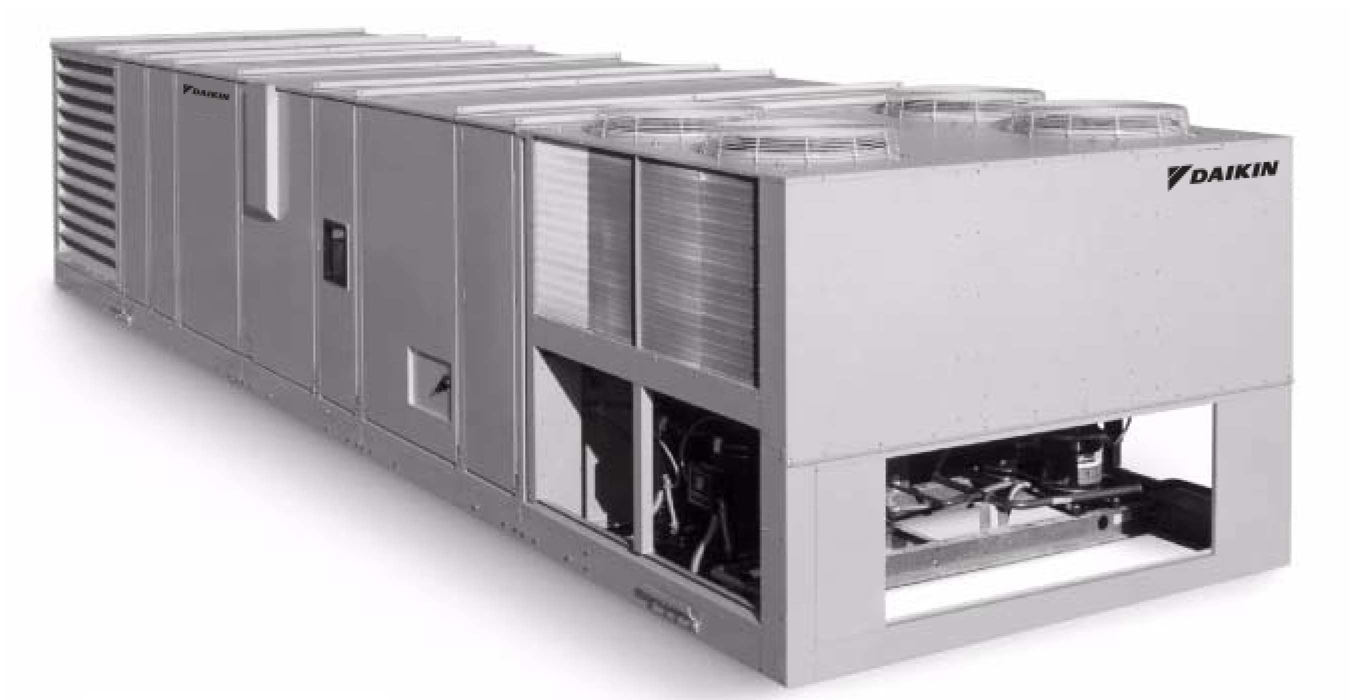
Installation and Maintenance Manual IM 738-2

Group: **Applied Air Systems**
Part Number: **IM 738**
Date: **October 2018**

RoofPak® Singlezone Roof Mounted Heating and Cooling Units

RPS/RDT/RFS/RCS 015–135C



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Contents

Introduction

This manual provides general information about the “C” vintage Daikin RoofPak applied rooftop unit, models RPS, RDT, RFS and RCS. 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, and service procedures, see IM 696. 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

Unit Nