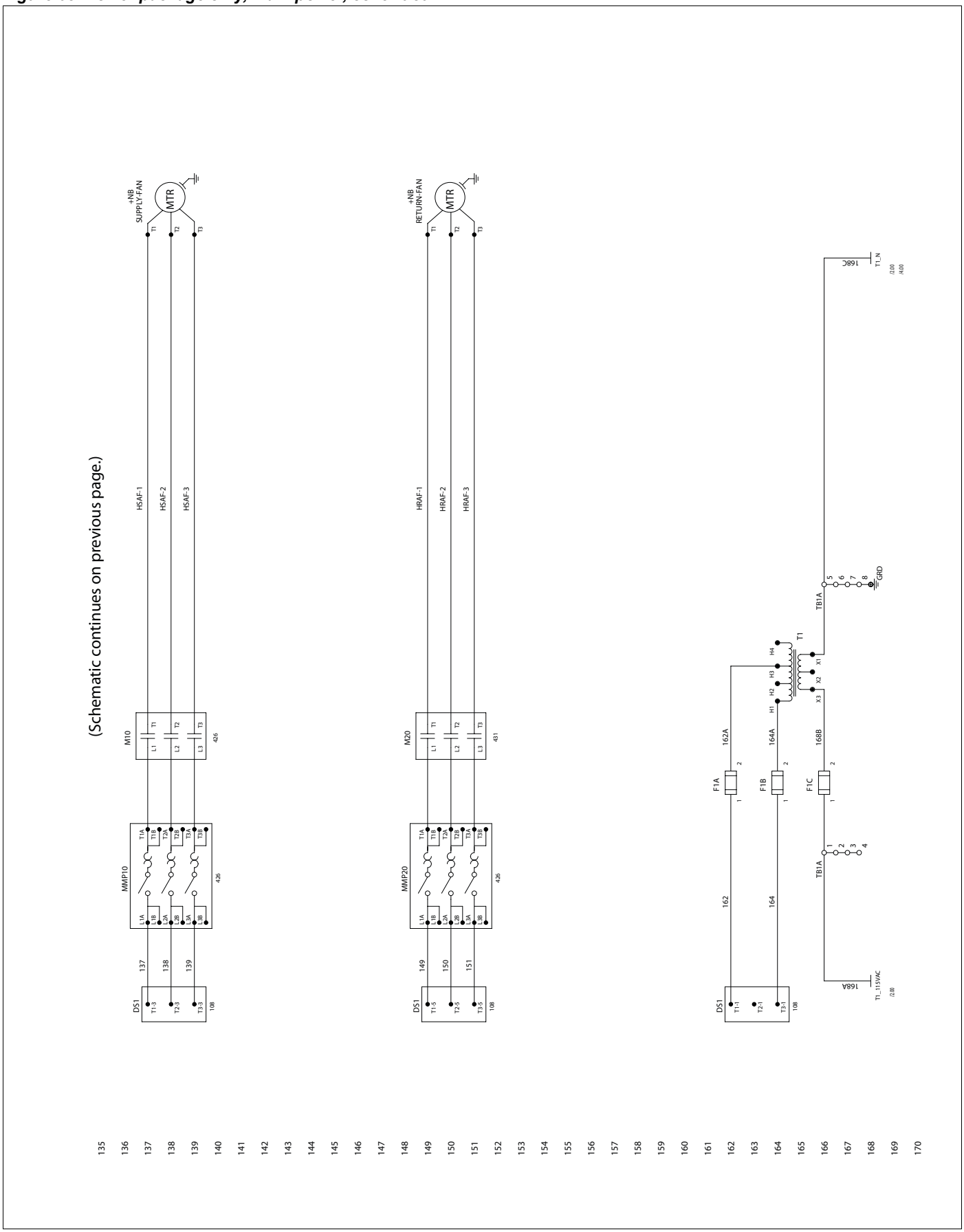
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Figure 67. Power package only, main power



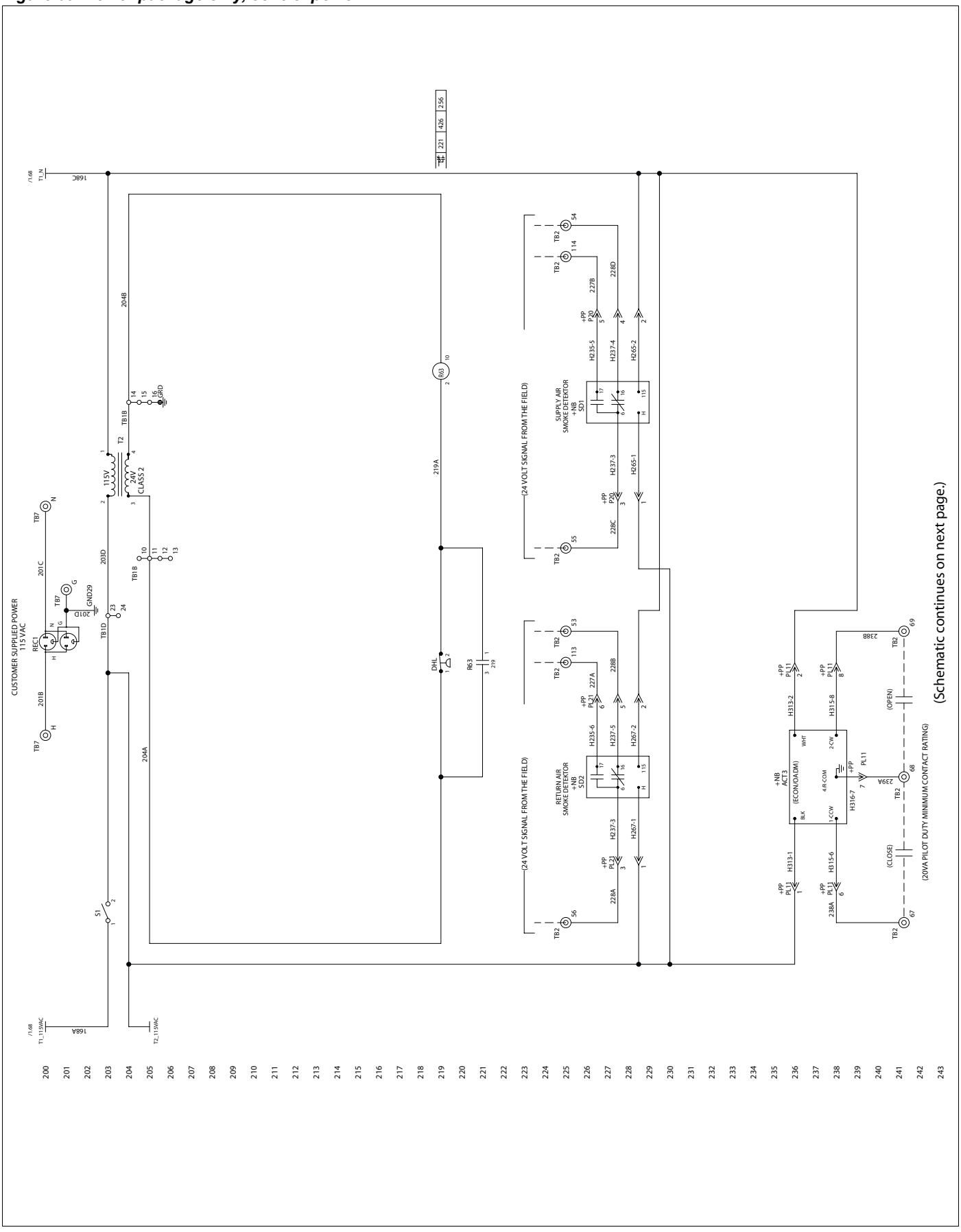
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Figure 68. Power package only, main power, continued



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Figure 69. Power package only, control power



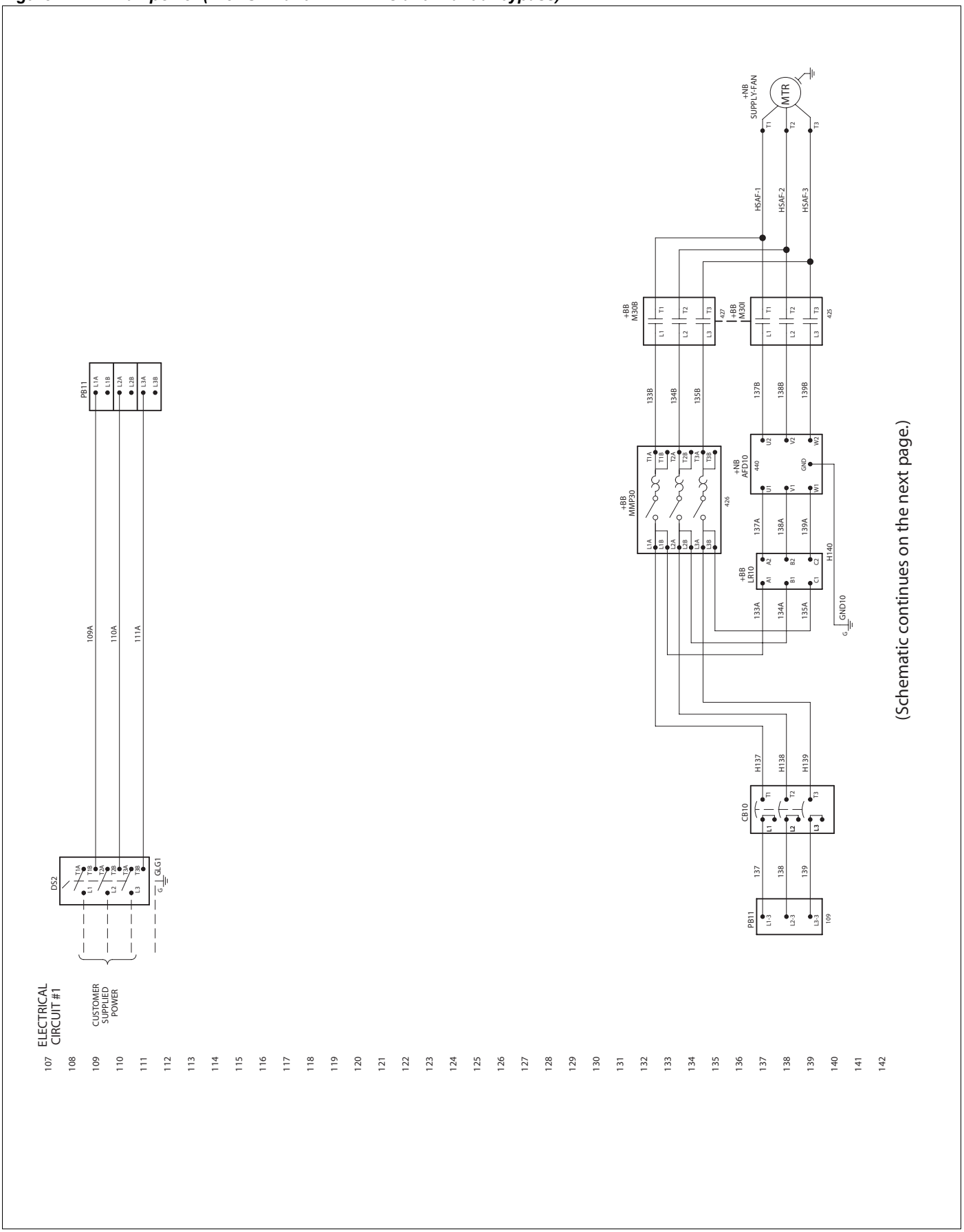
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Figure 70. Power package only, control power, continued



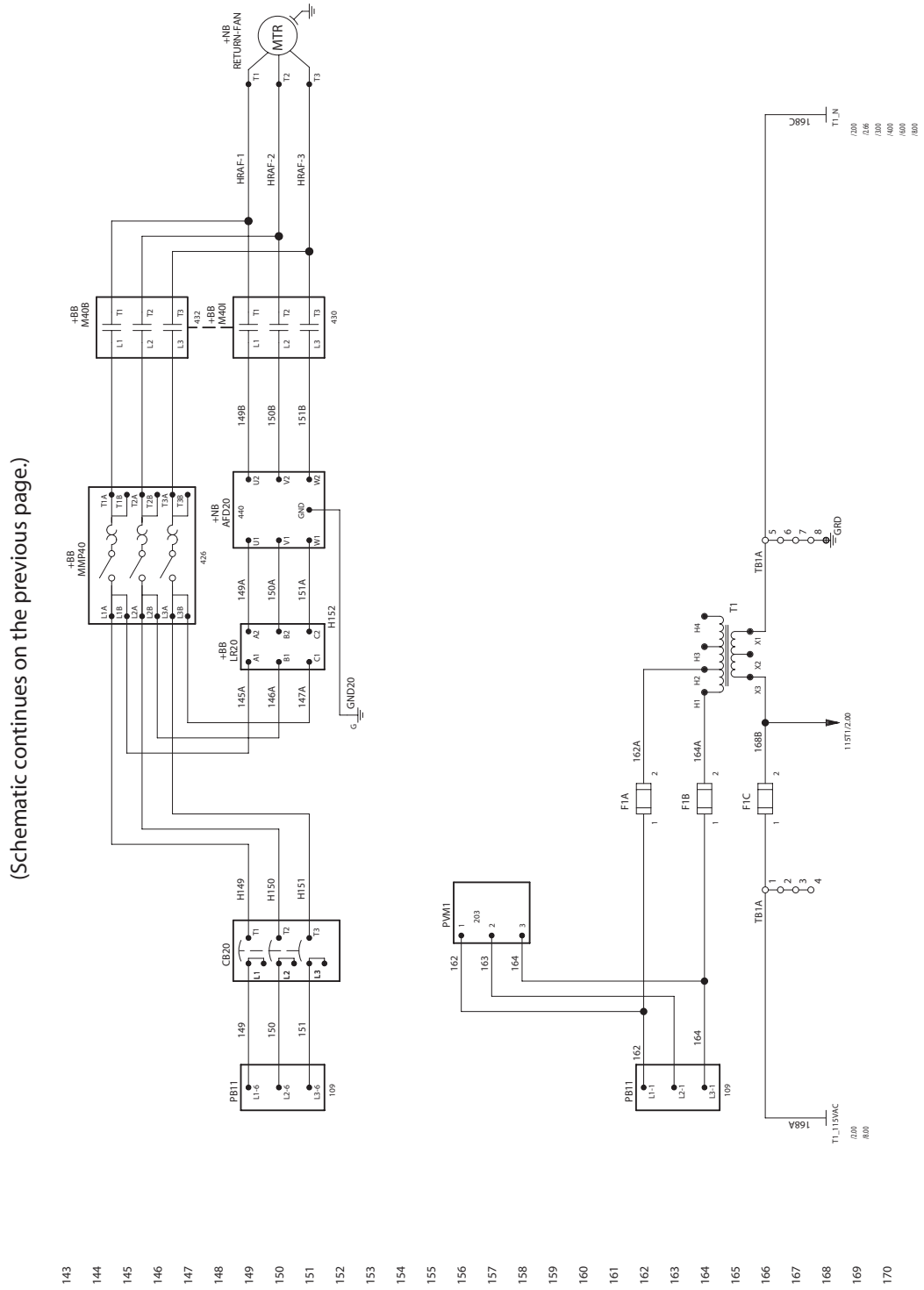
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Figure 71. VAV fan power (with SAF and RAF VFDs and manual bypass)



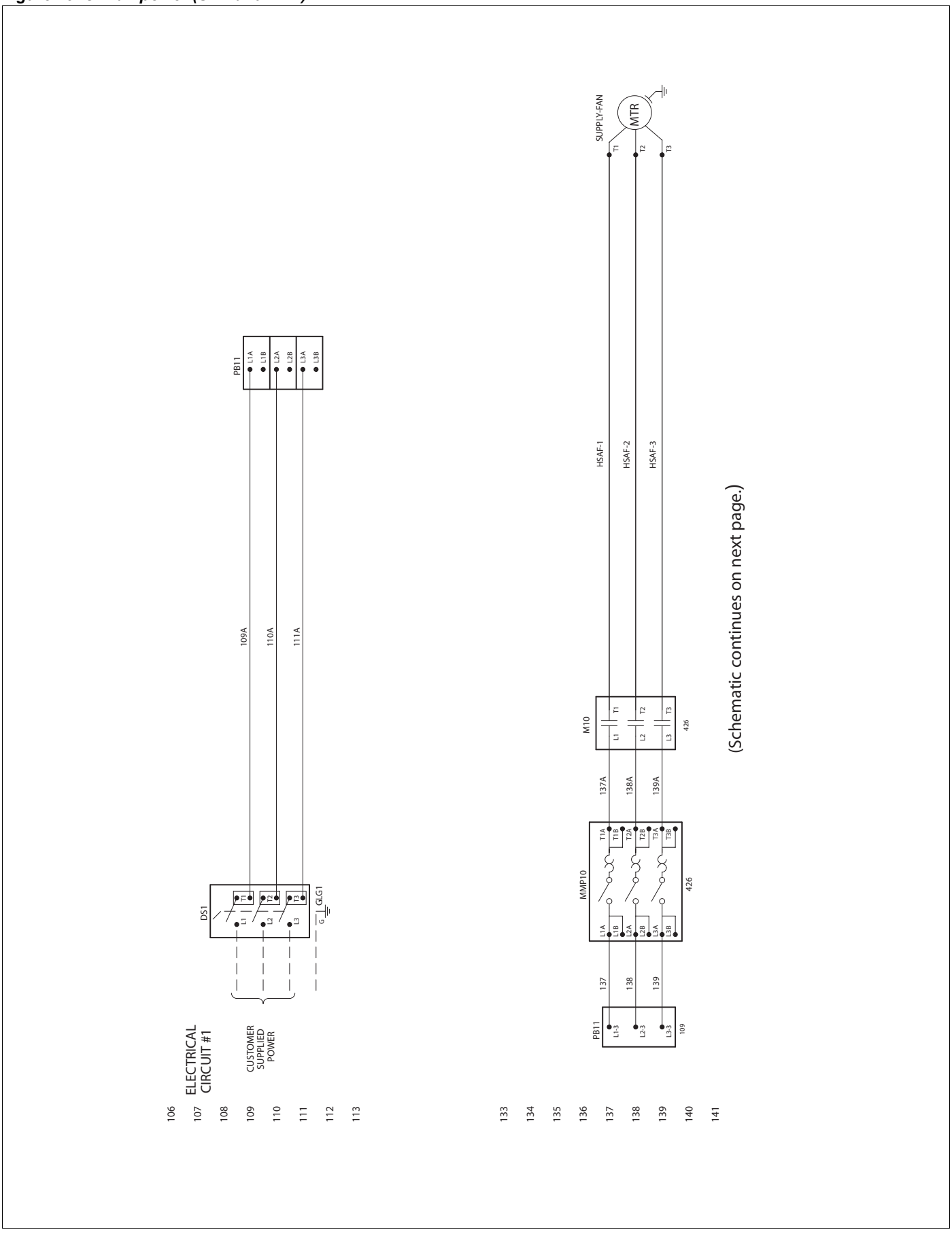
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Figure 72. VAV fan power (with SAF and RAF VFDs and manual bypass), continued



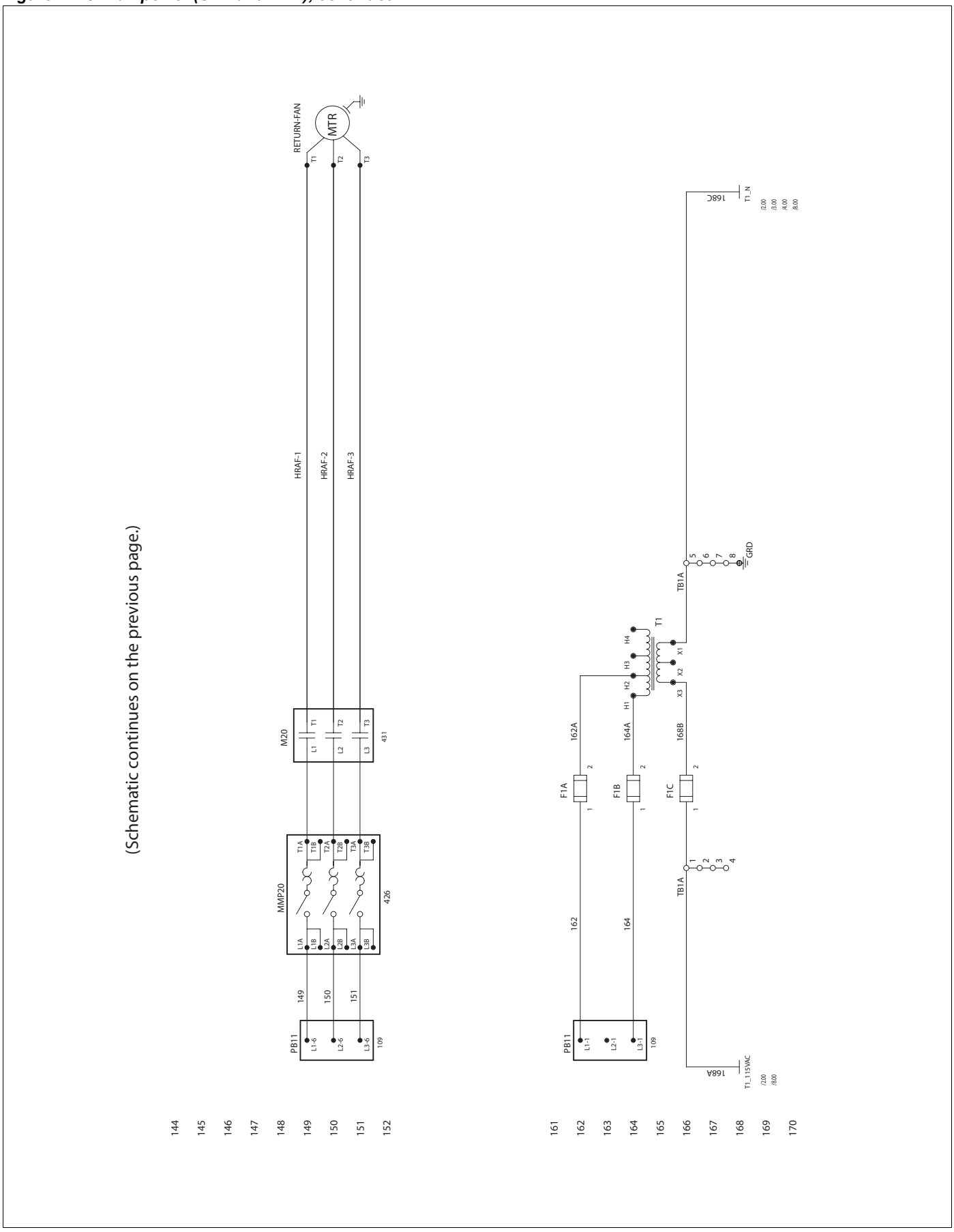
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Figure 73. CV fan power (SAF and RAF)



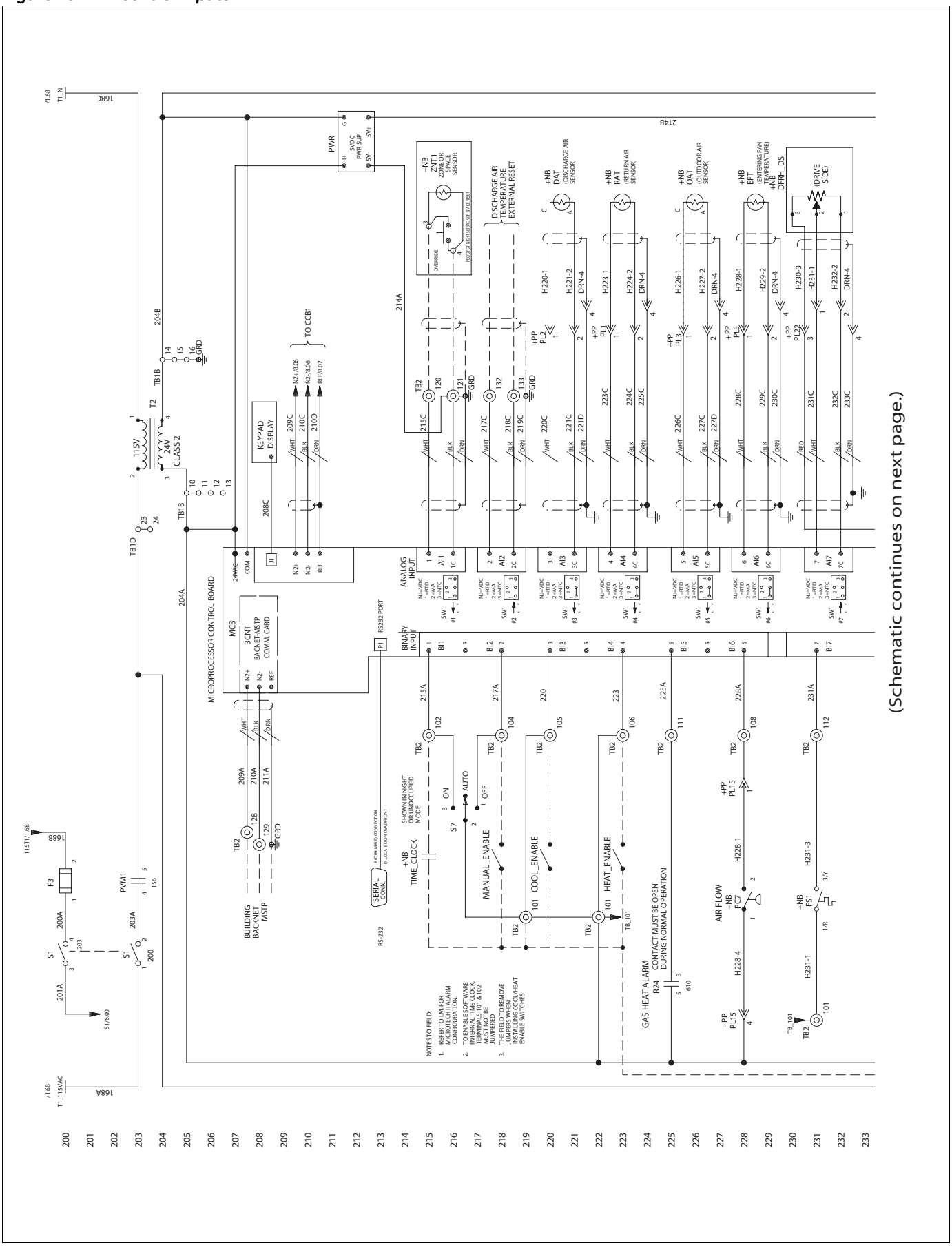
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Figure 74. CV fan power (SAF and RAF), continued



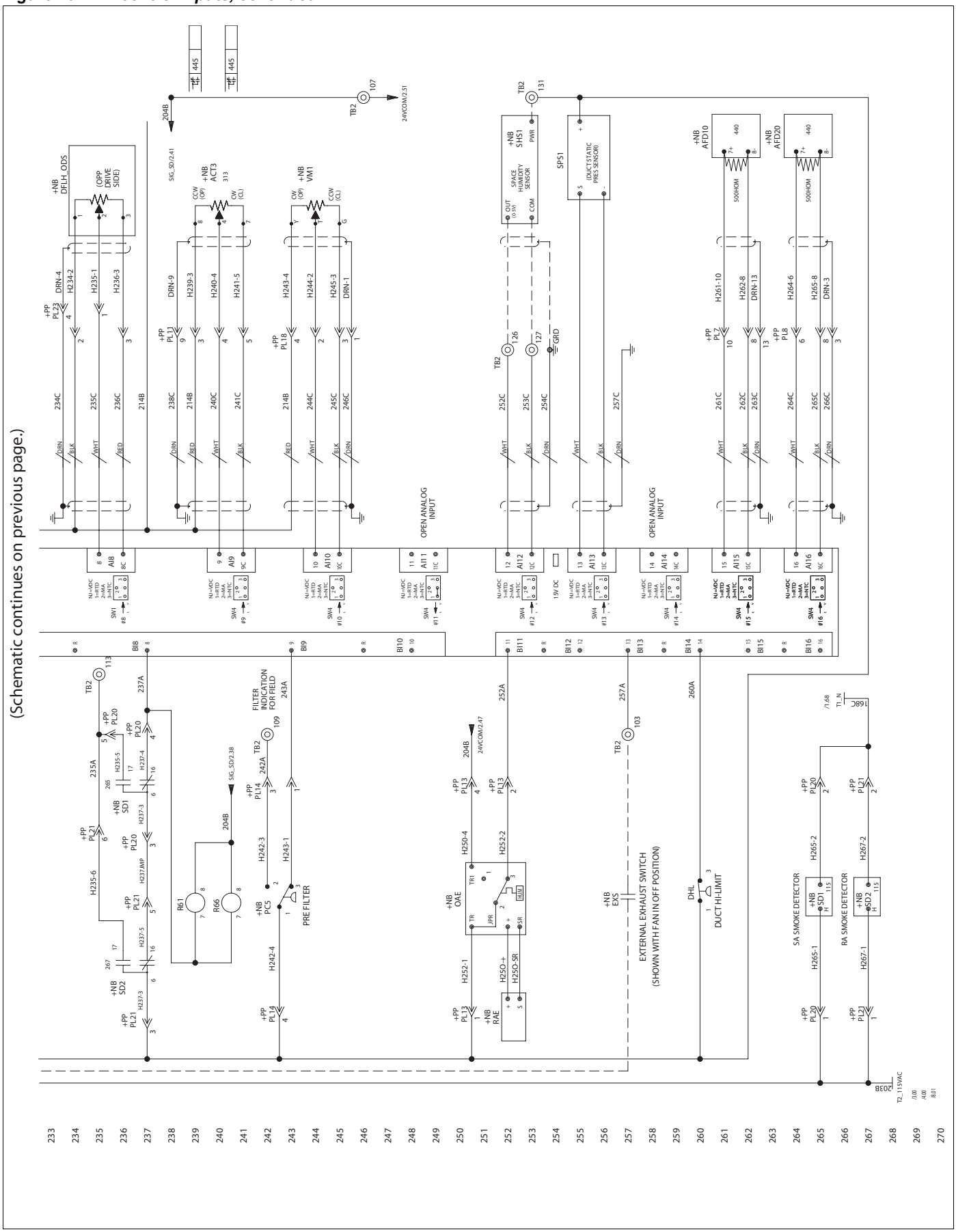
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Figure 75. VAV control inputs



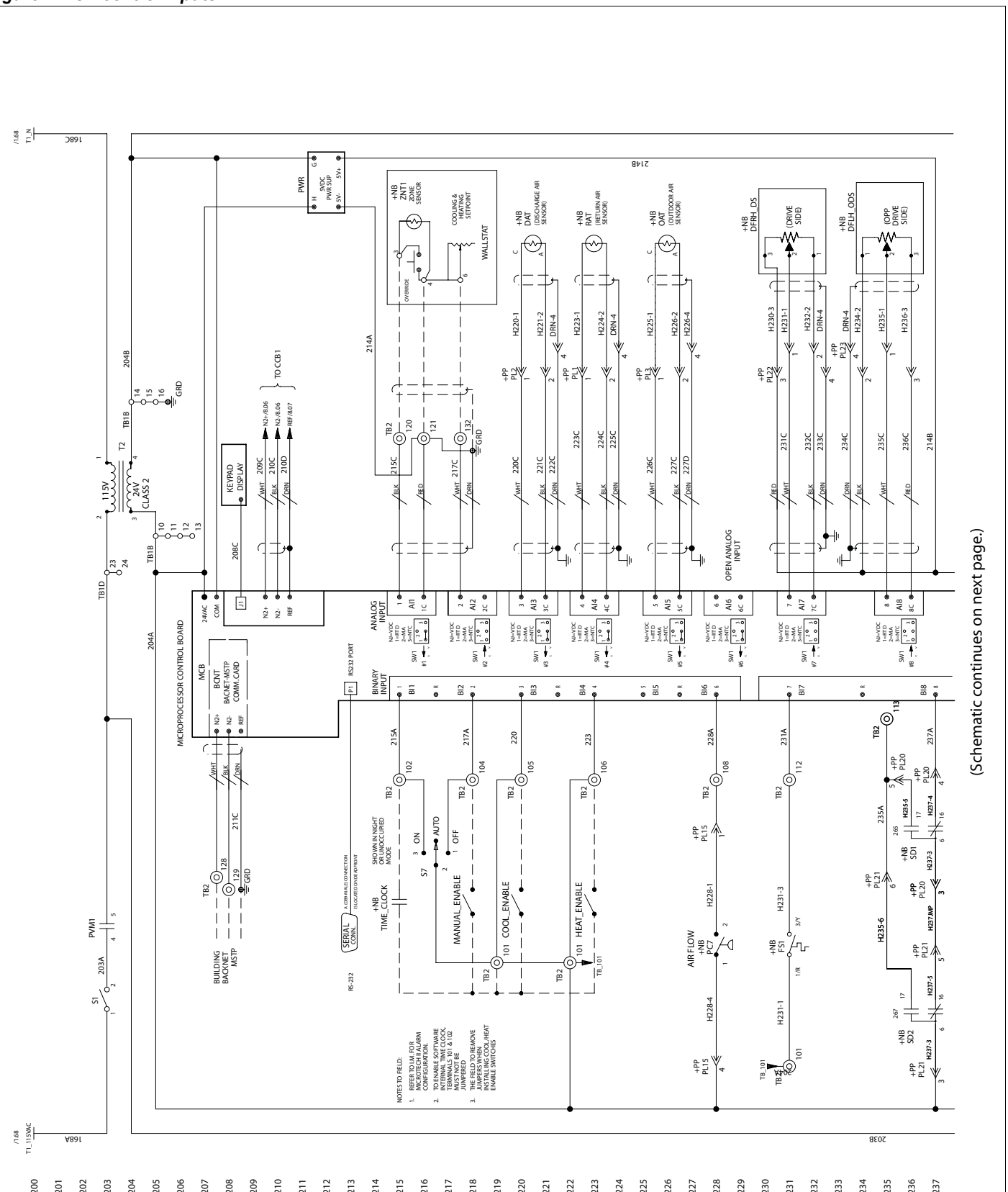
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Figure 76. VAV control inputs, continued



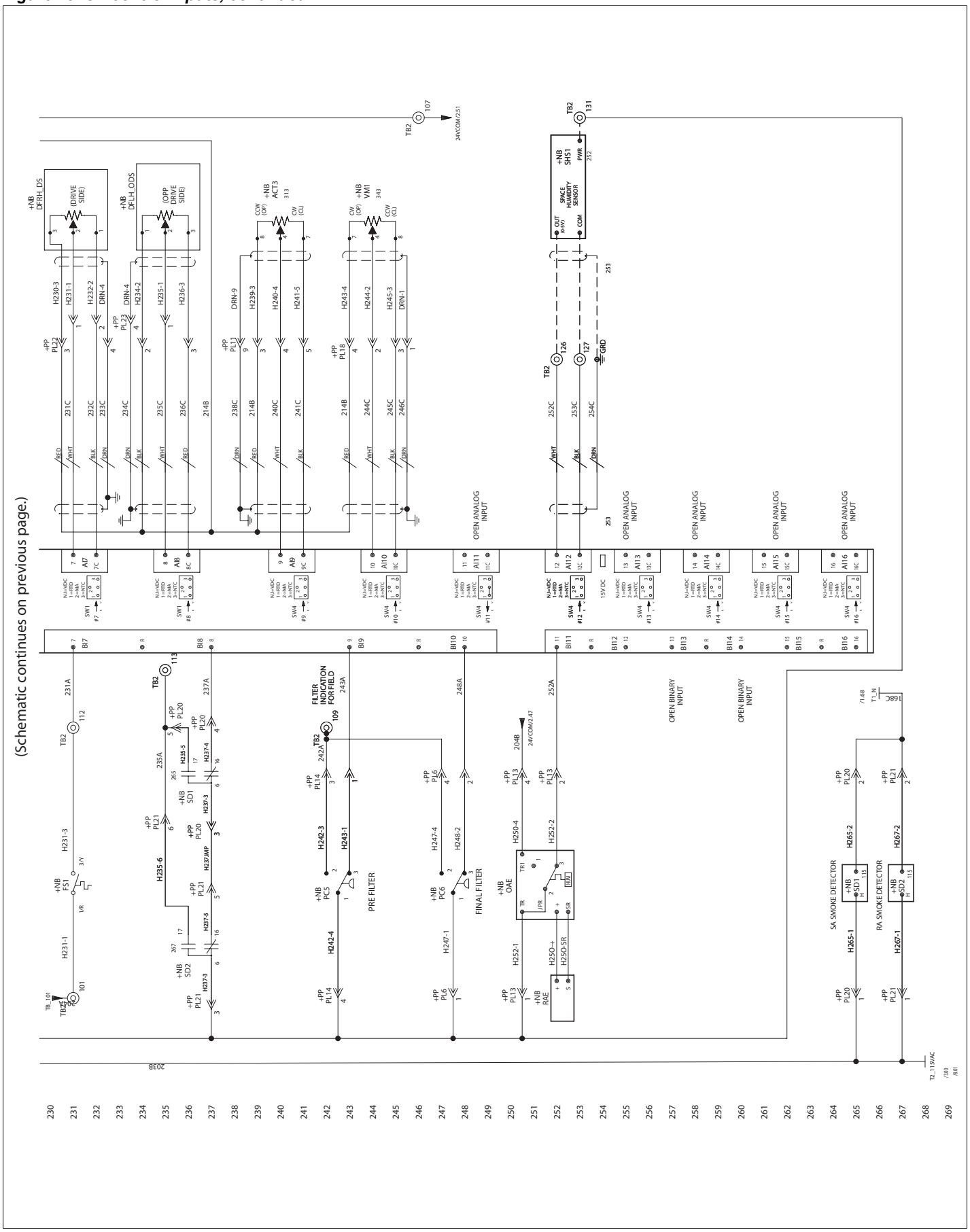
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Figure 77. CV control inputs



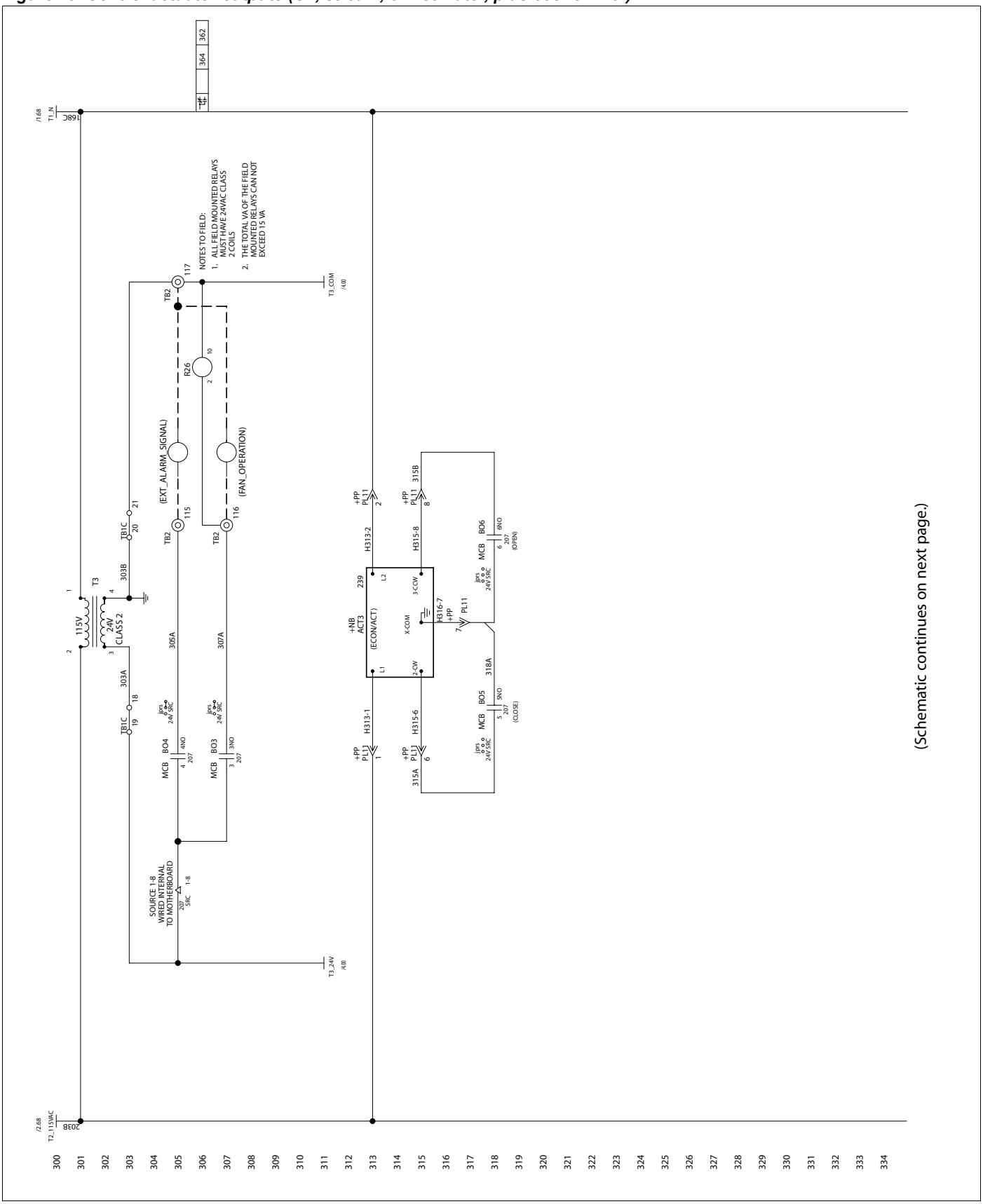
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Figure 78. CV control inputs, continued



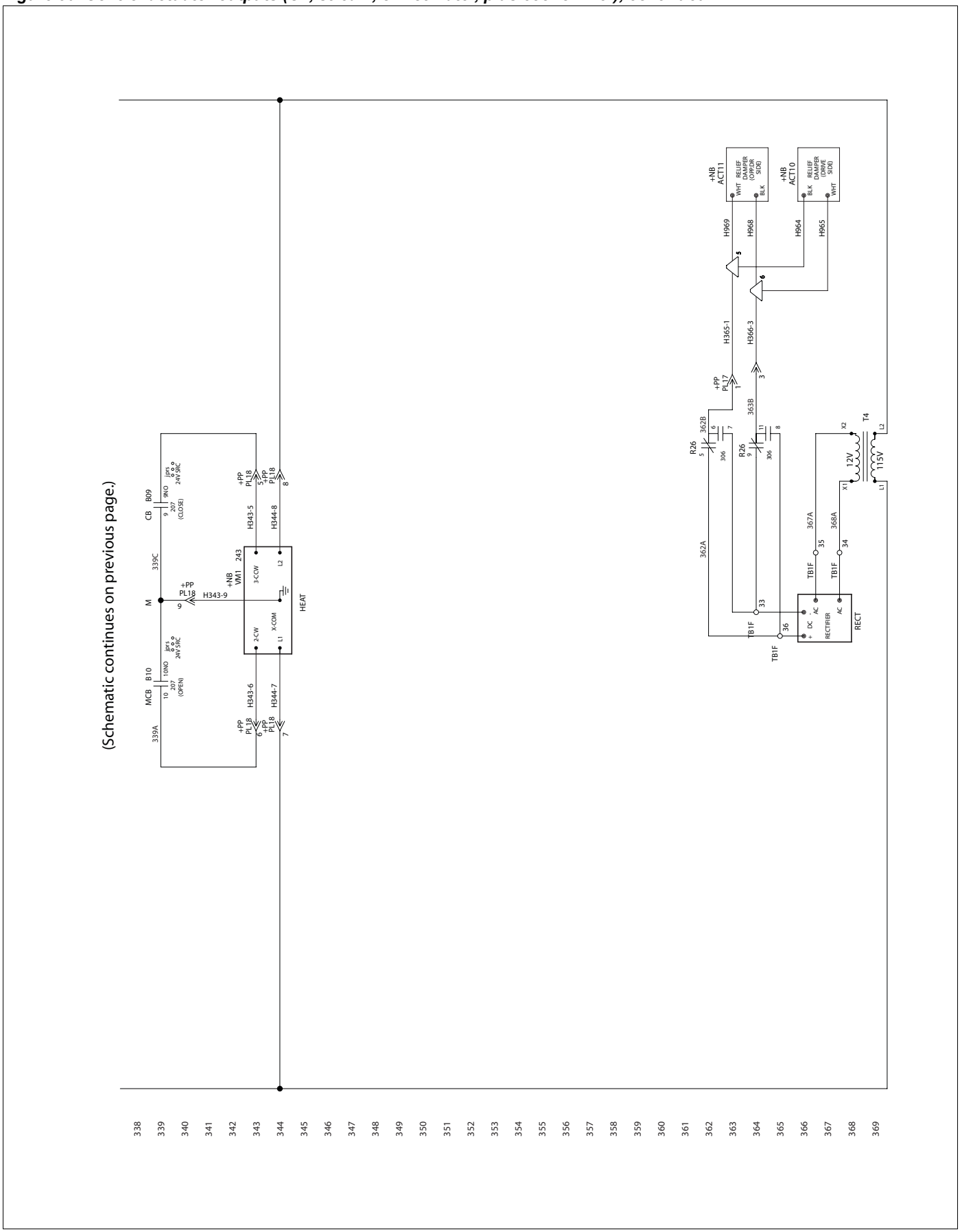
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Figure 79. Control actuator outputs (CV, stream, or hot water, plus economizer)



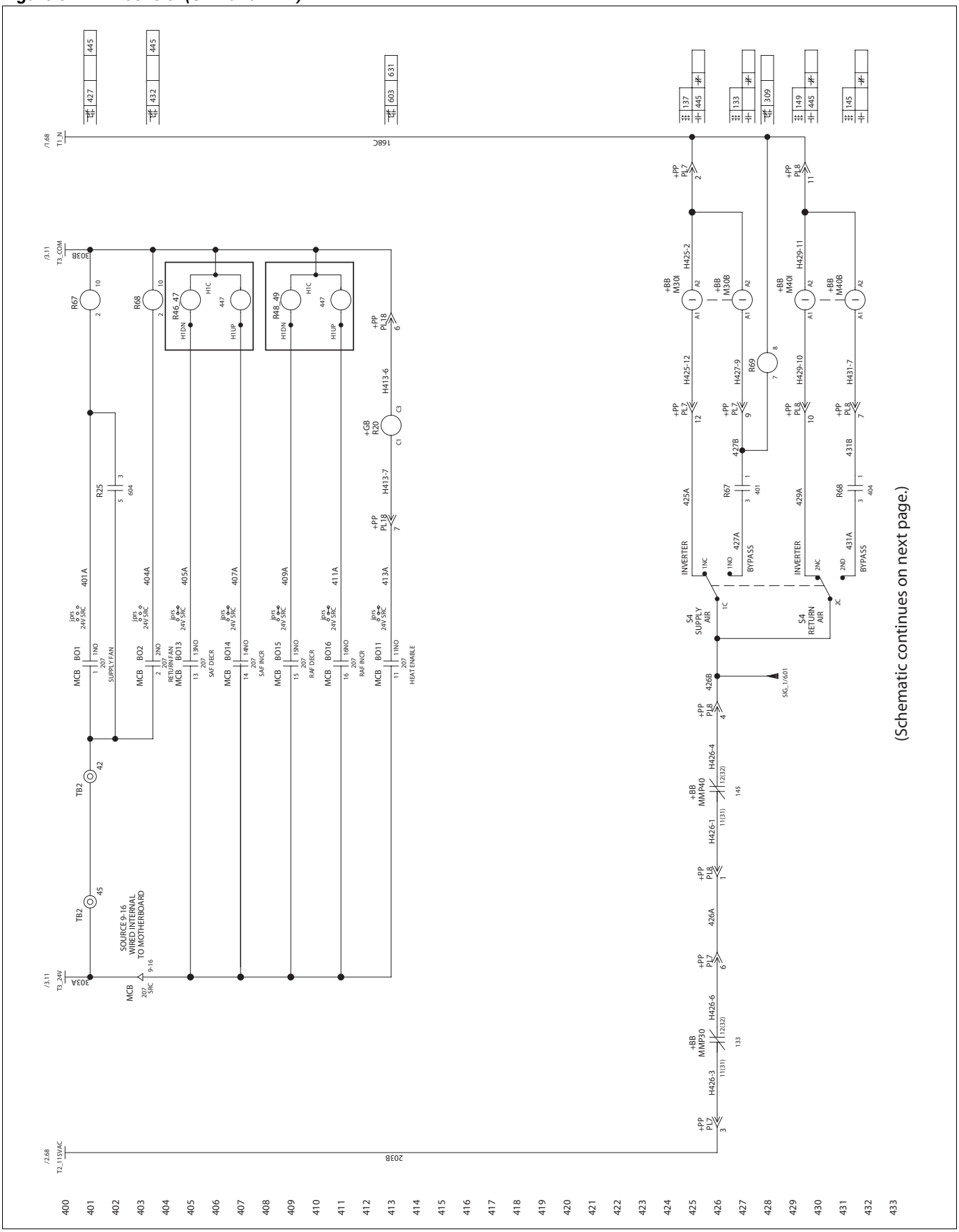
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Figure 80. Control actuator outputs (CV, stream, or hot water, plus economizer), continued



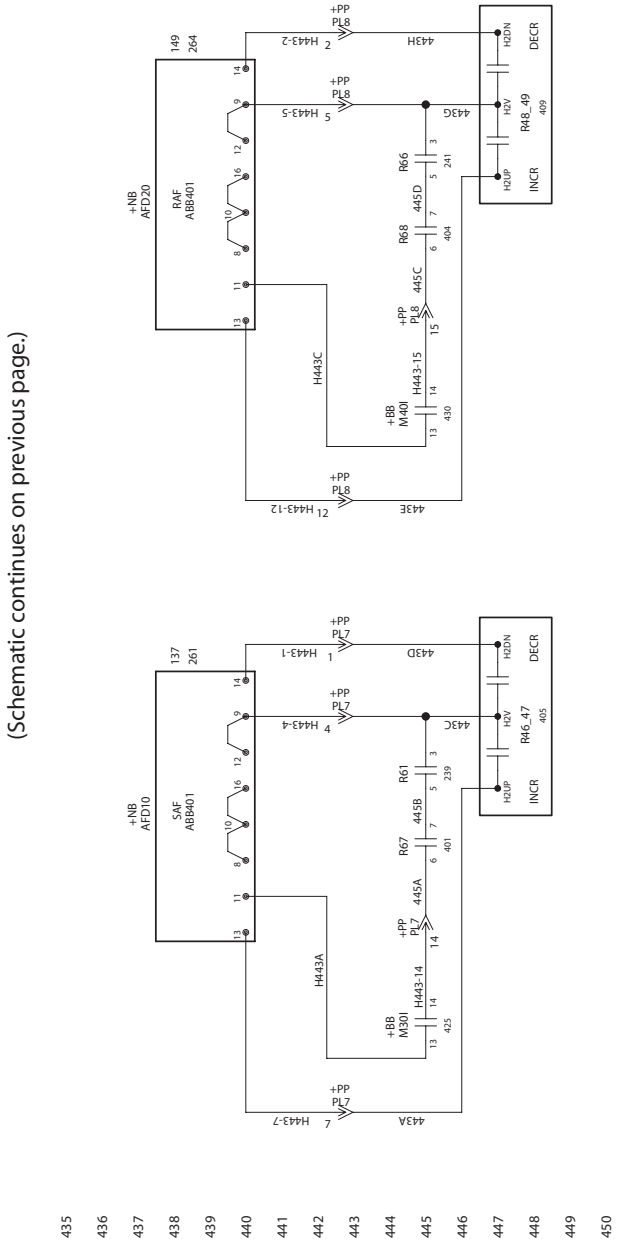
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Figure 81. VFD control (SAF and RAF)



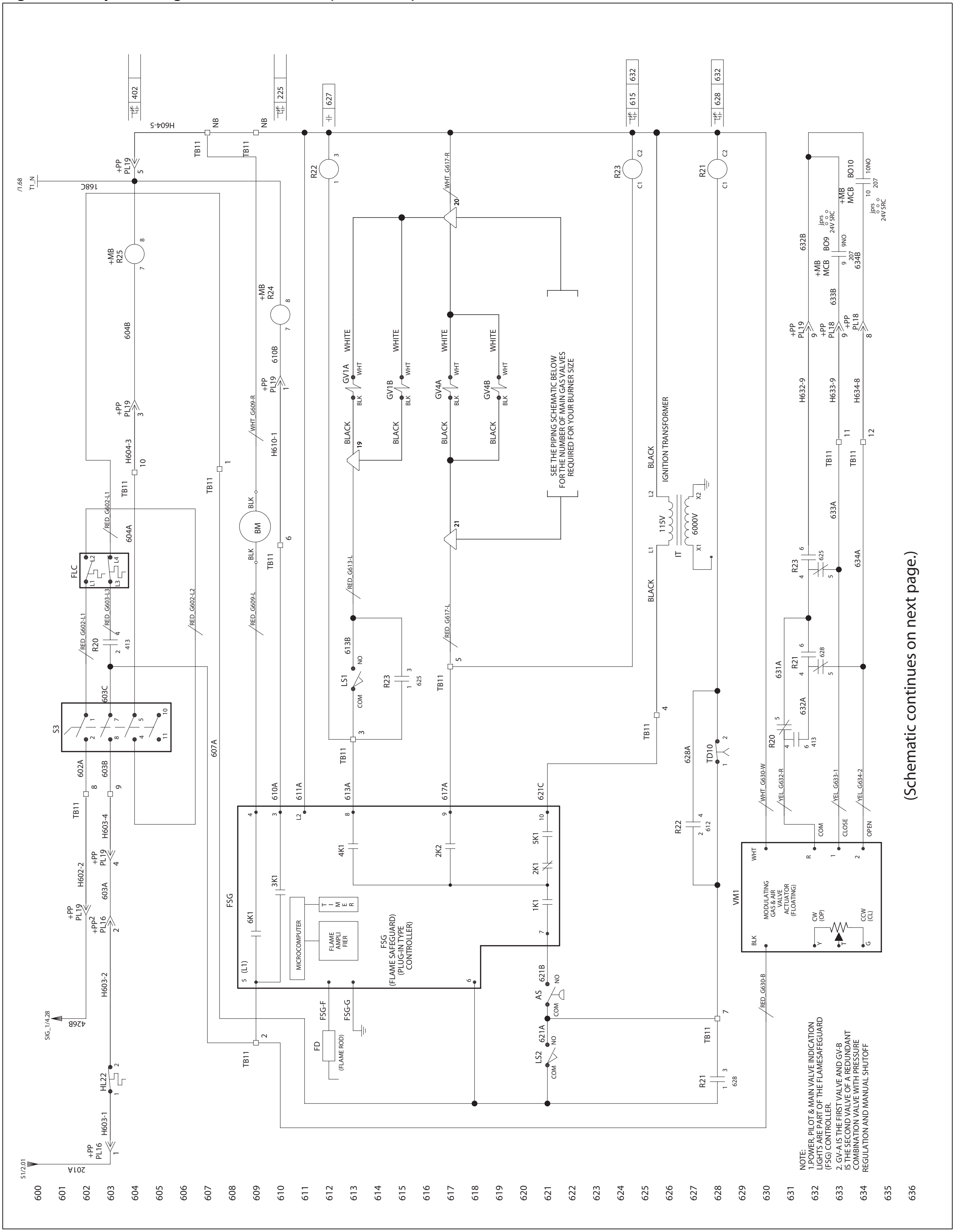
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Figure 82. VFD control (SAF and RAF), continued



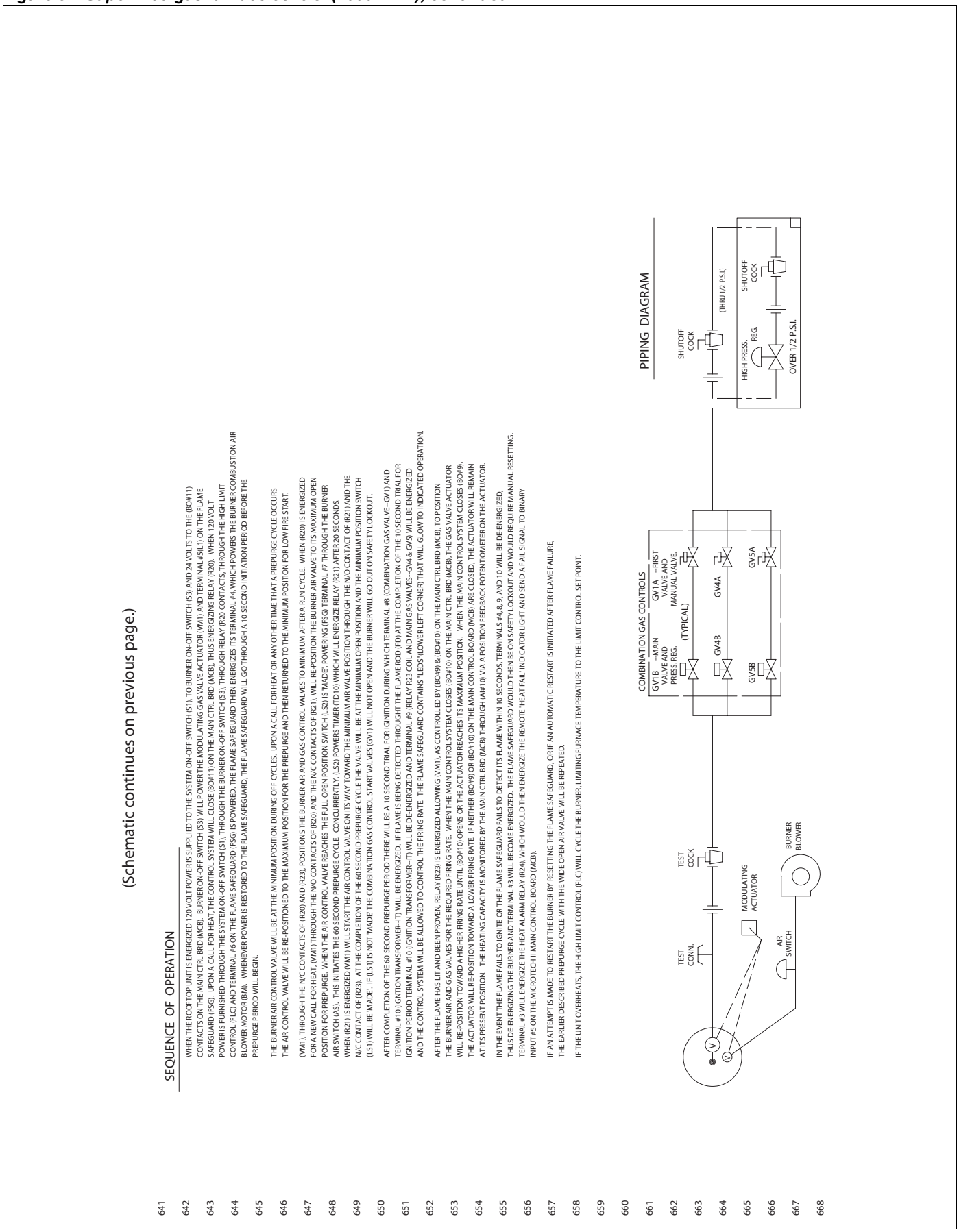
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Figure 83. Super Mod gas furnace control (1000 MBH)



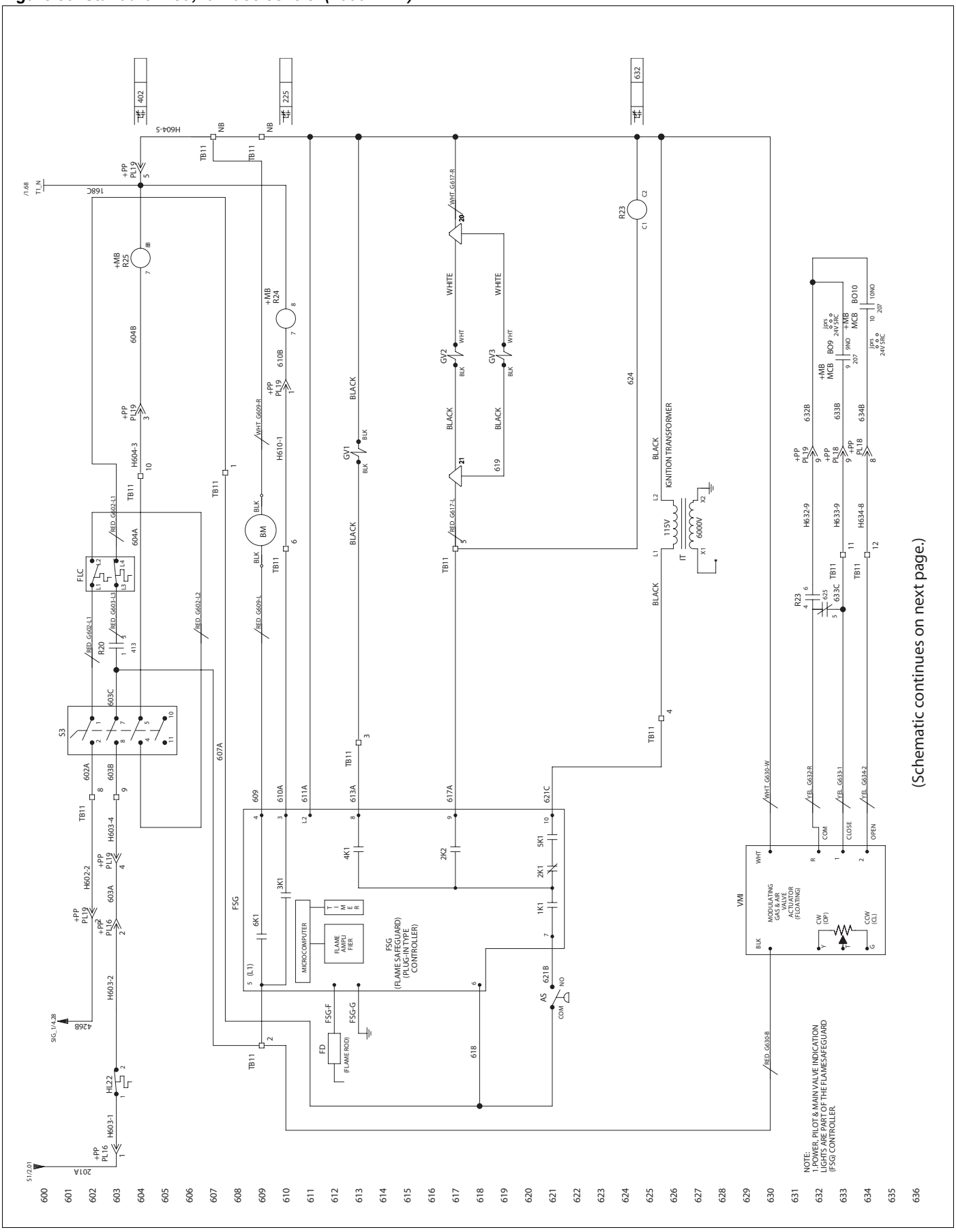
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Figure 84. Super Mod gas furnace control (1000 MBH), continued



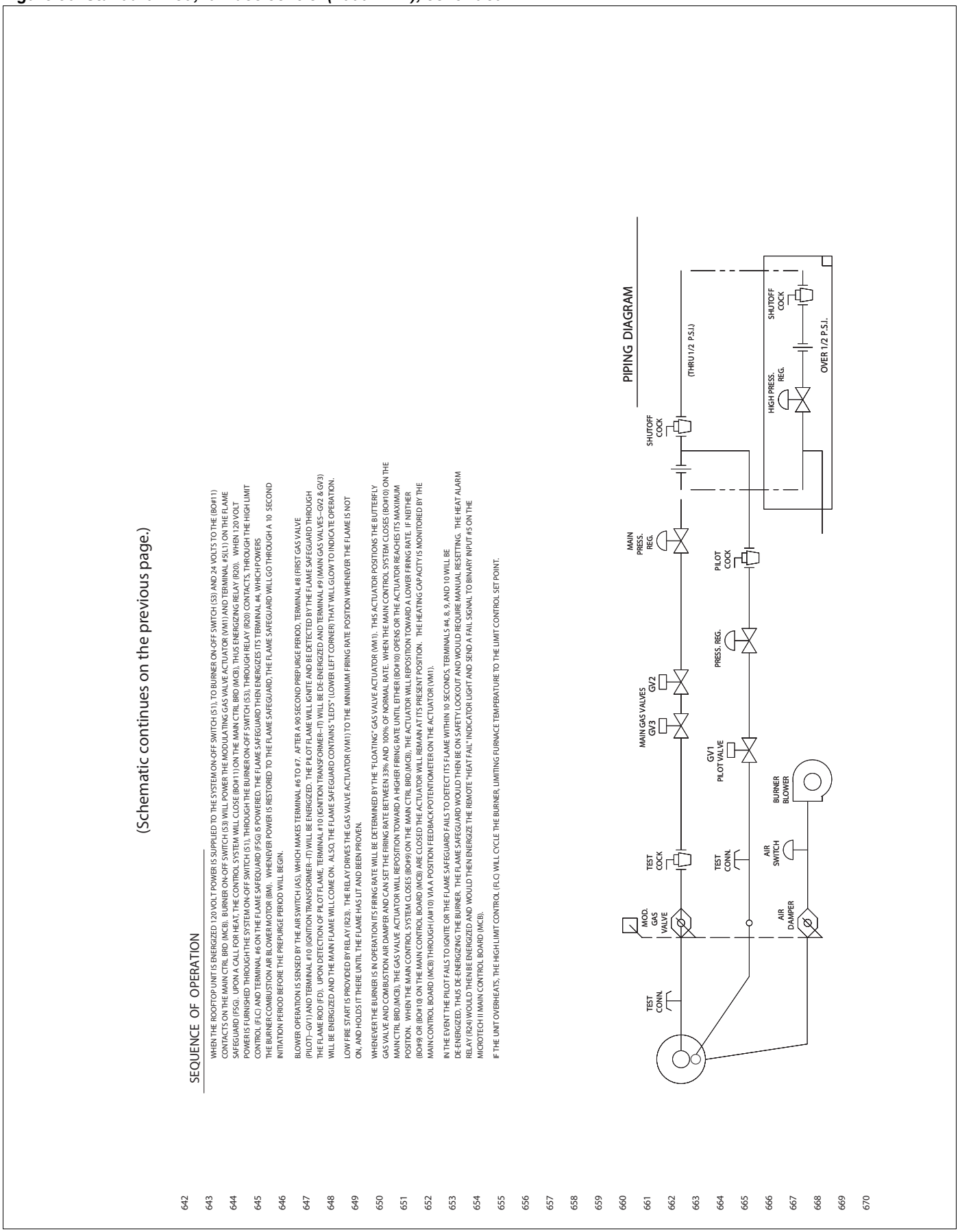
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Figure 85. Standard Mod, furnace control (1000 MBH)



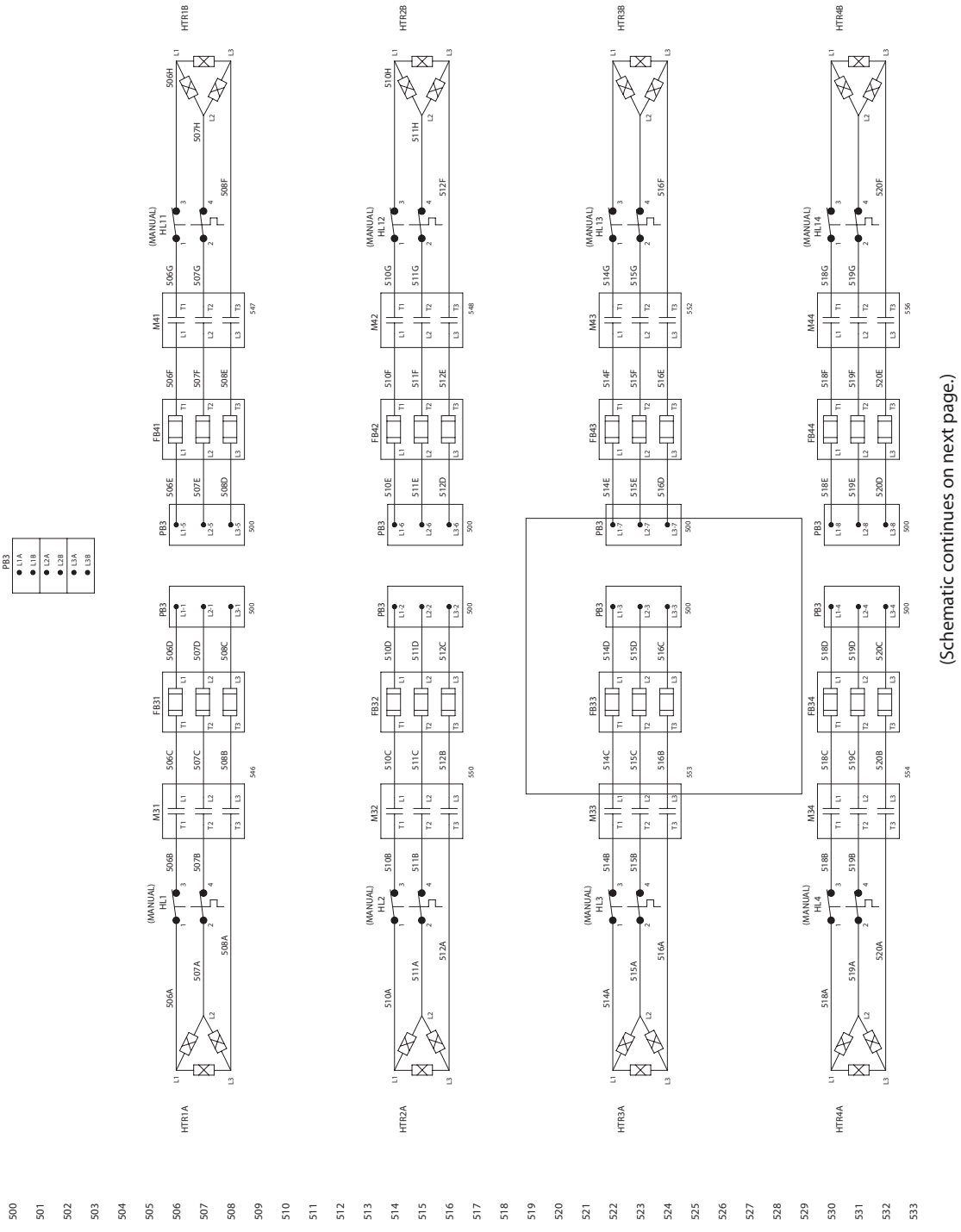
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Figure 86. Standard Mod, furnace control (1000 MBH), continued



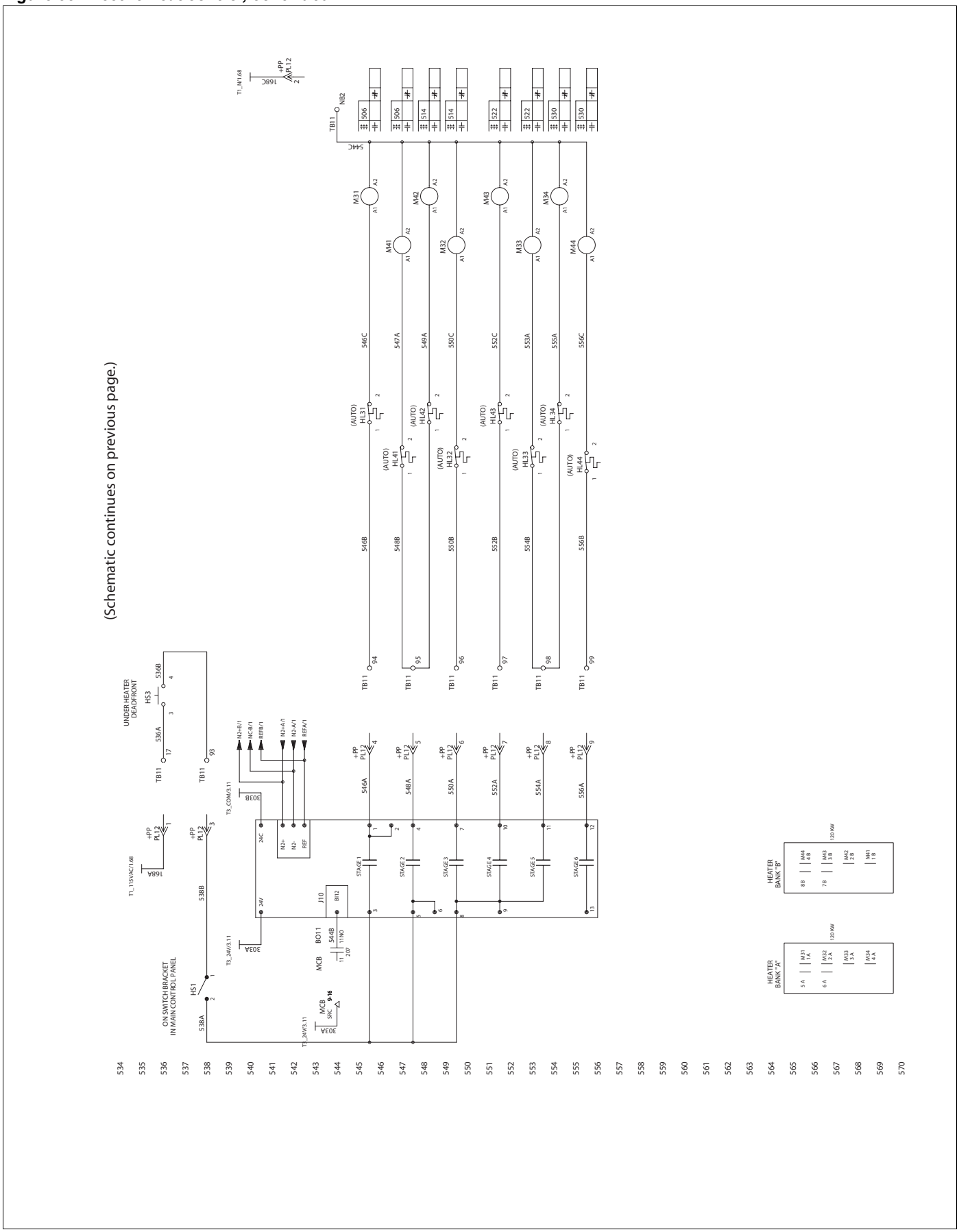
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Figure 87. Electric heat control



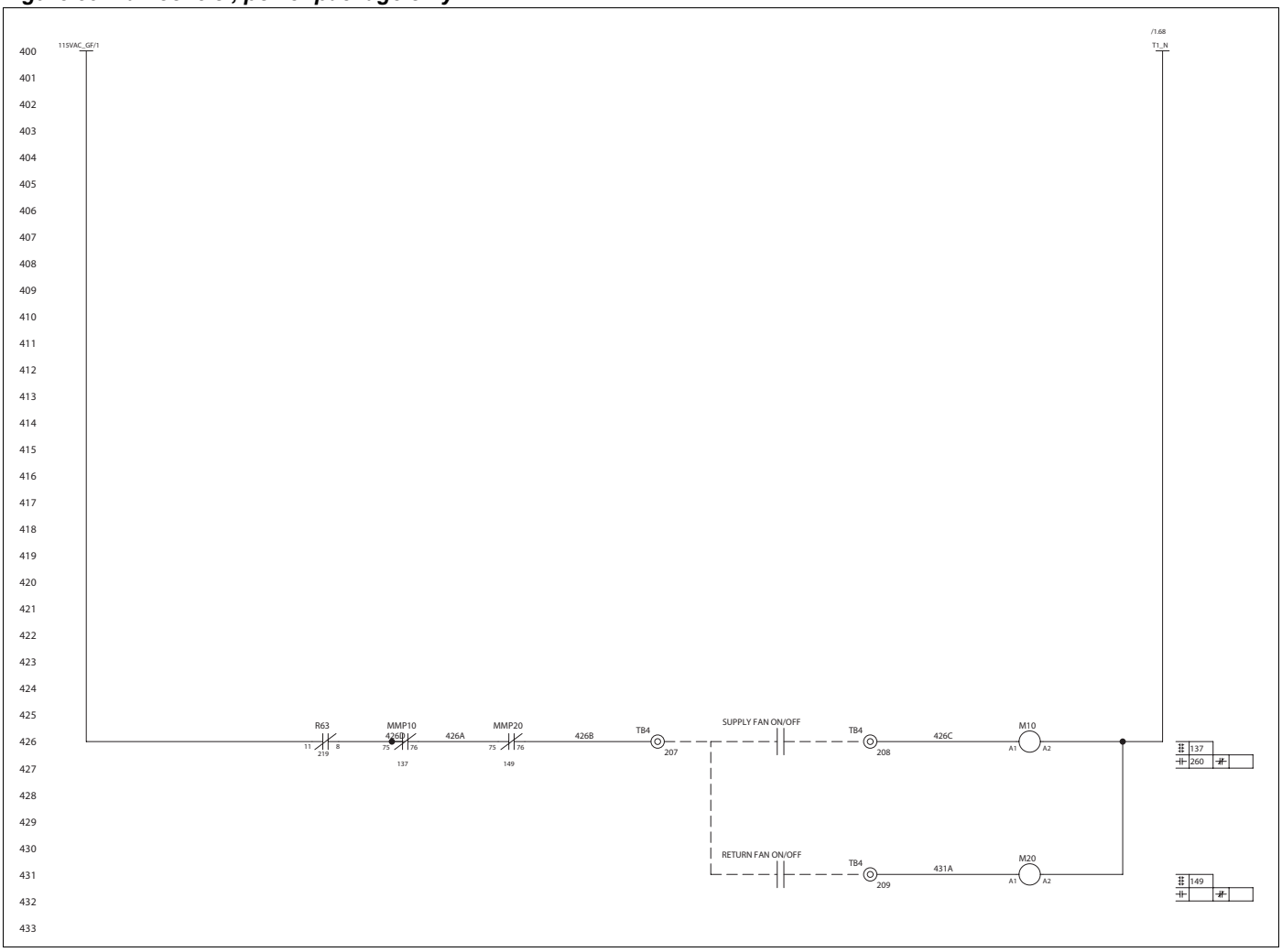
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Figure 88. Electric heat control, continued



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Figure 89. Fan control, power package only



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Figure 90. CV fan control (SAF and RAF)

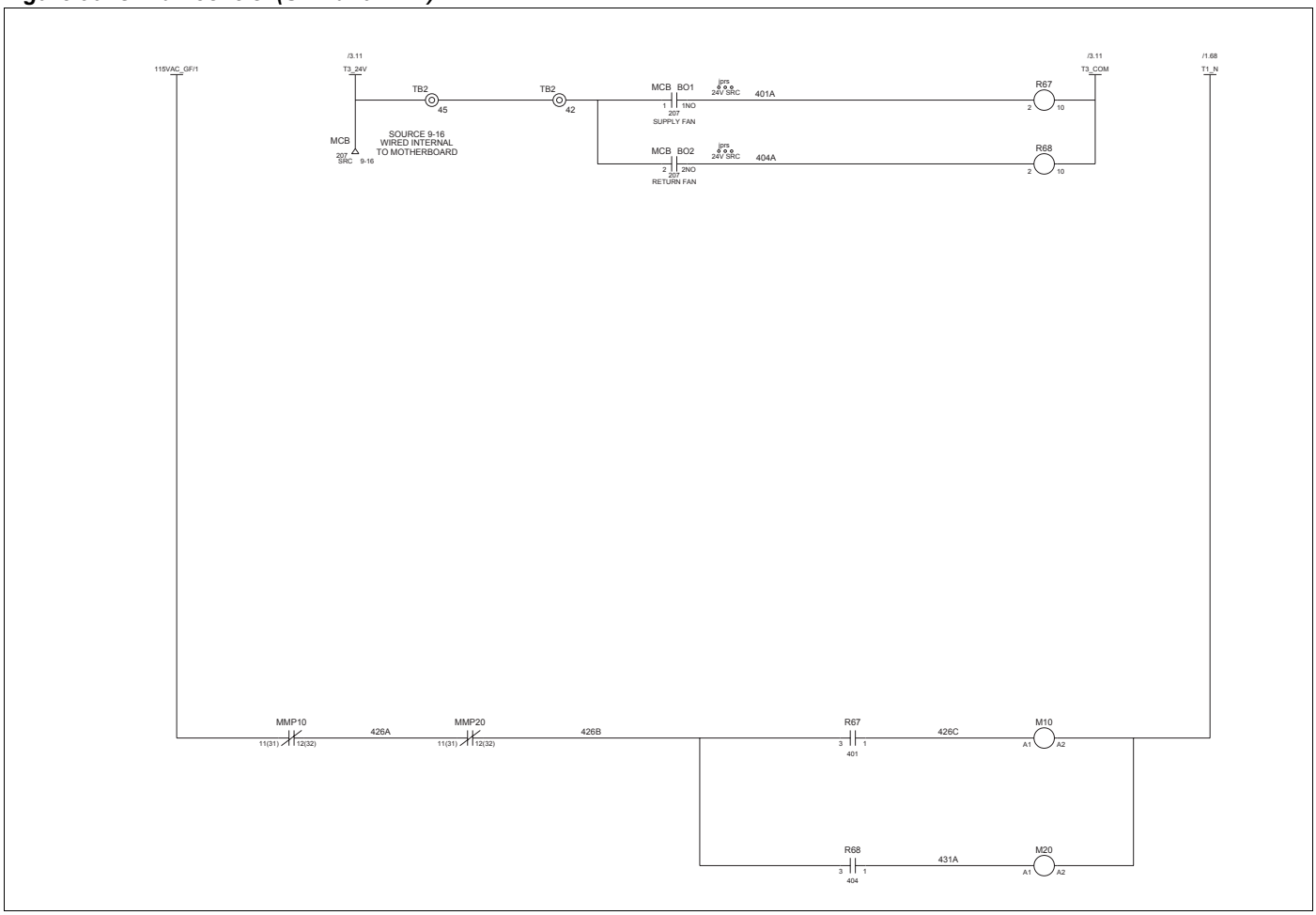
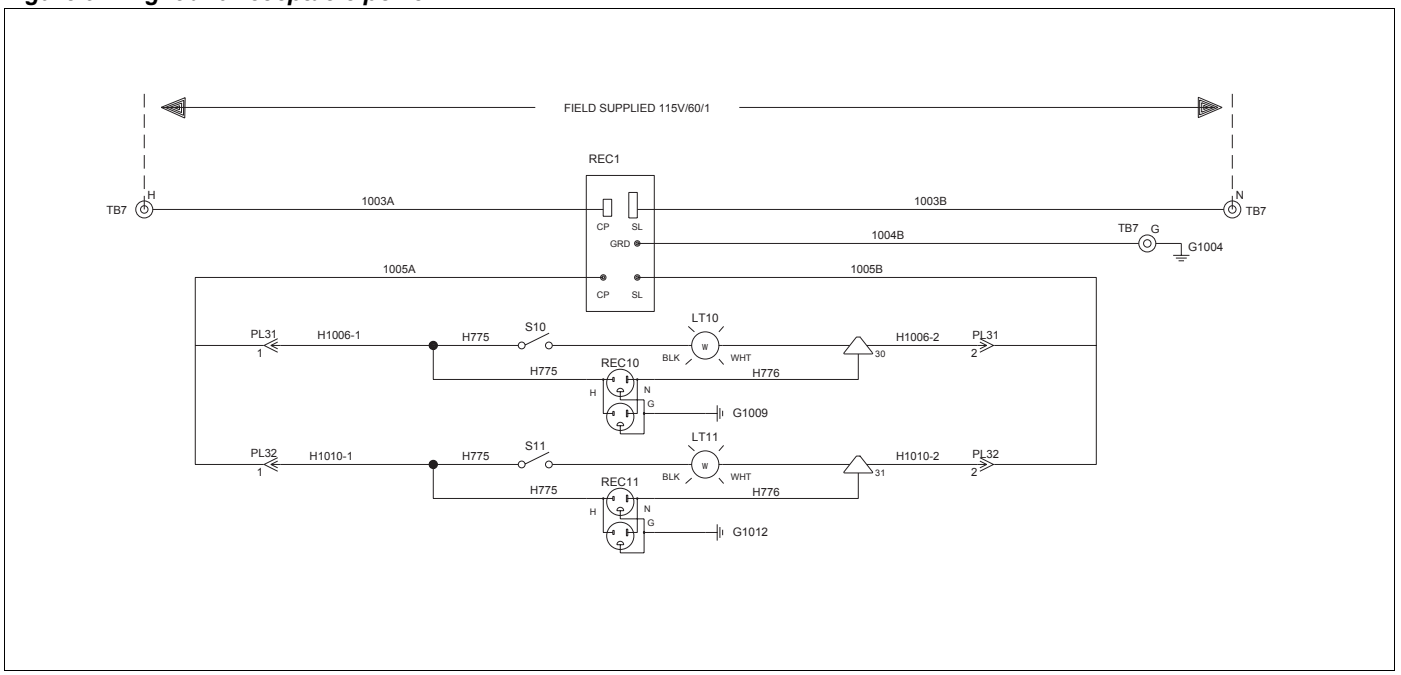


Figure 91. Light and receptacle power



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Unit Options

Enthalpy Control

Outside Air Enthalpy Control (OAE)

Units with MicroTech II control and an economizer come standard with an electromechanical enthalpy control device (OAE) that senses both the humidity and temperature of the outside air entering the unit. This device has an enthalpy scale marked A through D. Table 14 shows the control points at 50% RH for settings A through D. Figure 92 shows this scale on a psychrometric chart. When the outside air conditions exceed the setting of the device, the outside air dampers are positioned to the minimum outside air intake position by the MicroTech II controller.

Table 14: Enthalpy control settings

Control curve	Control point temperature at 50% RH
A	73°F (23°C)
B	70°F (21°C)
C	67°F (19*C)
D	63°F (17°C)

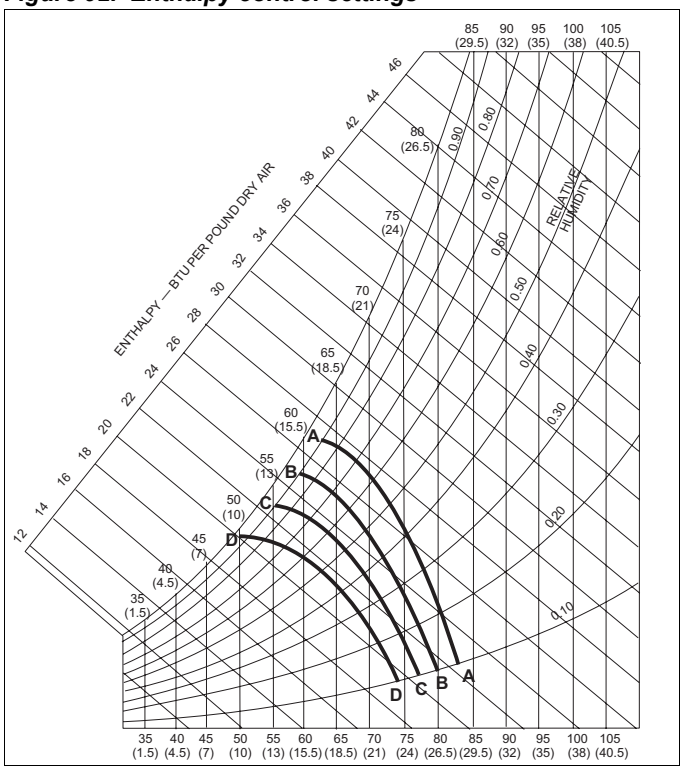
Differential Enthalpy Control (OAE/RAE)

An optional electric differential enthalpy control arrangement (OAE/RAE) is available on units with MicroTech II control. In this configuration a solid-state humidity and temperature sensing device is located in both the return (RAE) and outside intake (OAE) airstreams. This OAE device has the same A through D scale as the device described above. However, with the OAE/RAE arrangement the switch on OAE must be set all the way past the “D” setting. With this done, the MicroTech II controller adjusts the return and outside air dampers to use the airstream with the lowest enthalpy.

Ground Fault Protection

The ground fault protection is designed to protect motors from destructive arcing ground faults. The system consists of a ground fault relay and a ground fault current sensor. The ground fault relay employs solid state circuits that will instantaneously trip and open a set of relay contacts in the 115 volt control circuit to shut the unit down whenever a ground fault condition exists. The ground fault relay is self powered. The ground fault sensor is a current transformer type of device located on the load side of the power block through which the power wires of all phases are run.

Figure 92. Enthalpy control settings



Phase Voltage Monitor (see page 111)

The phase voltage monitor protects against high voltage, phase imbalance, and phase loss (single phasing) when any one of three line voltages drops to 74% or less of setting. This device also protects against phase reversal when improper phase sequence is applied to equipment, and low voltage (brownout) when all three line voltages drop to 90% or less of setting. An indicator run light is ON when all phase voltages are within specified limits. The phase voltage monitor is located on the load side of the power block with a set of contacts wired to the 115 volt control circuit to shut the unit down whenever the phase voltages are outside the specified limits.

External Time Clock

You can use an external time clock as an alternative to (or in addition to) the MicroTech II 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 MCB-BI1. This is the normal condition where the controller follows the programmable internal schedule. When the circuit is closed, power is fed to BI1. The MicroTech II controller responds by placing the unit in the occupied mode, overriding any set internal schedule.

For more information, see the “Digital Inputs” section of Bulletin No. IM 696, “MicroTech II Applied Rooftop Unit Controller.”

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Smoke and Fire Protection

McQuay optionally offers factory installed outdoor air, return air, and exhaust air dampers as well as smoke detectors in the supply and return air openings, complete with wiring and control. These components often are used in the building's smoke, fume, and fire protection systems. However, due to the wide variation in building design and ambient operating conditions into which our units are applied, we do not represent or warrant that our products will be fit and sufficient for smoke, fume, and fire control purposes. The owner and a fully qualified building designer are responsible for meeting all local and NFPA building code requirements with respect to smoke, fume, and fire control.

⚠ WARNING

Improper smoke, fire, or fume air handling can result in severe personal injury or death.

Smoke Detectors

Optional smoke detectors can be located at the supply and return openings. The wiring for these smoke detectors is shown on any of the "Typical Main Control Circuit" wiring schematics within the "Wiring Diagrams" section on pages 64–86.

The sequence of operation for these detectors is as follows: When smoke is detected by either sensor, the normally closed sensor contacts open. This removes power from binary input BI8 on the Main Control Board.

The MicroTech II controller responds by shutting down the unit. The controller is placed in the Alarm Off state and cannot be restarted until the alarm is manually cleared. Refer to the operation manual supplied with the unit for information on clearing alarms (OM138 or OM137).

The smoke detectors themselves must be reset manually once they have tripped. Power must be cycled to the smoke detector to reset.

Freeze Protection

An optional freezestat is available on units with MicroTech II control that have hot water, chilled water, or steam heating coils. The sensing element is located on the downstream side of the heating coil in the heating section of the unit. If the freezestat detects a freezing condition and closes, the MicroTech II controller takes different actions, depending on whether the fans are on or off. The freezestat is an auto reset type of control; however, the controller alarm that it causes is manually reset if the fan is on and auto reset if the fan is off.

Fan On Operation

If the freezestat detects a freezing condition while the fan is on, the MicroTech II controller shuts down the fans, closes the outdoor air dampers, opens the heating valve, and sets a 10-minute timer. The MicroTech II controller's active alarm is "Freeze Fault."

When the 10-minute timer expires, the controller begins checking the freezestat again. If the freezestat is open, the heating valve closes. If the freezestat closes again, the heating valve opens, and the 10-minute timer resets.

The unit remains shut down until the "Freeze Fail" alarm is manually cleared. Refer to the operation manual supplied with the unit for information on clearing alarms (OM138 or OM137).

Fan Off Operation

If the freezestat detects a freezing condition while the fan is off, the MicroTech II controller opens the heating valve and sets a 10-minute timer. The MicroTech II controller's active alarm is "Freeze Problem."

When the 10-minute timer expires, the controller begins checking the freezestat again. If the freezestat is open, the heating valve closes. If the freezestat closes again, the heating valve opens, and the 10-minute timer resets.

When the freezestat opens again, the "Freeze Prob" alarm automatically clears. This feature protects the coil and allows the system to start normally after a cold night.

Entering Fan Temperature Sensor

The entering fan temperature (EFT) sensor and an associated "Lo Airflow Problem" alarm are provided on VAV units with MicroTech II control and gas or electric heat. The EFT sensor is located in the supply fan section of the unit at the supply air funnel.

Heat is disabled whenever the airflow is detected to be too low for safe heating operation. This condition is indicated when the supply air temperature exceeds the mixed air temperature by more than 60°F (16°C).

Note: This value is not always 60°F. It depends on whether the unit is gas or electric heat and on the burner/baffling arrangement on gas heat units.

In this case, a "Lo Airflow Problem" alarm is generated and heat is not enabled until the alarm is manually cleared. Refer to the operation manual supplied with the unit for information clearing alarms (OM138 or OM137).

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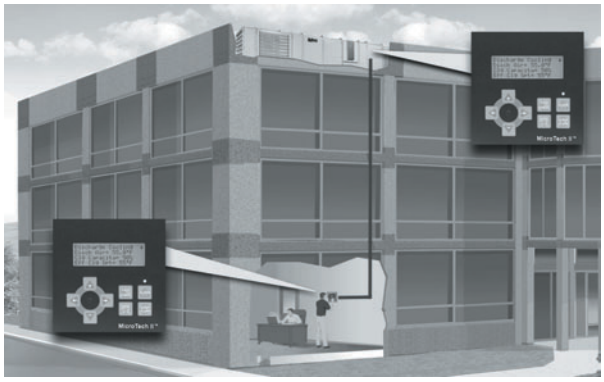
Duct High Pressure Limit

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

The DHL control is factory set to open when the discharge plenum pressure rises to 3.5" w.c. (872 Pa). This setting should be correct for most applications; however, it is adjustable. Removing the front cover of the device reveals a scale showing the current setting. Turning the adjustment screw (located on the bottom of the device) adjusts the setting up or down.

If the DHL switch opens, digital input MCB BI 14 on the Main Control Board will be de-energized. The MicroTech II 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 (OM138 or OM137).

MicroTech II™ Remote User Interface (UI)



Both a unit mounted and an identical, remote mounted keypad and display are provided with this option. A remote-mounted user interface (UI) is available as an option with all rooftop units. The following items are provided:

- Unit mounted UI
- Unit mounted power supply and R485 isolator for the remote UI
- Selector switch to activate either the unit mounted UI or the remote UI. Only one UI is active at a time.
- Wall mounted electrical box that contains the remote UI. See Figure 93.

Cable and Wiring Recommendations

Remote wiring to connect the unit to the remote UI is not included. See Figure 94 on page 86 for wiring information and the following recommendations.

- No more than 1200 feet of wiring can be used to connect the remote user interface to the unit.
- Use overall foil shield, 3 twisted pairs, 22 AWG stranded connectors with drain wire.
- UL 910 plenum rated = Belden 6542FE-1000-877
- Non-plenum rated = Belden 5542FE-1000-8

Figure 93. Factory-assembled remote user interface

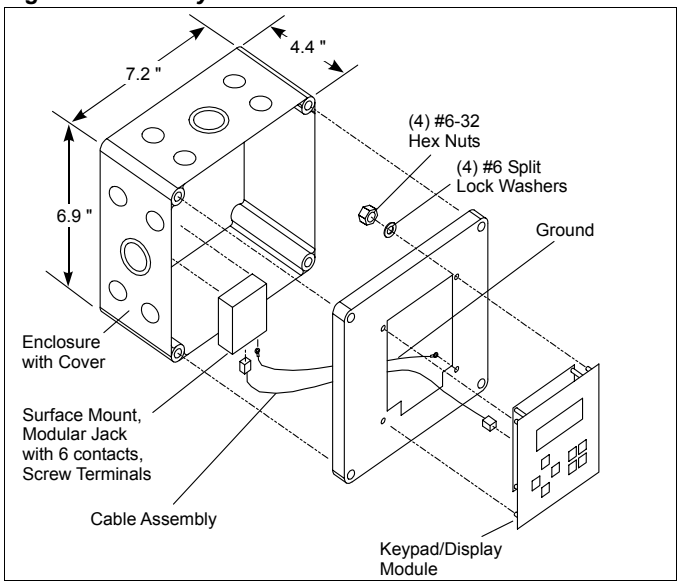
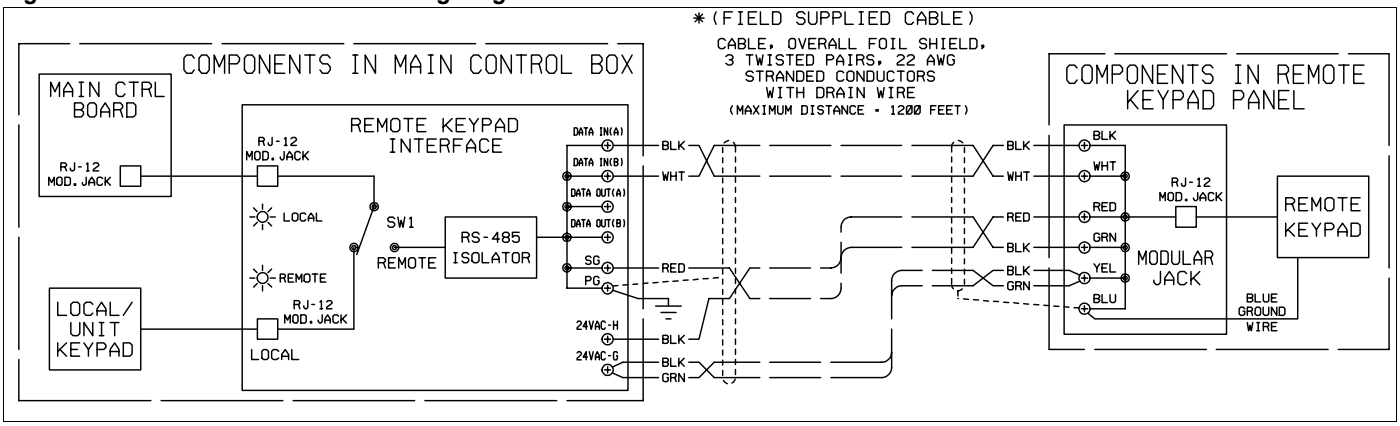


Figure 94. Remote user interface wiring diagram



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Variable Frequency Drive Operation

Refer to the vendor instructions supplied with the unit.

Convenience Receptacle/Section Lights

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 115V power wiring circuit to the 115V field terminal block TB7, located in the main control box.**

Optional lights are available for certain sections in the unit. Each light includes a switch and convenience receptacle and is powered by the external 115V power supply connected to TB7.

DesignFlow™ Outdoor Air Damper Option

DesignFlow™ airflow measurement stations are located inside the louvered outdoor air intake doors between the intake louver and outside air dampers. Essentially, they consist of a vane that is repositioned by airflow, the amount of rotation indicating the amount of airflow. They are calibrated precisely at the factory and no further calibration is required. However, a leveling adjustment is required in the field so that the DesignFlow unit is in the same orientation as when it was factory calibrated. See "DesignFlow Station Startup" below.

The rotational position of the DesignFlow unit vane is translated into CFM by the microprocessor in the MicroTech II control system. The position of the vane is determined by two things—the force of the airflow impacting the vane and the gravitational effect on the vane. Gravity is the only factor at the lower CFM end of the range. On a correctly leveled unit, this gravitational effect will be the same as when the unit was calibrated in the factory.

Accurately leveling a station involves applying a precise mechanical force against the vane. This force should cause the vane to move to a specific position if the DesignFlow unit is correctly leveled.

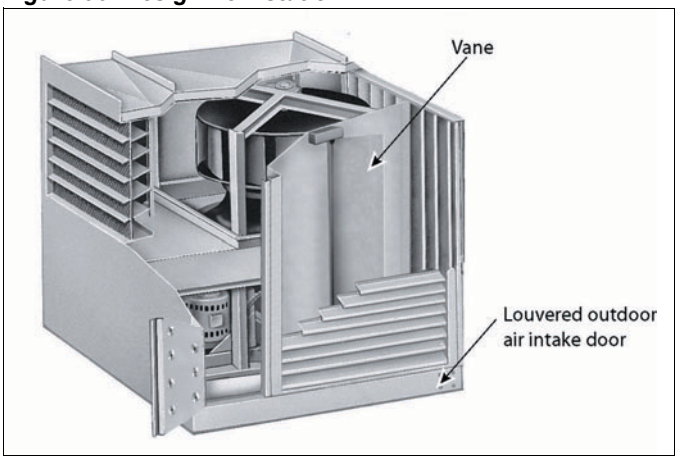
DesignFlow Station Startup

- Before initial startup of the rooftop unit, carry out the following procedure on both the right-hand (control panel side) and left-hand (side opposite the control panel) DesignFlow station vanes (see Figure 95).

Note: This procedure is much easier to carry out with two people—one making the mechanical adjustments and the other viewing and recording readings on the MicroTech II control panel.

1. Verify that power is supplied to the unit's MicroTech II control system. The DesignFlow startup procedure cannot be completed without use of the MicroTech II controls.
2. Unlock and open the louvered outdoor air intake door on the side of the unit (see Figure 95).
3. The swinging vane on the measurement station is locked in place for shipment. Unlock it by removing the two shipping screws. One is located one inch from the top of the vane and the other one inch from the bottom of the vane. Both are about eight inches in from the outer edge of the vane.
4. Examine the station for shipping damage. Manually rotate the vane and verify that it does not rub against anything.

Figure 95. DesignFlow station



5. Manually hold the vane closed against the mechanical stop at the top of the assembly. Then, read the current vane leveling position on the MicroTech II keypad/display.

   Do this by viewing the *LH Lvl Pos*= or *RH Lvl Pos*= parameter in the DesignFlow setup menu. The *LH Lvl Pos*= parameter indicates the current position of the vane for the left-hand DesignFlow station (side opposite the control panel). The *RH Lvl Pos*= parameter indicates the current position of the vane for the right-hand DesignFlow station (control panel side).

   Important: Wait several seconds until the value on the keypad stabilizes before taking the reading.

   For detailed information regarding operation and navigation through the unit keypad, refer to Operation manual OM 137 (discharge air control units) or OM 138 (zone control units).

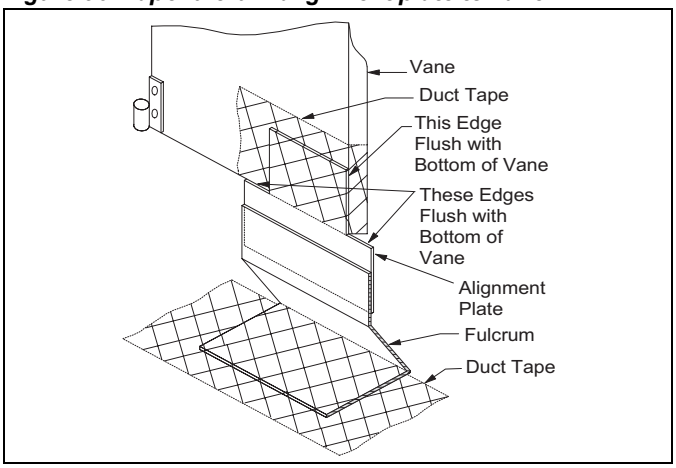
6. Confirm the value of the reading. Ideally, it should read close to 20.00 (19.50 to 20.50 is acceptable). If the reading is out of range, loosen the screws fixing the mechanical stop at the top of the assembly, make a small adjustment, and recheck until the reading is in the specified range.

   Note: Generally, adjustments should not be necessary.

7. Locate the leveling component kit, which is shipped with the unit, in the unit mail control panel.
8. Duct tape the fulcrum alignment plate to the bottom corner of the vane (see Figure 96) aligning it as follows:
   a. The bottom edge of its notches should be flush with the bottom edge of the vane.
   b. The side of one notch should be even with the bend near the outer edge of the vane.
   c. The plate should be flat against the outer surface of the vane.

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Figure 96. Tape fulcrum alignment plate to vane



9 Locate and install the fulcrum used in the leveling procedure as follows (see Figure 96):

- **a** Wipe the bottom of the louver door where the fulcrum will be located so that the duct tape will stick to it.
- **b** Pre-apply duct tape to the top surface of the bottom portion of the fulcrum, extending it about one inch beyond the edges on three sides.
- **c** With the alignment plate taped to the vane and the vane in the zero airflow position, locate the fulcrum parallel to and against the alignment plate.

Note: The zero airflow position is when the vane is swung away from the back wall and gently resting against its stop.

- **d** Once the fulcrum is in position, press the duct tape extensions down to hold the fulcrum in place.
- **e** Remove the alignment plate after installing the fulcrum.

10 Close and latch the louvered intake door.

11 Remove the cover from the access opening in the bottom blade of the outdoor air intake louver (see *Figure 99)*.

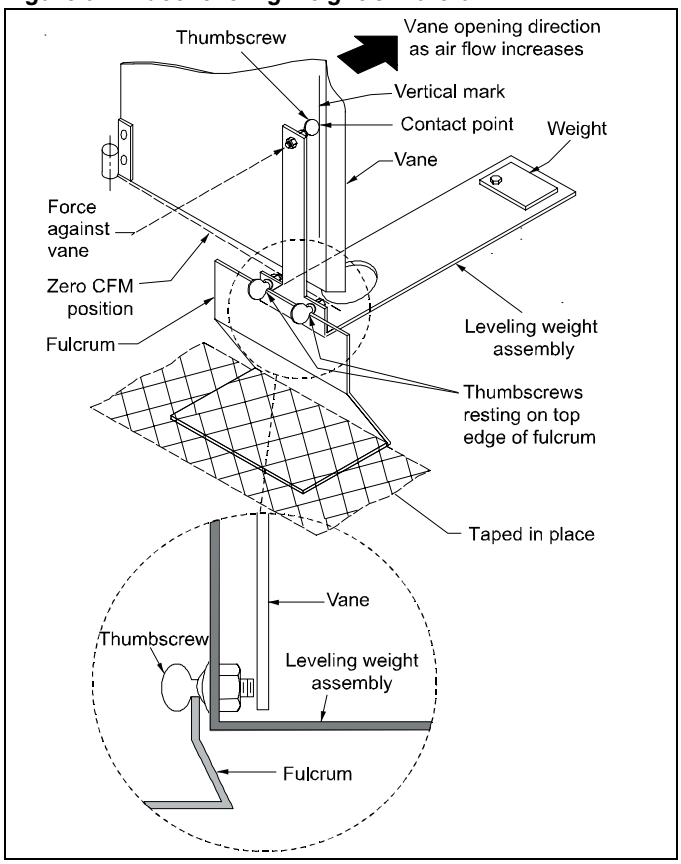
12 Verify that the unit fans are off and that the outdoor air dampers are closed. If there is a wind, cover the outdoor air louvers with poly film, cardboard, or other suitable material to prevent adverse readings due to wind.

13 Rest the leveling weight assembly on the fulcrum, as shown in Figure 95, so that:

- **a** Its bottom two thumbscrews rest on the top edge of the fulcrum.
- **b** Its top thumbscrew rests against the vertical alignment mark on the vane.

Note: The alignment mark is located 0.50 inch in from the bend on the outer edge of the vane. It intersects with a hole located one inch up from the bottom outer edge of the vane.

Figure 97. Place leveling weight on fulcrum



14 Set up the leveling test as follows:

- **a** While holding the weight so it stays on the fulcrum, manually rotate the vane to the wide-open position, manually return it to the zero CFM position, and gently release the vane.
- **b** Locate the leveling weight assembly so its contact point is against the vertical mark on the vane.
- **c** While the weight assembly teeters on the fulcrum, gently rap the base frame to slightly vibrate the assembly and encourage the vane to seek its equilibrium point.

15 Read the current *LH Lvl Pos*= (or *RH Lvl Pos*=) parameter in the DesignFlow Setup menu on the keypad/display. These parameters vary from 20% to 80% depending on the position of the DesignFlow vane

16 If the value indicated by the *LH Lvl Pos*= (*or RH Lvl Pos*=) parameter is not within the range of **23.64% to 24.08%**, adjust the level of the DesignFlow unit using the procedure described in “Making Level Adjustments” below.

17 When the *LH Lvl Pos*= (or *RH Lvl Pos*=) value is in range, remove the fulcrum and leveling weight assembly and replace the access opening cover in the louvered door.

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Making Level Adjustments

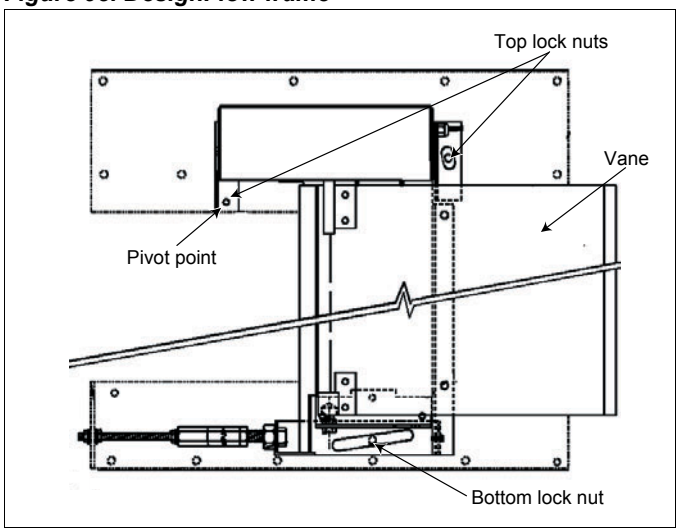
The DesignFlow unit is mounted so that it pivots at the top when three lock nuts are loosened, two at the top and one at the bottom of the assembly (see Figure 98). Leveling the unit involves precisely pivoting the assembly with a known force applied to the vane until the vane opens to a specific position.

If after performing Steps 13 through 15 above, the vane does not come to rest within the specified range, carry out the following steps:

1 Unlock and open the louvered outdoor air intake door on the side of the unit.

2 Loosen the two .25-20 NC lock nuts at the top of the DesignFlow frame. (See Figure 98.)

Figure 98. DesignFlow frame



3 Close and lock the intake door.

4 Remove the cover from the access opening in the bottom blade of the outdoor air intake louver (see Figure 99).

5 Loosen the .25-20 NC lock nut in the slotted hole at the bottom of the DesignFlow frame. (See Figure 100.)

6 **If the *LH Lvl Pos*= (*or RH Lvl Pos*=) value obtained in step 15 above is HIGHER than the specified range**, move the bottom of the DesignFlow frame closer to the outdoor air dampers (away from the back end of the unit). Do this by turning the long adjuster nut to increase the L dimension in Figure 100.

If the *LH Lvl Pos*= (*or RH Lvl Pos*=) value obtained in step 15 above is LOWER than the specified range, move the bottom of the DesignFlow frame away from the outdoor air dampers (toward the back end of the unit). Do this by turning the long adjuster nut to decrease the L dimension in Figure 100.

Note: If the necessary adjustment cannot be made using the long adjuster nut, reposition the two .25-20 NC jam nuts on the threaded rod to make larger adjustments (see Figure 100).

7 When finished making the adjustments, tighten the .25-20 NC lock nut in the slotted hole at the bottom of the DesignFlow frame. (See Figure 100.)

8 Gently rap the base frame to slightly vibrate the assembly to encourage the vane to seek its equilibrium point.

9 Recheck the vane position compared to the range specified in Step 16 above. Readjust the level as necessary.

10 When the level is correct, unlock and open the louvered outdoor air intake door on the side of the unit and tighten the two .25-20 NC lock nuts at the top of the DesignFlow frame. (See Figure 98.)

11 Close and lock the intake door.

12 Recheck the vane position and readjust the level as necessary.

13 When the vane position is correct, replace the access opening cover in the louvered door.

Figure 99. Remove covers from access opening

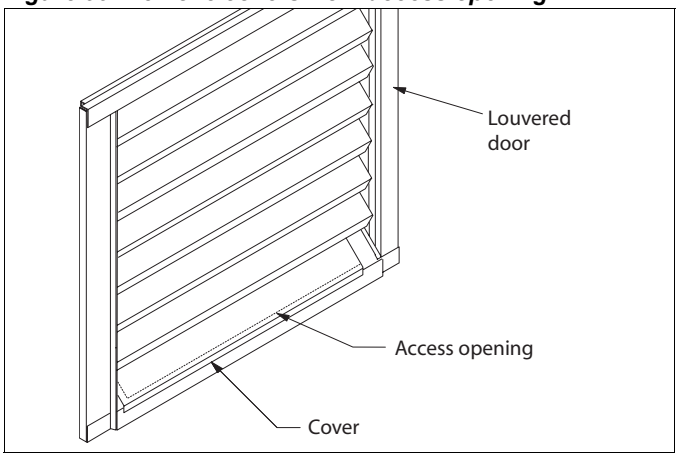
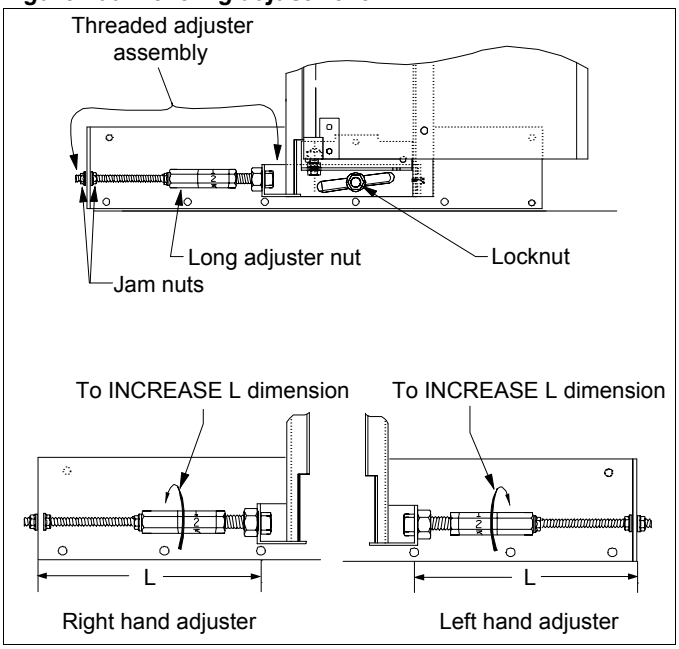


Figure 100. Leveling adjustment

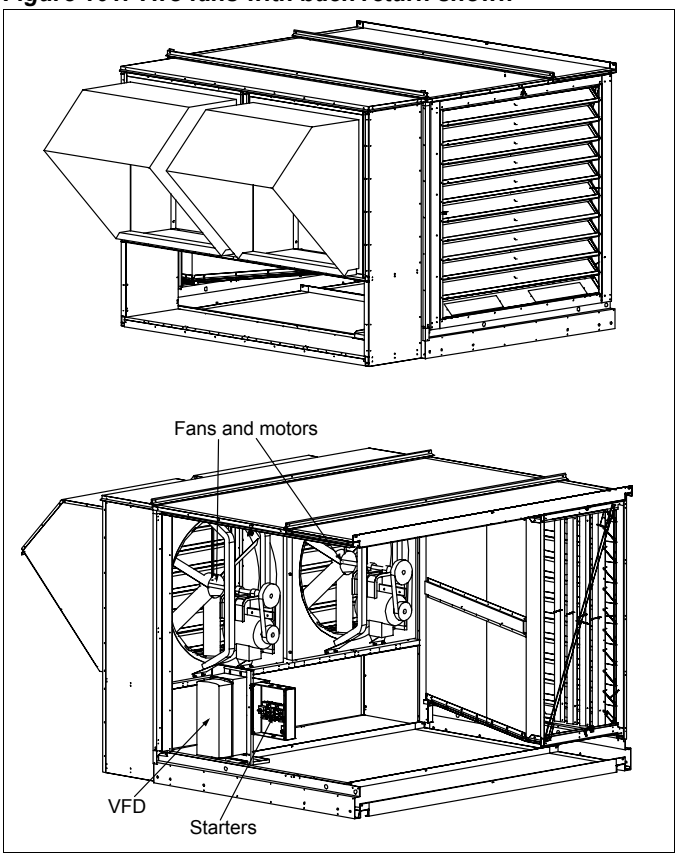


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Propeller Exhaust Fan Option

Economizer units may include propeller exhaust or centrifugal return fan options. This section covers maintenance and operating instructions for the propeller exhaust option. Centrifugal return fan construction, maintenance and operation is similar to that for supply fans and covered in other sections of this manual.

Figure 101. Two fans with back return shown



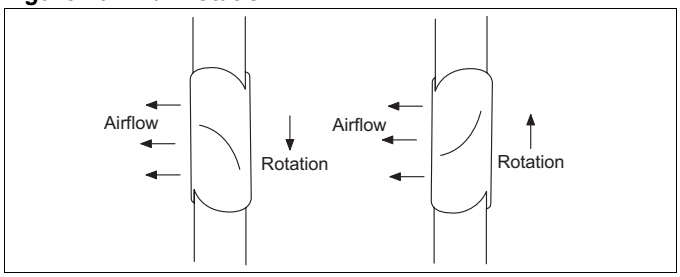
Prestarting Checks

Check all fasteners and set screws for tightness. This is especially important for bearing set screws.

The propeller should rotate freely and not rub on the fan panel venturi. Rotation direction of the propeller should be checked by momentarily turning the unit on. Rotation should be in the same direction as the rotation decal affixed to the unit or as shown in Figure 102 on page 90. For three-phase installations, fan rotation can be reversed by simply interchanging any two of the three electrical leads. For single phase installations follow the wiring diagram located on the motor.

The adjustable motor pulley is preset at the factory for the specified fan RPM. Fan speed can be increased by closing or decreased by opening the adjustable pulley. Two or three groove variable pitch pulleys must be adjusted an equal number of turns open. Any increase in fan speed represents a substantial increase in horsepower required from the motor. Always check motor load amperage and compare to name plate rating when changing fan speed.

Figure 102. Fan rotation



Once the fan is put into operation, set up a periodic maintenance program to preserve the reliability and performance of the fan. Items to include in this program are:

- Belts
- Bearings
- Fasteners
- Setscrews
- Lubrication
- Removal of Dust/Dirt

Belts

Premature belt failures are frequently caused by improper belt tension (either too tight or too loose) or misaligned pulleys. The proper tension for operating a V-belt is the lowest tension at which the belts will not slip peak load conditions. For initial tensioning, the proper belt deflection half way between pulley centers is 1/64" for each inch of belt span. For example, if the belt span is 64 inches, the belt deflection should be one inch using moderate thumb pressure at midpoint of the drive. See *Figure 103*.

Check belt tension two times during the first 24 hours of operation and periodically thereafter. To adjust belt tension, simply loosen four fasteners (two on each side of the motor plate) and slide the motor plate away from the fan shaft until proper belt tension is attained. On some fans, fasteners attaching the motor to the motor plate must be loosened in order to adjust the belt.

It is very important that the drive pulleys remain in proper alignment after adjustments are made. Misalignment of pulleys results in premature belt wear noise, vibration, and power loss. See Figure 104.

⚠ WARNING

Rotating parts can cause severe personal injury or death. Replace all belt/fan guards that are removed temporarily for service.

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Figure 103. Belt adjustment

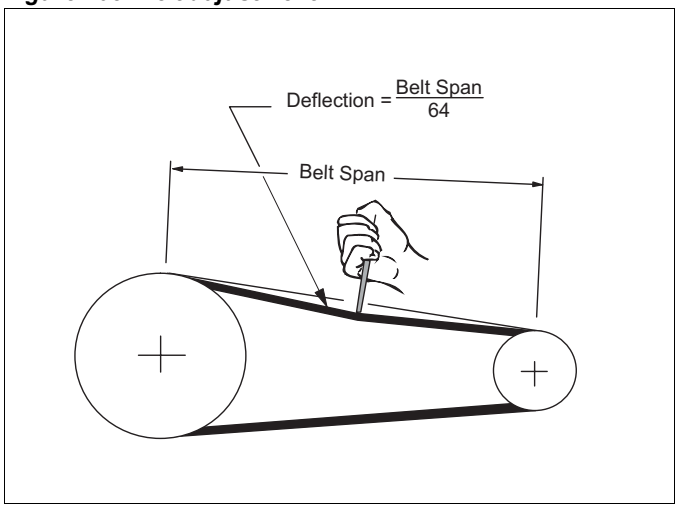


Figure 104. Drive pulley alignment

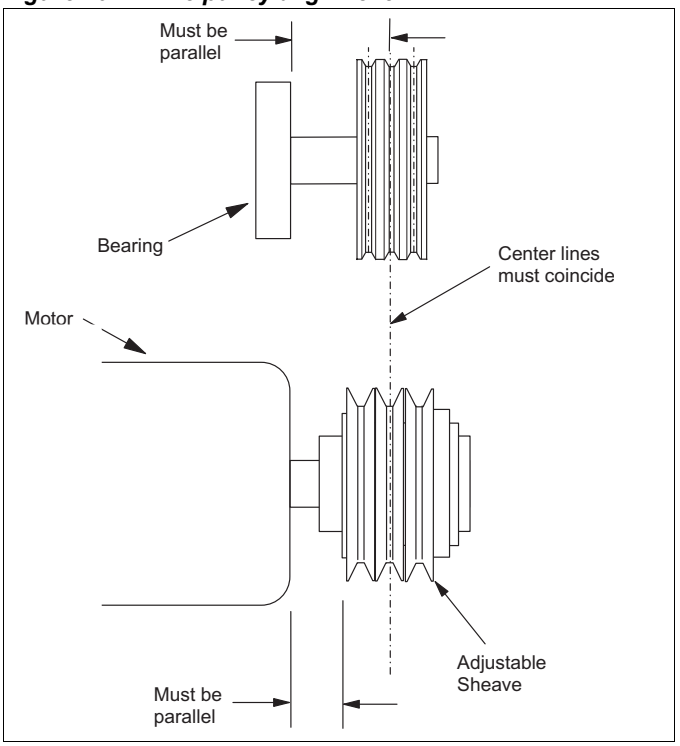
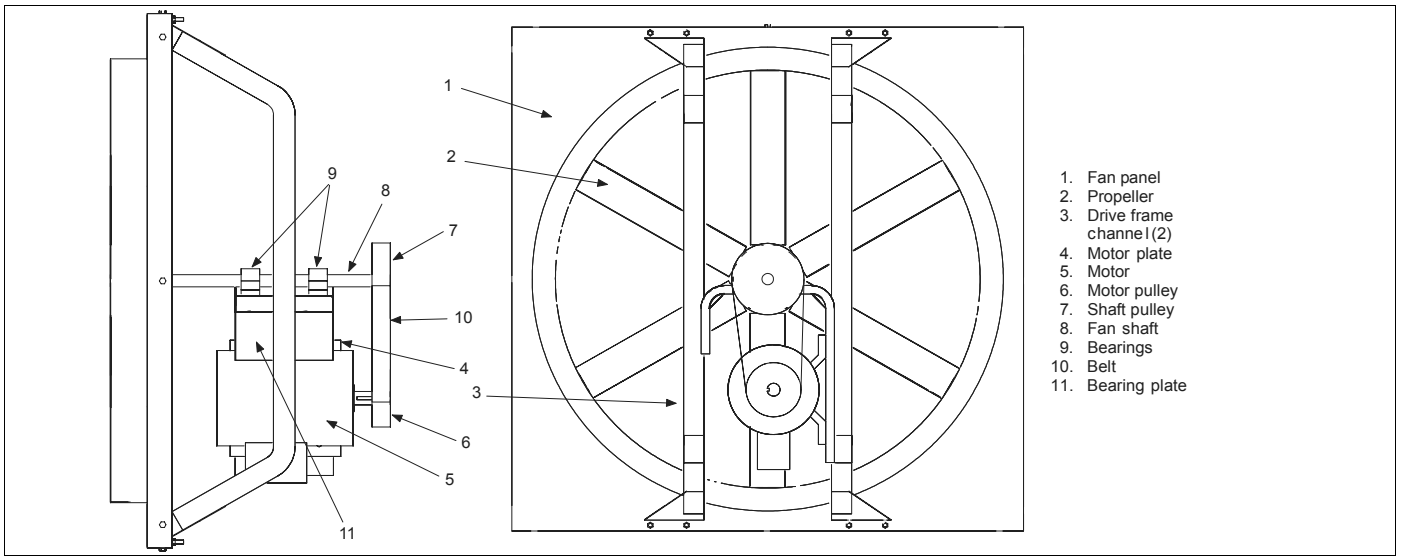


Table 15: Propeller exhaust fan troubleshooting

Problem	Cause	Corrective Action
Reduced Airflow	System resistance is too high.	Check backdraft dampers for proper operation. Remove obstructions in ductwork. Clean dirty filters. Check for adequate supply for air exhaust fans or exhaust air for supply fans.
	Unit running backwards.	See “Prestarting Checks” on page 90
	Fan speed too low.	Increase fan speed
	Excessive dirt on propeller.	Clean propeller
Excessive Noise	Bearings	Tighten bearing collars and setscrews. Lubricate bearings. Replace defective bearings.
	V-Belt drive	Tighten pulleys on motor shaft and fan shaft. Adjust belt tension. Align pulleys. Replace worn belts or pulleys.
	Excessive vibration	Clean dirt build-up from propeller. Check all setscrews and fasteners for tightness. Check for worn bearing. Correct propeller imbalance. Check for loose dampers, guards or ductwork.
	Defective motor	Replace motor.

Figure 105. Propeller exhaust fan replacement parts list



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Bearings

Bearings are the most critical moving part of the fan and should be inspected at periodic intervals. Locking collars and set screws, in addition to fasteners attaching the bearings to the bearing plate, must be checked for tightness. In a clean environment and temperatures above 32°F/below 200° F, fan shaft bearings with grease fittings should be lubricated semiannually using a high quality lithium based grease. If unusual environmental conditions exist temperatures below 32°F/above 200°F, moisture or contaminants, more frequent lubrication is required.

With the unit running, add grease very slowly with a manual grease gun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by over lubricating or using excessive pressure. Bearings without grease fittings are lubricated for life.

Fasteners and Setscrews

Any fan vibration has a tendency to loosen mechanical fasteners. A periodic inspection should include checking all fasteners and set screws for tightness. Particular attention should be paid to setscrews attaching the propeller to the shaft and the shaft to the bearings. Loose bearing set screws will lead to premature failure of the fan shaft.

Lubrication

Refer to “Bearings” for bearing lubrication. Many fractional horsepower motors installed on the smaller fans are lubricated for life and require no further attention. Motors equipped with oil holes should be oiled in accordance with the manufacturer’s instructions printed on the motor. Use a high grade SAE 20 machine oil and use caution not to over lubricate.

Motors supplied with grease fittings should be greased according to directions printed on the motor.

Removal of Dust/Dirt

Thoroughly clean the exterior surface of the motor, fan panel, and entire propeller periodically. Dirt can clog cooling openings on motor housings, contaminate bearing lubricant, and collect on propeller blades causing severe imbalance if left unchecked. Use caution and do not allow water or solvents to enter the motor or bearings. Under no circumstances should motors or bearings be sprayed with steam or water.

Exhaust Fan On/Off Control

The exhaust fans are turned on and off based on building static pressure, outdoor air damper position, and discharge fan capacity. Exhaust fans do not have to always run while the supply fan is on, as does a return fan. They are turned on and off through output MCB-B02 on the Main Control Board. For detailed information on Propeller Exhaust Fan Control, refer to the operation manual supplied with the unit (OM 138 or OM 137).

Exhaust Fan Troubleshooting

Table 15 provides guidelines for troubleshooting problems with the propeller exhaust fan options. A list of parts is provided in Figure 105.

Ultraviolet Lights Option

When this option is employed, ultraviolet C light bathes the moist surfaces on the coil and drain pan, killing most microorganisms that can grow there.

Typically, ultraviolet lights are installed on the leaving side of the cooling coils in the unit. Each light module is mounted on a rail and is removable for convenient bulb replacement.

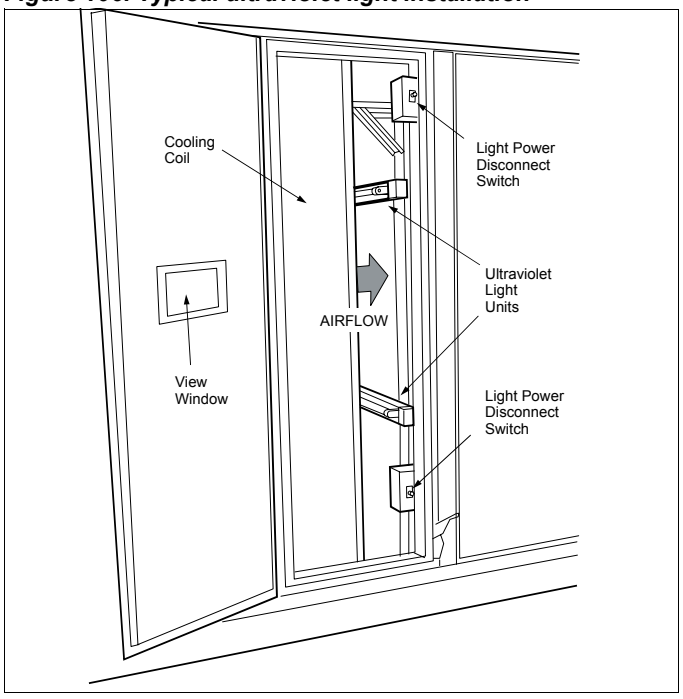
UV Light Power Disconnect switches (two per door) are factory installed on every door that allows a direct line of sight to the UV lamps when opened. These switches are designed to prevent UV exposure when cabinet doors are opened and must not be disabled.

A viewing window near the UV lights allows viewing to determine if the lights are energized. The viewing windows use specially designed glass that blocks harmful UV light.

⚠ WARNING

UVC exposure is harmful to the skin and eyes. Looking at an illuminated bulb can cause permanent blindness. Skin exposure to UVC can cause cancer.
Always disconnect power to unit before servicing. Do not operate if disconnect switch has been disabled.

Figure 106. Typical ultraviolet light installation



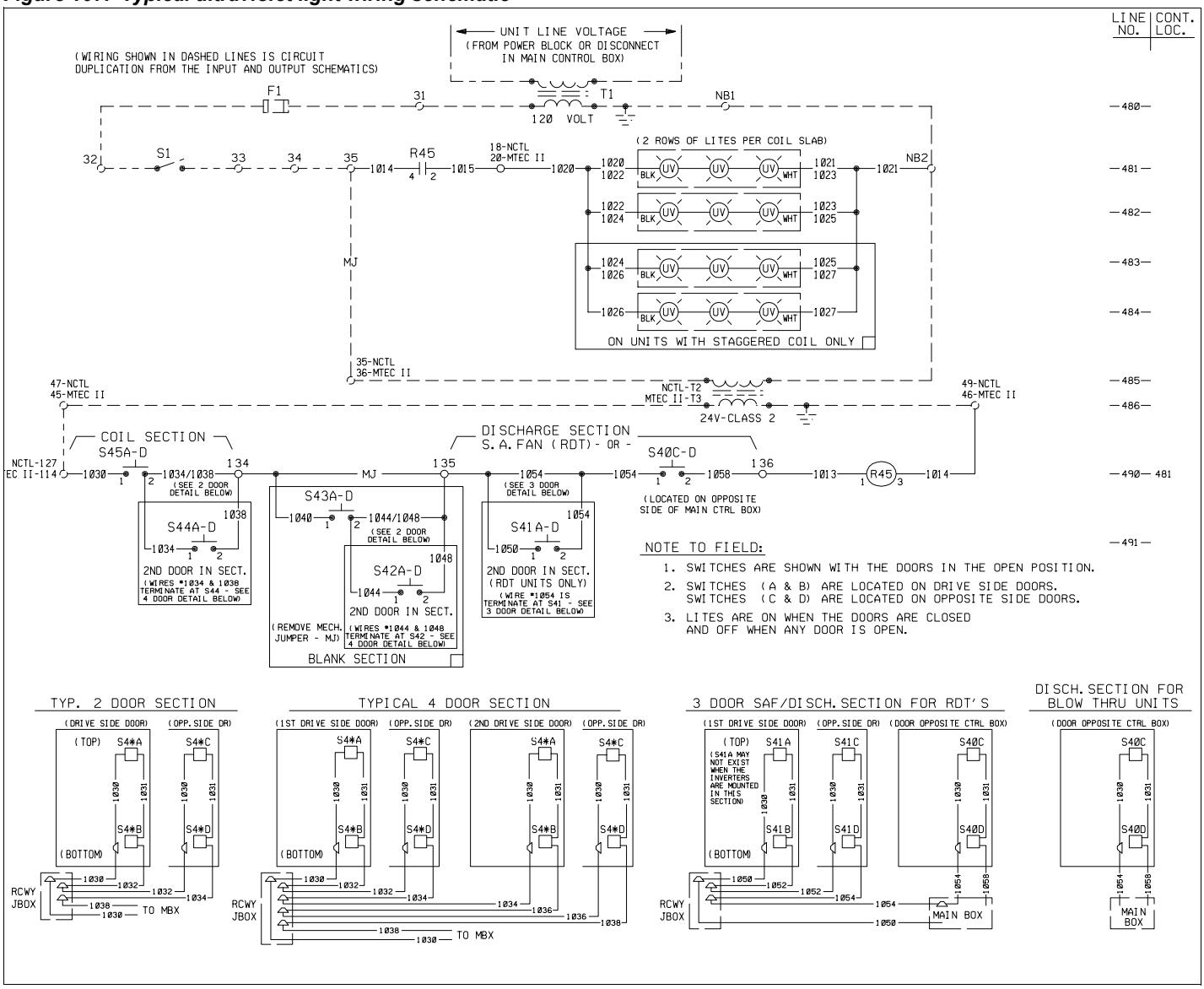
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Ultraviolet Light Operation

Refer to the wiring schematic below. 115 VAC power for the UV lights is provided by control circuit transformer T1. The lights operate whenever the unit is powered, system switch S1 is closed, and all doors with door power disconnect switches are closed. To turn the lights off, disconnect power to the entire unit, or open system switch S1.

The normally open disconnect switches are wired in series in a circuit that supplies 24VAC to the coil of relay R45. When all doors are closed, relay R45 is energized, and its normally open contacts (in series with system switch S1) provide 115VAC to the UV lights.

Figure 107. Typical ultraviolet light wiring schematic



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Check, Test, and Start Procedures

All units are completely run tested at the factory to promote proper operation in the field. Nevertheless, 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 McQuay International.

⚠ 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 II Applied Rooftop Unit Controller" manual (Bulletin IM 696), and operation manual (Bulletin OM 137 or OM 138) before operating or servicing.
Bond the equipment frame to the building electrical ground through grounding terminal or other approved means.

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.

If the unit has a factory mounted disconnect switch, use the switch's bypass mechanism to open the main control panel door without de-energizing the control panel. See page 110 for instructions.

Whenever accessing the main control panel while it is still energized, keep the inner deadfront protective panels on to avoid exposure to high voltage power.

Servicing Control Panel Components

⚠ 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.

Disconnect all electric power to the unit when servicing control panel components located behind the protective deadfront panels. Unless power is disconnected to the unit, the components behind the protective deadfront panels are energized with high voltage. Always inspect units for multiple disconnects to ensure all power is removed from the control panel and its components before servicing.

to change the keypad entry under *Setup/Service \ Unit*

Before Start-up

1. Verify that the unit is completely and properly installed with ductwork connected.
2. Verify that all construction debris is removed, and that the filters are clean.
3. Verify that all electrical work is complete and properly terminated.
4. Verify that all electrical connections in the unit control panel and compressor terminal box are tight, and that the proper voltage is connected.
5. Verify all nameplate electrical data is compatible with the power supply.
6. Verify the phase voltage imbalance is no greater than 10%.
7. Verify that gas piping is complete and leak tight.
8. Verify that the shutoff cock is installed ahead of the furnace, and that all air has been bled from the gas lines.
9. Manually rotate all fans and verify that they rotate freely.
10. Verify that the belts are tight and the sheaves are aligned.
11. Verify that all setscrews and fasteners on the fan assemblies are still tight. Do this by reading and following the instructions in "Setscrews," which is in the "Maintenance" section of this manual.
12. Verify that the coding coil 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. Before attempting to operate the unit, review the control layout description to become familiar with the control locations.
15. 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.
16. Determine which optional controls are included with the unit.
17. Before closing (connecting) the power disconnect switch, open (disconnect) the following unit control circuit switches:
    - **a** Main Control Panel
      - – Turn system switch S1 to OFF.
      - – Electric heat units: turn switch HS1 to OFF.
    - **b** Furnace Control Compartment
      - – Turn furnace switch S3 to OFF.
      - – Main Control Panel Switch S7 to OFF.
18. If the DAC or SCC unit does not have an optional zone temperature sensor (ZNT1) connected to it, you may need *Configuration \ Space Sensor*= from YES to NO.

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Note: If desired, you can significantly reduce all MicroTech II internal control timers by the changing the entry under keypad menu *Setup/Service\Unit Configuration\Timer Settings\Service=* from "*0 min*" to "*X min*" where X is the number of minutes you want the unit to operate with fast timers.

Power Up

1. Close the unit disconnect switch. With the control system switch S1 in the OFF position, power should be available only to the control circuit transformer (TI) and the compressor crankcase heaters.
2. Turn the Switch S1 to ON. Power should now be supplied to the control panel, and the LEDs on MCB1 should follow the normal startup sequence (refer to the "MCB LED Power-Up Sequence" of IM 696).

Fan Start-up

1. Verify all duct isolation dampers are open. Unit mounted isolation dampers may be mounted in the supply or return sections.
2. Place the unit into the "Fan Only" mode through the keypad menu *System Summary\System\Ctrl Mode= Fan Only.*
3. Turn Switch S7 to ON. The controller should enter the "Startup Initial" operating state. If the fan does not run:
   a. Check fuses F1 and F3.
   b. Check the manual motor protectors or that the circuit breakers have not tripped.
   c. Check the optional phase monitor.
4. If the fans are equipped with optional spring isolators, check the fan spring mount adjustment. When the fans are running they should be level. Refer to "RAH spring mount hold down fasteners" on page 51.
5. Verify the rotation is correct.
6. Verify the DHL safety is opening at a pressure compatible with duct working pressure limits.

Note: The supply and return fan drives usually are selected for operation in the drive's midspeed range. The return fan drives are usually shipped with fixed pitch sheaves that will provide the selected fan speed; however, the supply fan drives are usually shipped with variable pitch sheaves that are adjusted to provide the minimum fan speed. Both drives should be adjusted for proper airflow during air balancing. For more information, refer to "Air Balancing" on page 96.

Economizer Start-up

⚠ CAUTION

Adjust dampers properly. Improper adjustment can damage the dampers.
When an economizer is ordered without an actuator, the linkage requires a 3.14" linear stroke to open it fully. Do not allow dampers to be driven beyond their normal full closed or full open position.

1. Check whether the outdoor air is suitable for free cooling by displaying the keypad menu *Temperature\OA Damper\OA Ambient=*. "Low" indicates low outdoor air enthalpy; "High" indicates high outdoor air enthalpy. See "Enthalpy Control" on page 84 to verify that the enthalpy changeover control is working properly. You may want to take temperature and humidity measurements.
2. Verify that switches PS1 and PS2 are at OFF. This prevents compressor operation during the procedure.
3. At the keypad, set the cooling setpoint low enough so the controller calls for cooling. Adjust the value in *Temperature\Zone Cooling\Occ Clg Spt=* below the temperature shown in *Temperature\Zone Cooling\Control Temp=*. In addition, on DAC units, adjust the value in *Temperature\Discharge Cooling\DAT Clg Spt=* below the temperature shown in *Temperature\Discharge Cooling\Disch Air=*.
4. Place the unit into cooling mode through the keypad menu *System Summary\System\Ctrl Mode= Cool Only.*
5. 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. Look at menu *Temperature\OA Damper\MinOA Pos=*. Change this entry to another value. Verify that the dampers move to the new minimum position setpoint.
6. If the unit is equipped with the electromechanical enthalpy changeover control (Honeywell H205) and the outdoor air condition is borderline, attempt to change its input to the MicroTech II controller by turning the switch adjustment to "A" or "D." Check enthalpy status in keypad menu *Temperature \ OA Damper \ OA Ambient=*. If this reading is "Low," go to step 5a. If it is "High," go to step 5b.

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.

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Heating System Start-up

General

1. At the keypad, set the heating setpoints high enough so that the controller will call for heating. The value in *Temperature \ Zone Heating \ Occ Htg Spt=* will need to be adjusted above the temperature shown in *Temperature \ Zone Heating \ Control Temp=*. In addition, on DAC units, the value in *Temperature \ Discharge Heating \ DAT Htg Spt=* will need to be adjusted above the temperature shown in *Temperature \ Discharge Heating \ Disch Air=*.
2. Place the unit into heating mode through the keypad menu *System Summary \ System \ Ctrl Mode= Heat Only.*
3. Verify that the high ambient heat lockout temperature setpoint, *Temperature \ Zone Heating \ OATHtg Lock=* is set above the current outside air temperature (shown in *System Summary \ Temperatures \ OA Temp=*).

Gas Furnace

Refer to the "Start-up and Operating Procedures" section of the Forced Draft Gas Fired Furnace Installation Manual, Bulletin No. IM 684 or 685. Perform the start-up procedures given in it.

Electric Heat

Turn the electric heat switch HS1 to ON. The electric heaters should energize. If the unit has multistage electric heat, the MicroTech II Auxiliary Control board EHB1 should energize the heaters in successive stages. The rate of staging is set in keypad menu *Setup/Service \ Heating Setup \ Stage Time=*. The default value of "*5 min*" can be adjusted from 2 to 60 minutes.

Steam Heat

The steam valve actuator should open the valve. The steam valve is open when the valve stem is up. If the unit loses power, the spring in the actuator should drive the valve wide open. Check this by opening system switch S1.

Hot Water Heat

The hot water valve actuator should open the valve to the coil. The three-way hot water valve is open to the coil when the valve stem is down. If the unit loses power, the spring in the actuator should drive the valve wide open to the coil. Check this by opening system switch S1.

Air Balancing

Air balancing should be performed by a qualified air balancing technician. Note that the supply fan motors are usually shipped with variable pitch sheaves which are typically set at the low end of the drive's fan rpm range. See "Mounting and Adjusting Motor Sheaves" on page 98. The return fan motors are usually shipped with fixed pitch sheaves.

⚠ 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 as part of the air balancing procedure:

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. For VAV units that have fan tracking control, adjust the supply/return fan balance by using the MicroTech II controller's built-in, automatic capability. For complete information on using this feature, see the *"Return Fan Airflow Control: Fan Tracking"* section in Bulletin No. OM 137, *"MicroTech II Applied Rooftop Unit Controller."*
4. When the final drive adjustments or changes are complete, check the current draw of the supply and return fan motors. The amperage must not exceed the service factor stamped on the motor nameplate.
5. Upon completion of the air balance, replace variable pitch motor sheaves (if any) with comparably sized fixed pitch sheaves. A fixed pitch sheave will reduce vibration and provide longer belt and bearing life.

⚠ WARNING

Rotating parts can cause severe personal injury or death. Replace all belt/fan guards that are temporarily removed for service.

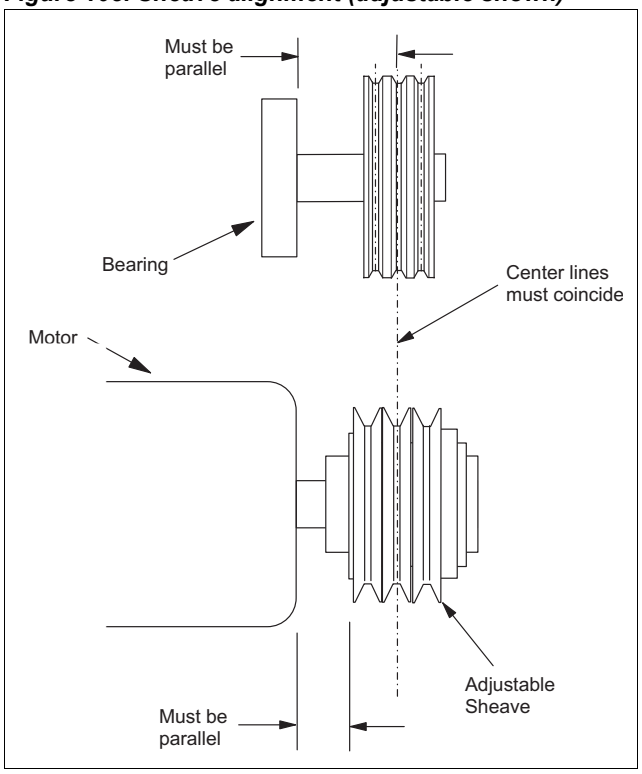
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Sheave Alignment

Mounting:

1. Verify both driving and driven sheaves are in alignment and the shafts are parallel. The center line of the driving sheave must be in line with the ce1nter line of the driven sheave. See Figure 108.
2. Verify that all setscrews are torqued to the values shown in Table 19 on page 107 before starting drive. Check setscrew torque and belt tension after 24 hours of service.

Figure 108. Sheave alignment (adjustable shown)



Drive Belt Adjustment

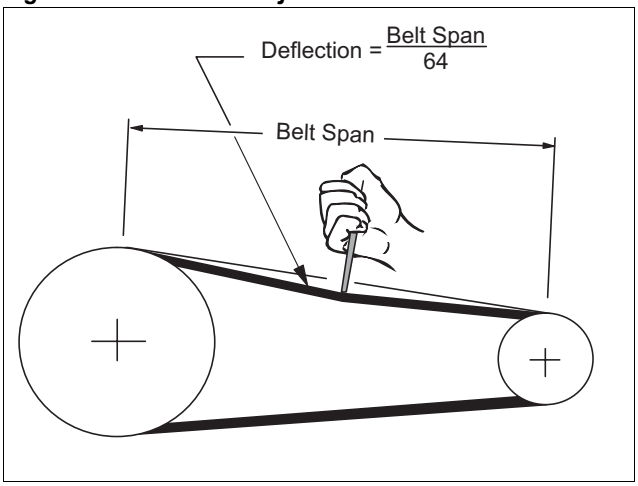
General Rules of Tensioning

1. The ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
2. Check tension frequently during the first 24-48 hours of operation.
3. Over tensioning shortens belt and bearing life.
4. Keep belts free from foreign material which may cause slippage.
5. 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.

Tension Measurement Procedure

1. Measure the belt span. See Figure 109.
2. Place belt tension checker squarely on one belt at the center of the belt span. Apply force to the checker, perpendicular to the belt span, until the belt deflection equals belt span distance divided by 64. Determine force applied while in this position.
3. Compare this force to the values on the drive kit label found on the fan housing.

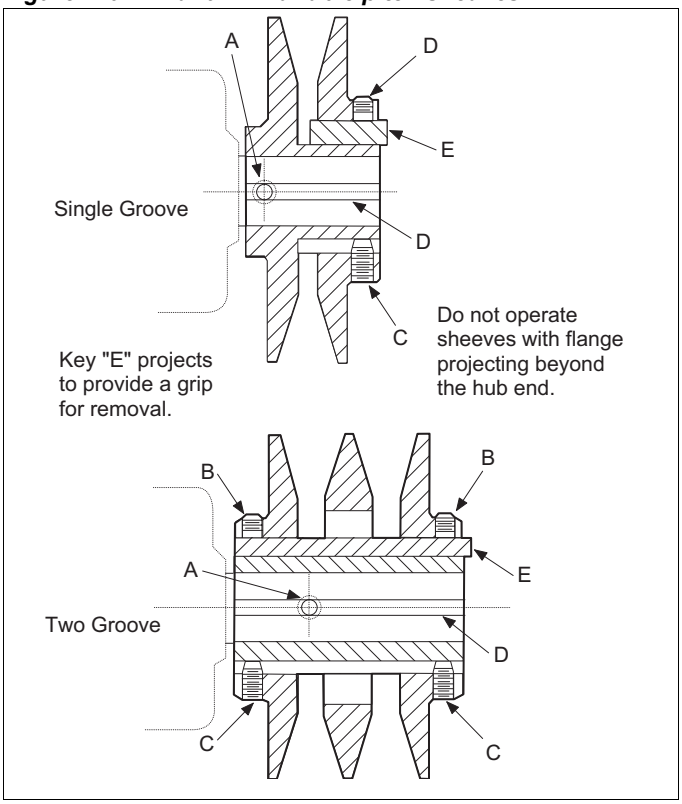
Figure 109. Drive belt adjustment



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Mounting and Adjusting Motor Sheaves

Figure 110. VM and VP variable pitch sheaves



VM and VP Variable Pitch Sheaves

Mounting:

1. Mount all sheaves on the motor shaft with setscrew **A** toward the motor (see Figure 110).
2. Be sure both the driving and driven sheaves are in alignment and that the shafts are parallel.
3. Fit internal key **D** between sheave and shaft and lock setscrew **A** securely in place.

Adjusting:

1. Slack off all belt tension by moving the motor toward the driven shaft until the belts are free from the grooves. For easiest adjustment, remove the belts.
2. Loosen setscrews **B** and **C** in the moving parts of the sheave and pull out external key **E** *(*see *Figure 110)*. This key projects a small amount to provide a grip for removing.
3. Adjust the sheave pitch diameter for the desired fan speed by opening the moving parts by half or full turns from closed position. **Do not open more than five full turns for A belts or six full turns for B belts.** Adjust both halves of two-groove sheaves by the same number of turns from closed to ensure that both grooves have the same pitch diameter.
4. Replace external key **E** and securely tighten setscrews **B** over the key. Tighten setscrews **C** into the keyway in the fixed half of the sheave.
5. Put on belts and adjust the belt tension. **Do not force belts over grooves.** Loosen the belts by adjusting the motor base closer to the fan shaft.
6. Be sure that all keys are in place and that all setscrews are tight before starting the drive. Check the setscrews and belt tension after 24 hours of service.

LVP Variable Pitch Sheaves

Mounting:

1. For single-groove sheaves, slide the sheave onto the motor shaft so that the side of the sheave with setscrew **A** is next to the motor *(*see Figure 111 on page 99).
   For two-groove sheaves, slide the sheave onto the motor shaft so that the side of the sheave with setscrew **A** is away from the motor (see Figure 111 on page 99).
2. To remove the flange and locking rings:
   a. Loosen setscrews **D**.
   b. Loosen **but do not remove** capscrews **E**.
   c. Remove key **F**. This key projects a small amount to provide a grip for removing.
   d. Rotate the flange counterclockwise until it disengages the threads on the shaft barrel.
3. Be sure that the driving and driven sheaves are in alignment and the shafts are parallel. When aligning two-groove sheaves, allow room between the sheave and motor to get to capscrews **E**.
4. Insert key **C** between the sheave and the shaft and tighten setscrew **A** securely.

Adjusting:

1. Slack off all belt tension by moving the motor toward the driven shaft until the belts are free from the grooves. For easiest adjustment, remove the belts.
2. Loosen setscrews **D**.
3. Loosen **but do not remove** capscrews **E**.
4. Remove key **F**. This key projects a small amount to provide a grip for removing.
5. Adjust the pitch diameter by opening or closing the movable flange by half or full turns. Note that two-groove sheaves are supplied with both grooves set at the same pitch diameter. **Both movable flanges must be moved the same number of turns to ensure the same pitch diameter for satisfactory operation. Do not open sheaves more than five turns for A belts or six turns for B belts.**
6. Replace key **F**.
7. Tighten setscrews **D** and capscrews **E**.
8. Put on the belts and adjust the belt tension. Do not force belts over grooves. Loosen the belts by adjusting the motor base closer to the fan shaft

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9 Before starting the drive, make sure that all keys are in place and all setscrews and all capscrews are tight. Check and retighten all screws and re-tension the belts after approximately 24 hours of operation.

MVP Variable Pitch Sheaves

Adjusting:

1 Slack off belt tension by moving the motor toward the driven shaft until the belts are free from the grooves. For easiest adjustment, remove the belts.

2 Loosen both locking screws **A** in outer locking ring, **but do not remove** them from the sheave. There is a gap of approximately 1/2" (1 mm) between the inner and outer locking rings. This gap must be maintained for satisfactory locking of the sheave.
If locking screws **A** are removed by accident and the gap is lost, screw the outer locking ring down until it touches the inner locking ring. Then back off the outer ring 1/2 to 3/4 turn until the inner and outer ring screw holes line up. Reinsert locking screws **A**, but do not tighten them until after adjustment is made.

3 Adjust the sheave to the desired pitch diameter by turning the outer locking ring with a spanner wrench. Any pitch diameter can be obtained within the sheave range. One complete turn of the outer locking ring will result in a 0.233" (6 mm) change in pitch diameter.] **Do not open A-B sheaves more than four 3/4 turns for A belts or 6 turns for B belts. Do not open C sheaves more than nine 1/2 turns.**

4 Tighten both locking screws **A** in the outer locking ring.

5 Put on the belts and adjust the belt tension. **Do not force belts over grooves.** Loosen the belts by adjusting the motor base closer to the fan shaft.

⚠ CAUTION

Do not loosen any screws other than the two locking screws (A) in the outer locking ring. Before operating the drive, securely tighten these screws.

Figure 111. LVP variable pitch sleeves

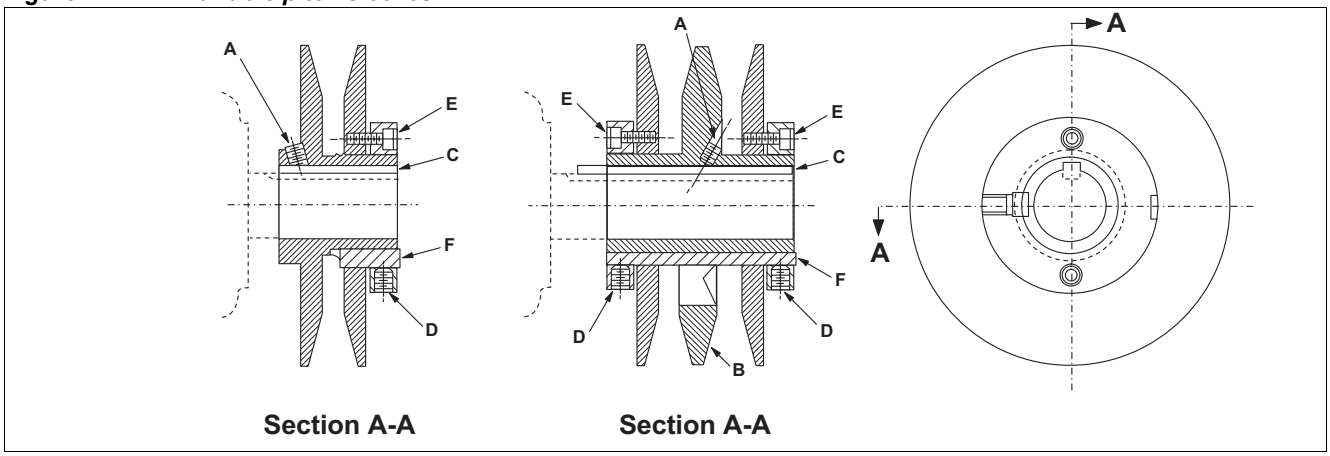
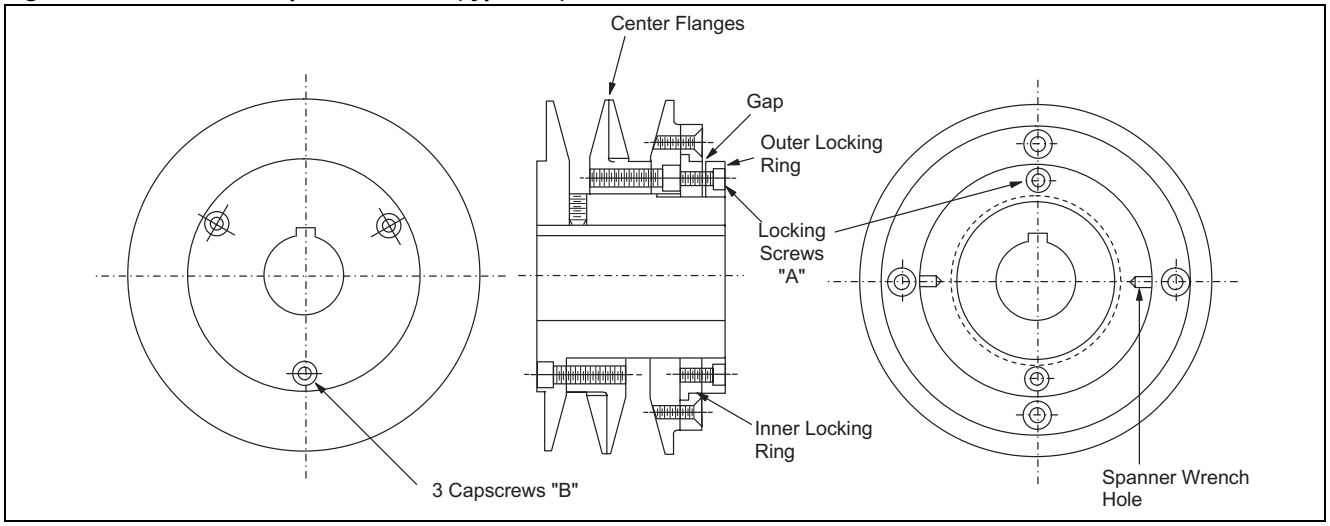
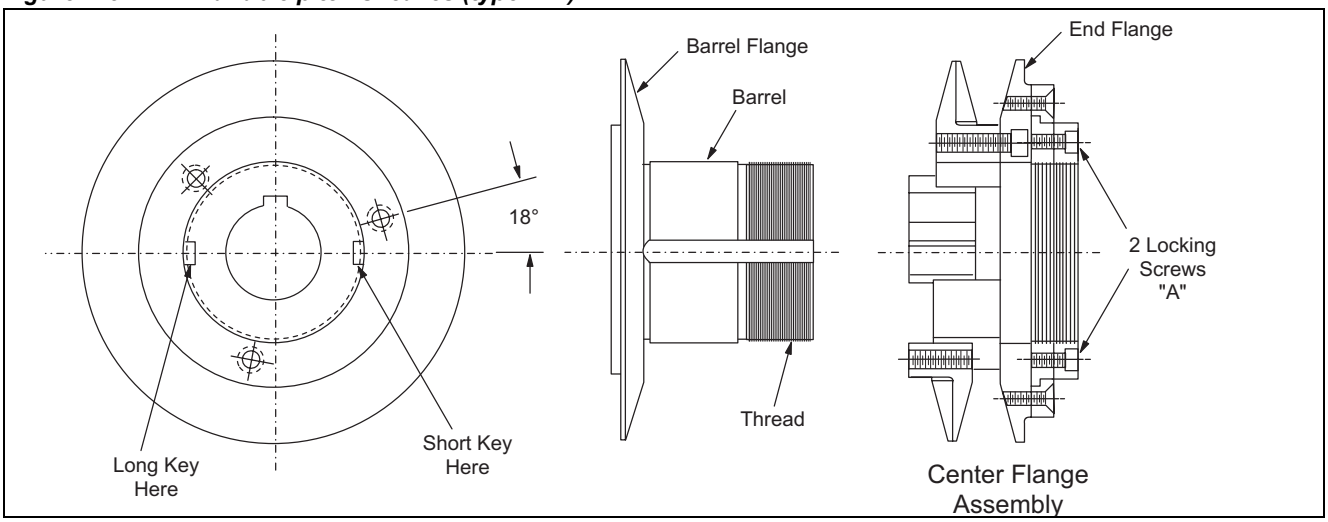


Figure 112. MVP variable pitch sheaves (type A-B)



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Figure 113. MVP variable pitch sheaves (type A-B)



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Final Control Settings

When all start-up procedures are completed, set the controls and program the MicroTech II controller for normal operation. Use the following list as a guide; some items may not apply to your unit. For more detail, see IM696 and OM137 or OM138.

1. Turn system switch S1 to ON and S7 to AUTO.
2. Turn gas furnace switch S3 to AUTO or turn electric heat switch HS1 to ON.
3. Set the electromechanical (Honeywell H205) enthalpy control (OAE) as required (A, B, C, or D). Set the solid-state (Honeywell H705/C7400) enthalpy control (OAE/ RAE) past "D."
4. Set the heating and cooling parameters as required for normal unit operation:
   a. *Temperature* \ *Zone Cooling* \
   b. *Temperature* \ *Zone Heating* \
   c. *Temperature* \ *Discharge Cooling* \
   d. *Temperature* \ *Discharge Heating* \
5. Set the low ambient compressor lockout setpoint as required in menu, *Temperature* \ *Zone Cooling* \ *OAT Clg Lock*=. Do not set it below 50°F (10°C) unless the unit is equipped for low ambient operation.
6. Set the high ambient heat lockout temperature setpoint, *Temperature* \ *Zone Heating* \ *OAT Htg Lock*= as required.
7. Set the alarm limits as required in *Setup/Service* \ *Alarm Limits* \.
8. Set the duct static pressure control parameters as required in keypad menu *Airflow* \ *Duct Pressure* \.
9. Set the building static pressure control parameters as required in keypad menu *Airflow* \ *Bldg Pressure* \.
10. Set the fan tracking parameters as required in keypad menus *Setup/Service* \ *Fan Tracking Setup* \ and *Setup/ Service* \ *Fan Balance* \.
11. Set the economizer control parameters as required in keypad menu *Temperature* \ *OA Damper* \.
12. Set the control timers as required in keypad menu *Setup/Service* \ *Timer Settings* \.
13. Set the date and time in keypad menu *Setup/Service* \ *Time/Date* \.
14. Set the operating schedule as required using keypad menus. **Note:** When used with a Building Automation System, these settings may need to be kept at the default of no schedule:
    a. *Schedules* \ *Daily Schedule* \
    b. *Schedules* \ *Holiday Schedule* \
15. Temporarily disconnect static pressure sensor tubing from sensors SPS1 and SPS2 (if installed) and place the unit into the calibrate mode by using the keypad menu *Setup/Service* \ *Unit Configuration* \ *Calibrate Mode*= and changing the value from NO to YES. The calibrate mode automatically zeroes all static pressure sensors and calibrates any actuator feedback pots connected to the MicroTech II controller. When the calibration is finished, the keypad menu *System Summary* \ *System* \ *Unit Status*= changes from "*Calib*" to "*Off Man*."
16. To restart the unit, reconnect static pressure tubing and change keypad menu *System Summary* \ *System* \ *Ctrl Mode*= from OFF to AUTO.

Maintaining Control Parameter Records

McQuay recommends that the MicroTech II 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. The following tables display all the setpoints, monitoring points, and program variables offered by MicroTech II plus the keypad road map used to find each parameter.

A number of menus and menu items that appear on the unit keypad/display are conditional and may not apply to a specific unit, depending on the unit software configuration. The unit software configuration is defined by a "Software Configuration Code" shown on a label located near the keypad/display. The Software Configuration Code also can be displayed via the six menu items in the Config Code menu on the unit keypad/display. Refer to "Main Control Board (MCB) Configuration" in OM 137 or OM 138.

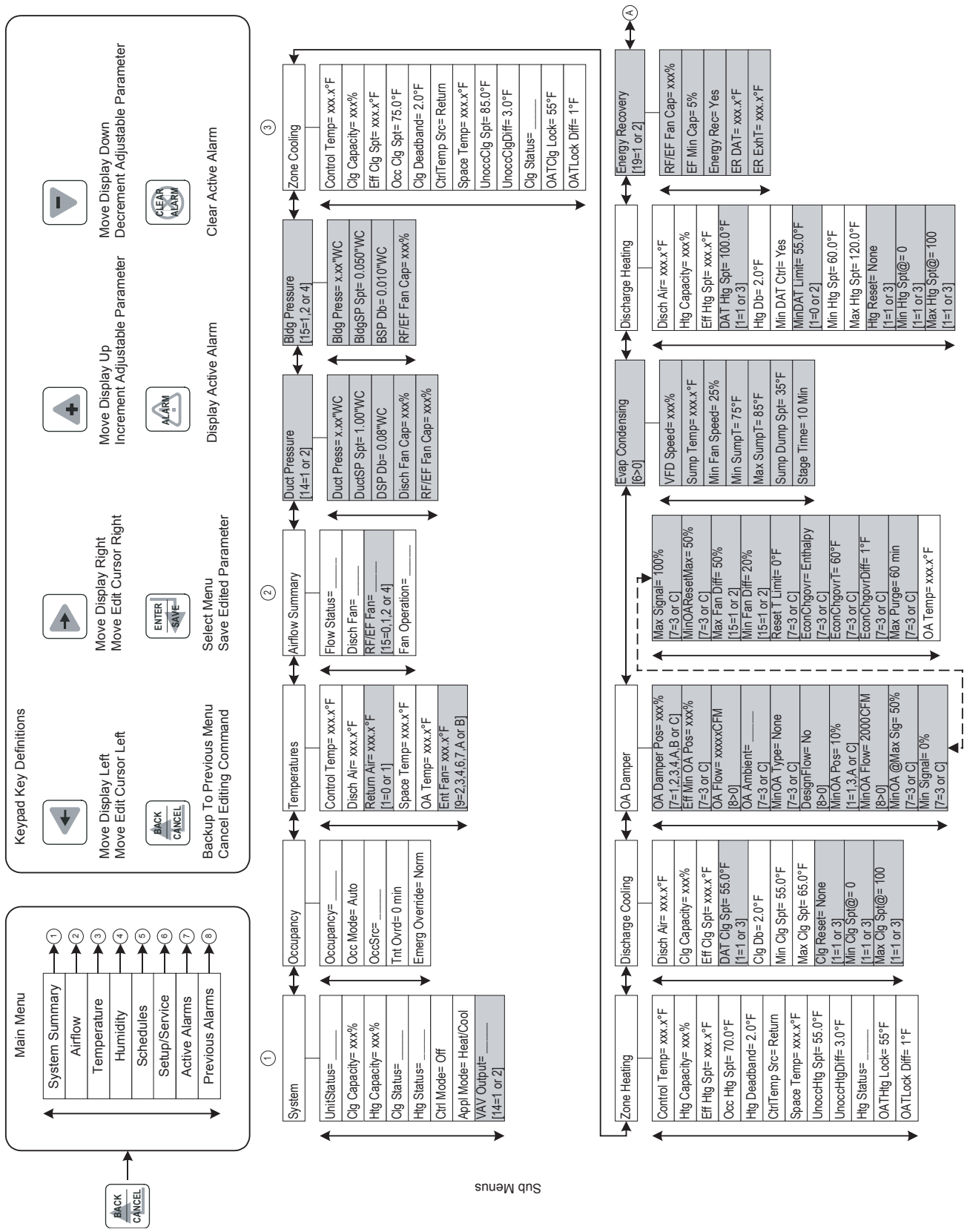
The shaded menus and menu items in Figure 114 on page 102 are conditional. A conditional menu or menu item includes a reference in Figure 114 to the position in the Software Configuration Code upon which its applicability depends. For example, the Duct Pressure menu in Figure 114 includes a notation [14=1 or 2]. This notation means that the Duct Pressure menu (and all its menu items) applies to the specific unit only if position 14 in its Software Configuration Code is a 1 or a 2. Otherwise, the menu or menu item is not applicable to the unit and does not affect its operation.

The items in Figure 114 include the factory-set value for all adjustable items. **Keep a record of any changes made to any of these items.**

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Figure 114. Keypad accessible menu structure

Keypad accessible menu structure



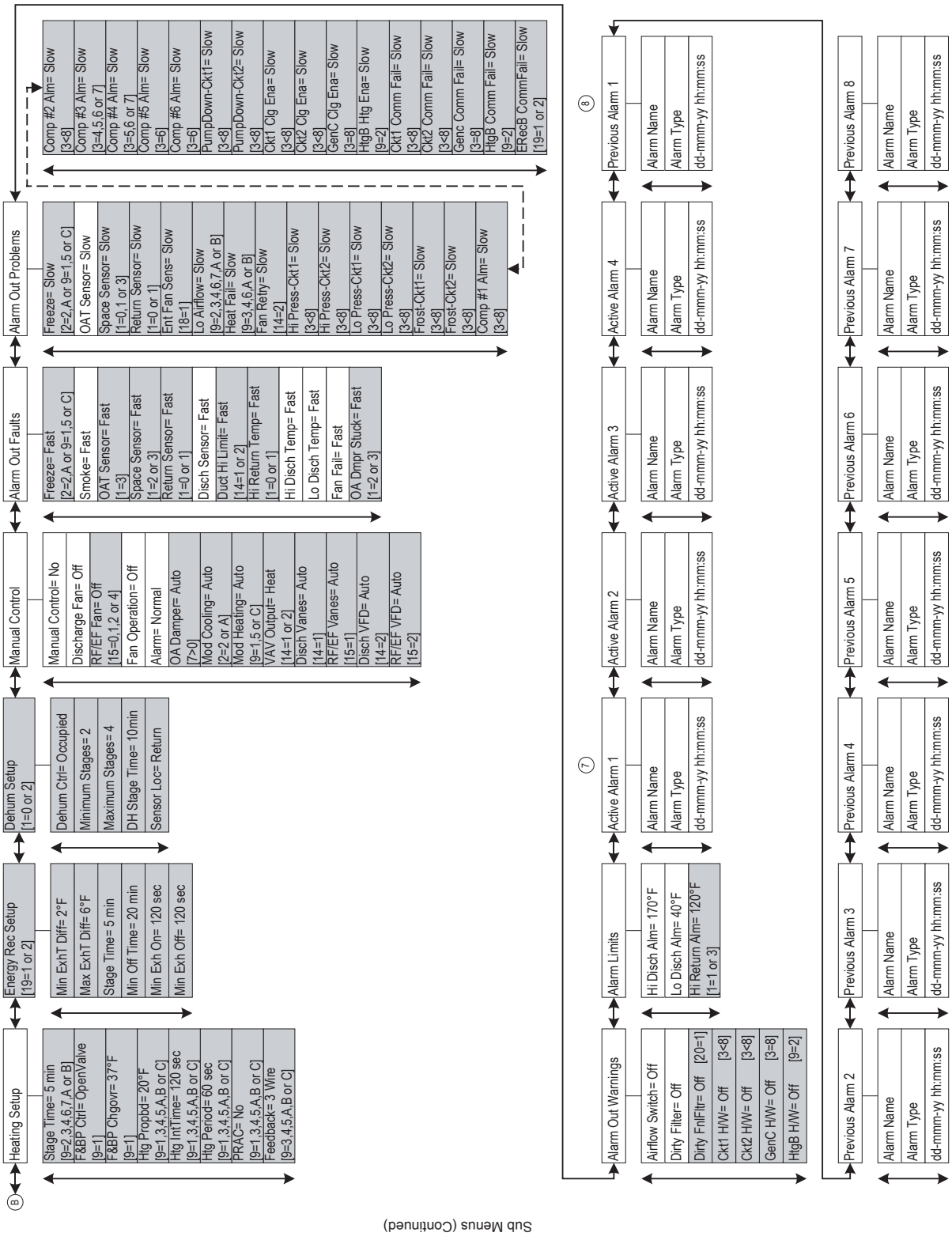
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Figure 114. Keypad accessible menu structure (continued)



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Figure 114. Keypad accessible menu structure (continued)



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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. 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. 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.

⚠ 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.

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 all 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.
- Lubricate the motor and fan shaft bearings.
- Align or replace the belts as needed.
- Clean or replace the filters as needed.
- Check each circuit's refrigerant sightglass when the circuit is operating under steady-state, full load conditions. The sightglass should then be full and clear. If it is not, check for refrigerant leaks.

Note: A partially full sight glass is not uncommon at part load conditions.

- 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.
- Examine the gas furnace (see Bulletin No. IM 684 or IM 685).
- Lubricate the door latch mechanisms.

Unit Storage

Location

- The McQuay Rooftop Airhandling Unit is an outdoor unit. However, the 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.
- If isolation dampers are provided, verify that they are properly installed and fully closed to prevent the entry of animals and debris through the supply and return air openings.
- Units without isolation dampers should be fitted with covers over the supply and return air openings.

Preparation

Supply (and Return) fans

1. Move the motor base to check and lubricate slides and leadscrews.
2. 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.
3. Once every two weeks, rotate the fan and motor shafts. Mark the shaft positions first to make sure they stop in a different position.
4. Depending on local climatic conditions, condensate may collect on components inside the units. To prevent surface rust and discoloration, spray all bare metal parts with a rust

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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.

Cooling circuits

The steps below are necessary only if the unit has been started.

1. Provide that each circuit is properly pumped down.
2. Pull the fuses to each compressor (store them in the control cabinet)
3. Close all the refrigerant service valves on each circuit
4. Tag the valves as a warning for the technician who restarts the units

Gas Furnace

If the unit is equipped with a gas furnace, close the gas shutoff valve and open furnace control switch S3.

Control Compartment

1. McQuay International 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.
3. The location and wattage of the heat source is dependent on local environmental conditions.
4. Check the control compartment every two weeks to provide that the heat source is functional and is adequate for 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.

Gas Furnace

For information on maintenance of the gas furnace, refer to Bulletin No. IM 684 or IM 685.

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. Refer to Table on page 106 for specific recommended lubricants.

Motor Bearings

Supply and return fans—Supply and return fan motors should have grease added after every 2000 hours of operation. Use one of the greases shown in Table 16 on page 106. 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. Run the motor for five minutes before replacing the plugs.

Note: Specific greasing instructions are located on a tag attached to the motor. If special lubrication instructions are on the motor, they supersede all other instructions.

Fan Shaft Bearings

Relubricate fan shaft bearings periodically. Relubricate according to the schedule shown in Table on page 106. 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 16.

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 16: Recommended greases

Manufacturer	Product name	Temp. range (°F)
Texaco Lubricants Co.	Premium RB	-30 to 300
Keystone Ind. Lubricants	84EP-2	-40 to 200
Mobil Oil Corporation	Mobilith AW2	-40 to 325
Chevron U.S.A. Inc.	SRI-2	-20 to 325
Exxon Company. U.S.A.	Ronex MP	-40 to 300
Shell Oil Company	Alvania No. 2	-20 to 240

Table 17: Recommended fan shaft bearing lubrication intervals

Operating duty	Bearing ambient temperature		
	To 130°F	To 150°F	Over 150°F
Continuous	6 months	4 months	2 months
12 Hrs./Day	12 months	12 months	6 months

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Propeller Exhaust

For more information, see page 89.

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. See Table 18.

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.

Table 18: Vibration levels

Fan speed (RPM)	Vibration
800 or less	5 mils maximum displacement
801 or greater	0.20 in/sec maximum velocity

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** Variable pitch sheaves—Axial and radial runout of flanges; uneven groove spacing; out of balance. Also similar faults in driven sheave.
   - **b** Bad V-belts; lumpy, or mismatched; belt tension too tight or too loose.
4. Bad bearings, 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.

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.

Using Table 19, check the tightness of all setscrews with a torque wrench. Note that if the return fan bearings setscrews must be retightened, a special procedure is required to equally load both bearings (see “Return Fan Bearing Setscrews” below).

Table 19: 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

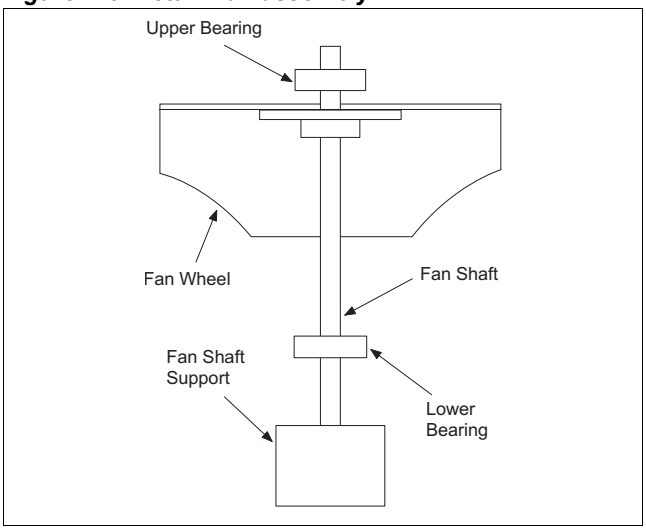
Return Fan Bearing Setscrews

Because the return fan is mounted on a vertical shaft, the following procedure must be used to retighten any return fan bearing setscrews that have loosened. This procedure will provide that both bearings are equally loaded. If one bearing is carrying the entire weight of the fan, it could fail prematurely.

1. Loosen the fan belts.
2. Support the weight of the fan and the fan shaft with timbers or some other suitable means (see the fan shaft support in Figure 115). **Important:** To maintain proper drive alignment and fan-to-tunnel clearance, the fan and shaft must not drop at all when the setscrews are loosened in Step 4.
3. Verify that the upper shaft collar is securely fastened to the shaft. Check the setscrew torque.
4. Loosen the upper and lower bearing setscrews. The entire weight of the fan and shaft is now supported by the fan shaft support.
5. Retighten all bearings to the torque specification given in Table 19. Remove the fan shaft support and re-tension the belts.

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Figure 115. Return fan assembly



Supply Fan Wheel-to-Funnel Alignment

If the unit is equipped with an airfoil or backward curved supply fan, the fan wheel-to-funnel alignment must be as shown in Figure 116, Figure 117, Figure 119 and Figure 120 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 20, Table 21, and Table 22.
3. Retighten the setscrews to the torque specification given in Table 19 on page 107. 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. Radial clearance can be adjusted by slightly loosening the funnel hold-down fasteners, shifting the funnel as required, and retightening the fasteners.

Figure 116. 20" DWDI airfoil wheel-to-funnel (015C to 030C)

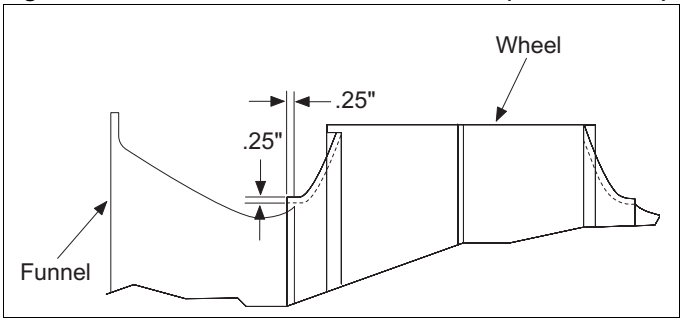


Figure 117. 24" DWDI backward curved wheel-to-funnel (036C, 040C)

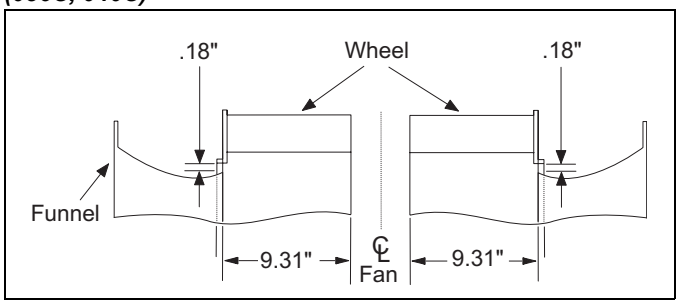


Figure 118. 27 to 40" DWDI airfoil wheel-to-funnel alignment

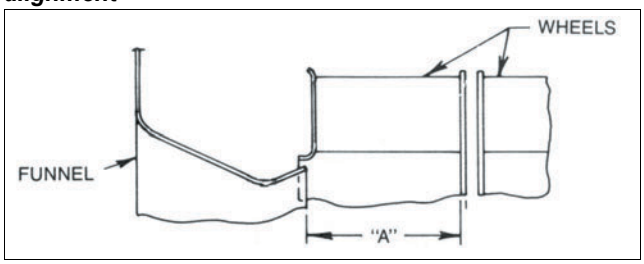


Table 20: 27 to 40" DWDI airfoil wheel-to-funnel relationship

Wheel-to-funnel relationship (in inches)	
Wheel diameter (inches)	**"A" +0.3/ — 0.0**
27	9.9 (246 mm)
30	10.6 (269 mm)
33	11.7 (297 mm)
36	13.1 (333 mm)
40	14.5 (368 mm0

Figure 119. 40" SWSI airfoil wheel-to-funnel alignment (RDT 045 to 075)

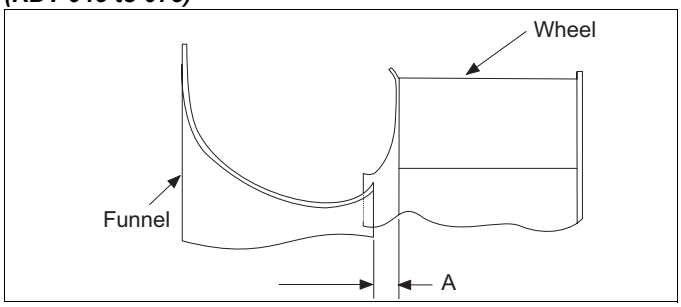


Table 21: SWSI airfoil wheel-to-funnel relationship

Wheel-to-funnel relationship (in inches)	
Wheel diameter	**"A"**
40	**0.62**

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Figure 120. 44" and 49"SWSI airfoil wheel-to-funnel alignment

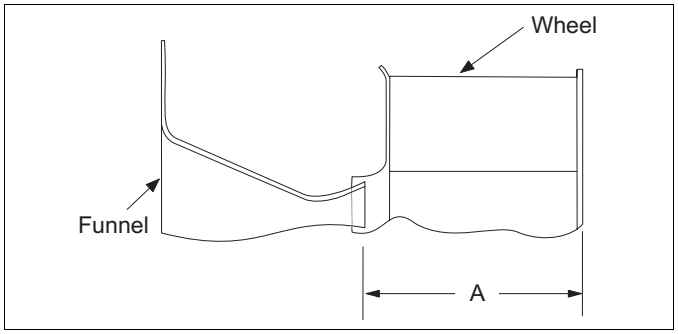


Table 22: 44" and 49"SWSI airfoil wheel-to-funnel Relationship

Wheel-to-funnel relationship (in inches)	
Wheel diameter	**"A"**
44	16.21
49	17.81

Experience in the field has shown that R-407C systems can be "topped off" after a leak has been repaired and operate normally. There is no need, except in the case of a critically charged systems, to replace the entire charge after a leak has been repaired.

Winterizing Water Coils

Coil freeze-up can be caused by such things as air stratification and failure of outdoor dampers and/or preheat coils. Routine draining of water cooling coils for winter shutdown cannot be depended upon as insurance against freeze-up. Severe coil damage may result. It is recommended that all coils be drained as thoroughly as possible and then treated in the following manner.

- Fill each coil independently with an antifreeze solution using a small circulating pump and again thoroughly drain.
- Check freezing point of antifreeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there will be a diluting effect. The small amount of antifreeze solution remaining in the coil must always be concentrated enough to prevent freeze-up.

Note: Carefully read instructions for mixing antifreeze solution used. Some products have a higher freezing point in their natural state than when mixed with water.

Control Panel Components

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.
   See ① in **Figure 121**.
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 position; then rotate knob clockwise to the ON position. See **Figure 121,** ②.

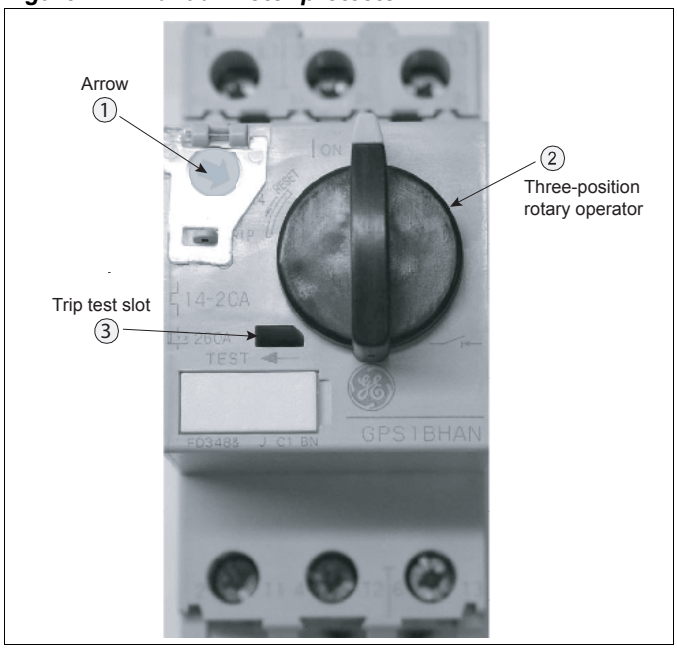
⚠ WARNING

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-TRIP-ON
  See ② **Figure 121**.
- Lockout—tagoutable rotary operator: turn the rotary operator to OFF, slide out the extension arm, and insert a lockout pin.
- Ambient compensated –20°F to +60°F
- Single-phase sensitivity: if one phase exceeds setpoint, all three phases open.
- Trip test: insert a 9/64" screw driver in the slot to simulate a trip. See ③ in **Figure 121.**

Figure 121. Manual motor protector



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Circuit Breaker

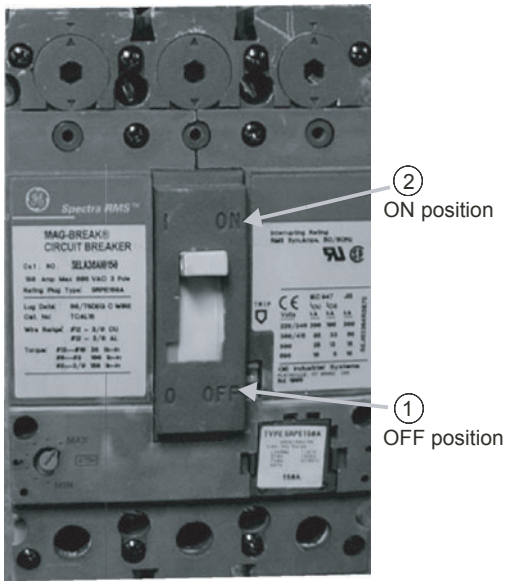
Circuit breakers are installed upstream of all VFDs to provide short circuit protection.

To reset a tripped circuit breaker: Clear the trip by rotating the lever down to the OFF position. See ① in Figure 122. Then rotate lever up to the ON position. See ② in Figure 122.

⚠ 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.

Figure 122. Circuit breaker



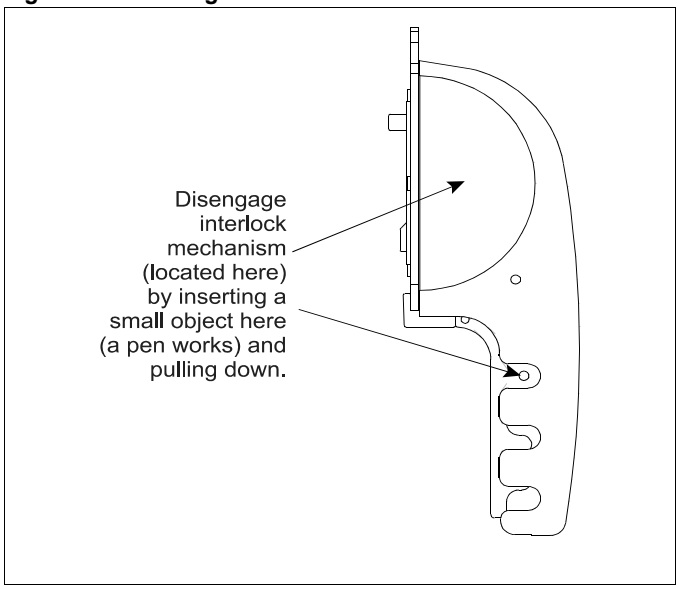
Disconnect

The optional disconnect is a molded case switch with many of the same features of the circuit breaker. The disconnect comes standard with a through-the-door handle and mechanism to disconnect power to the unit prior to opening the door. The handle can be padlocked in the OFF position while performing maintenance to 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 123. Through-the-door handle disconnect



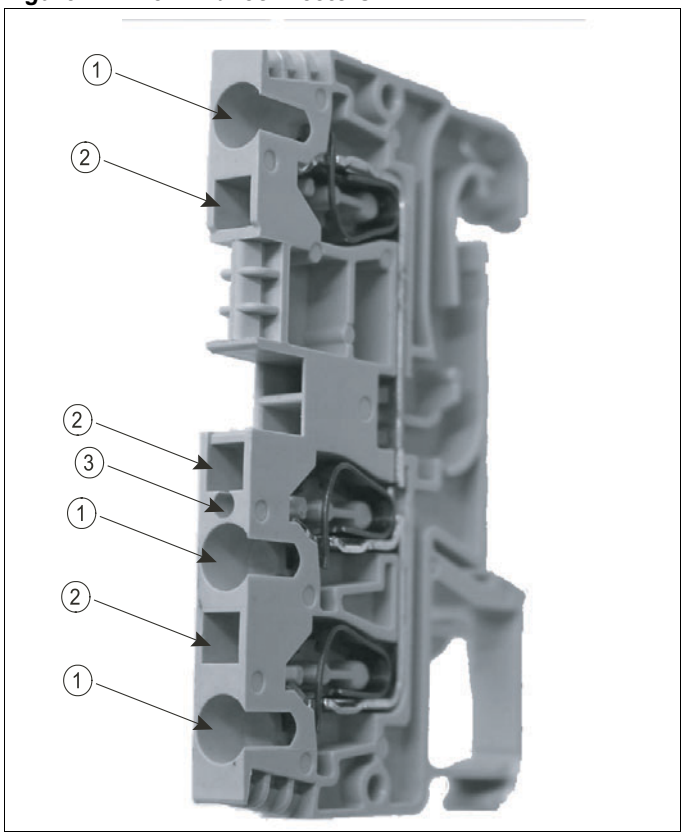
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Terminals

The terminals are spring clamp type. They only require inserting (see ① in **Figure 124**) and clamping the wire to be stripped, which offers several advantages over screw terminals. The clamping is done by inserting a flat-bladed screw driver (up to 9/64" wide). See ② in **Figure 124**.

- Spring connection does not require torquing and resists vibration
- Easily identifiable terminal markers
- Built-in test ports on each terminal, up to 2.3 mm diameter See ③ in **Figure 124**.

Figure 124. Terminal connectors



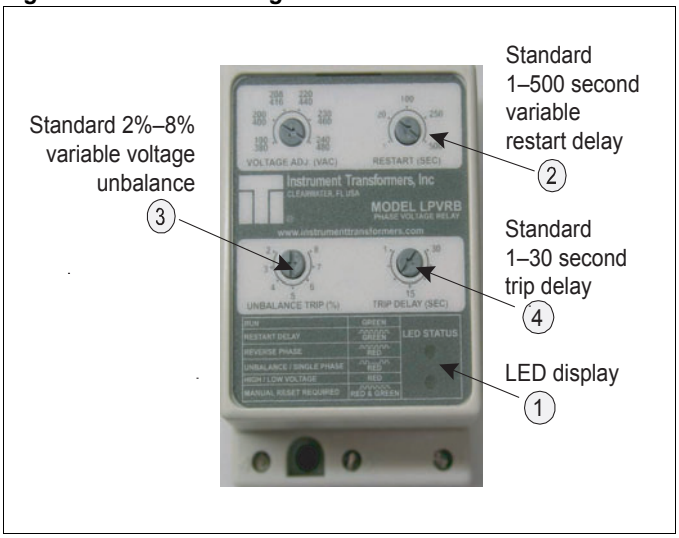
Phase Voltage Monitor (PVM) (see page 84)

The phase voltage monitor 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.

Other features:

- LED display to indicate status (see ① in Figure 125)
  - – Loss of phase
  - – High or low voltage
  - – Voltage unbalance
  - – Phase reversal
  - – Rapid cycling
  - – Standard 1 to 500 second variable restart delay (see ② in Figure 125)
- Standard 2% to 8% variable voltage unbalance (see ③ in Figure 125)
- Standard 1 to 30 second trip delay (see ④ in Figure 125)

Figure 125. Phase voltage monitor



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Replacement Parts List

Component designation	Description	McQuay part number
MCB	Main Control Board	060006101
CCB1	Auxiliary Cooling Control Board (DX Circuit #1 or generic condenser)	112026101 (replaces 106102701)
CCB2	Auxiliary Cooling Control Board (DX Circuit #2)	112026101 (replaces 106102701)
EHB1	Auxiliary Electric Heat Control Board	112026101 (replaces 106102701)
ERB1	Auxiliary Energy Recovery Control Board	112026101 (replaces 106102801)
–	RS-485 Communication Module (for Auxiliary Control Boards)	060006202
–	Standoffs for mounting RS-485 Communication Module (PN 060006206) onto Auxiliary Control Board (PN 112026101)	048166707
–	Keypad/Display	060006301
–	Keypad-Main Control Board Cable	111044601
ZNT1	Zone Temperature Sensor with Tenant Override	111048101
	Zone Temperature Sensor with Tenant Override & Remote Setpoint Adjustment (SCC units only)	111048102
DAT	Discharge Air Temperature Sensor (50 ft cable length-field cut to length)	060004705
EFT	Entering Fan Air Temperature Sensor (50 ft cable length-field cut to length)	060004705
OAT	Outside Air Temperature Sensor (50 ft cable length-field cut to length)	060004705
RAT	Return Air Temperature Sensor (50 ft cable length-field cut to length)	060004705
SPS1	Static Pressure Sensor: Duct, No. 1	049545007
SPS2	Static Pressure Sensor: Duct, No. 2	049545007
	Static Pressure Sensor: Building (Space) Pressure	049545006
T2	Transformer: 115/24 VAC	060004601
T3	Transformer: 115/24 VAC	060004601
T9	Transformer: 115/24 VAC	060630801
HUM1	Humidity Sensor: Wall Mount	067294901
	Humidity Sensor: Duct Mount	067295001
PC5	Dirty Filter Switch: First Filter Section	065493801
PC6	Dirty Filter Switch: Final Filter Section	065493801
PC7	Airflow Proving Switch	060015801
DHL	Duct High Limit Switch	065493801
OAE	Enthalpy Control: Electromechanical	030706702
	Enthalpy Control: Electronic (Used with RAE)	049262201
RAE	Return Air Enthalpy Sensor (Used with Electronic OAE)	049262202
SD1	Smoke Detector: Supply Air	049025001
SD2	Smoke Detector: Return Air	049025001
–	BACnet MS/TP Communication Module (RS485)	060006202
–	BACnet/IP Communication Module (Ethernet Cable 10BASET)	060006201
–	LonMark Space Comfort Controller (SCC) Communication Module	060006203
–	LonMark Discharge Air Controller (DAC) Communication Module	060006204
–	5 VDC Power Supply	111049601
–	Serial Port Ribbon	111047201
–	MCB Battery	BR2325
–	MCB Connector Repair Kit	300036605
–	Power Disconnect Switch	033696300
–	18 in. Lamp Holder	205484001
–	24 in. Lamp Holder	205484101
–	36 in. Lamp Holder	205484201
–	Hard Wire Module	205485501
–	18 in. Lamp	205484501
–	24 in. Lamp	205484601
–	36 in. Lamp	205484701

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Service and Warranty Procedure

Replacement Parts

When writing to McQuay 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, it will be necessary to 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.

In-Warranty Return Material Procedure

Material may not be returned except by permission of authorized factory service 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 McQuay 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.

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Limited Product Warranty (North America)

McQuay International (“Company”) warrants to contractor, purchaser and any owner of the product (collectively “Owner”) that Company, at its option, will repair or replace defective parts in the event any product manufactured by Company, including products sold under the brand names McQuay Air Conditioning, AAF Air Conditioning, AAF HermanNelson and McQuay Service, and used in the United States or Canada, proves defective in material or workmanship within twelve (12) months from initial startup or eighteen (18) months from the date shipped by Company, whichever occurs first. Authorized replaced parts are warranted for the duration of the original warranty. All shipments of such parts will be made FOB factory, freight prepaid and allowed. Company reserves the right to select carrier and method of shipment.

In addition, labor to repair or replace warranty parts is provided during Company normal working hours on products with rotary screw compressors, centrifugal compressors and on absorption chillers. Warranty labor is not provided for any other products.

Company’s liability to Owner under this warranty shall not exceed the lesser of the cost of correcting defects in the products sold or the original purchase price of the products.

PRODUCT STARTUP ON ABSORPTION, CENTRIFUGAL AND SCREW COMPRESSOR PRODUCTS IS MANDATORY and must be performed by McQuay Service or a Company authorized service representative.

It is Owner’s responsibility to complete and return the Registration and Startup Forms accompanying the product to Company within ten (10) days of original startup. If this is not done, the ship date and the startup date will be deemed the same for warranty period determination, and this warranty shall expire twelve (12) months from that date.

Exceptions

1. If free warranty labor is available as set forth above, such free labor does not include diagnostic visits, inspections, travel time and related expenses, or unusual access time or costs required by product location.
2. Refrigerants, fluids, oils and expendable items such as filters are not covered by this warranty.
3. This warranty shall not apply to products or parts which (a) have been opened, disassembled, repaired, or altered by anyone other than Company or its authorized service representative; or (b) have been subjected to misuse, negligence, accidents, damage, or abnormal use or service; or (c) have been operated, installed, or startup has been provided in a manner contrary to Company’s printed instructions, or (d) were manufactured or furnished by others and which are not an integral part of a product manufactured by Company; or (e) have not been fully paid for by Owner.

Assistance

To obtain assistance or information regarding this warranty, please contact your local sales representative or McQuay Service office.

Sole Remedy

THIS WARRANTY CONSTITUTES THE OWNER’S SOLE REMEDY. IT IS GIVEN IN LIEU OF ALL OTHER WARRANTIES. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT AND UNDER NO CIRCUMSTANCE SHALL COMPANY BE LIABLE FOR INCIDENTAL, INDIRECT, SPECIAL, CONTINGENT OR CONSEQUENTIAL DAMAGES, WHETHER THE THEORY BE BREACH OF THIS OR ANY OTHER WARRANTY, NEGLIGENCE OR STRICT LIABILITY IN TORT.

No person (including any agent, sales representative, dealer or distributor) has the authority to expand the Company’s obligation beyond the terms of this express warranty or to state that the performance of the product is other than that published by Company.

For additional consideration, Company will provide an extended warranty(ies) on certain products or components thereof. The terms of the extended warranty(ies) are shown on a separate extended warranty statement.

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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.mcquay.com.

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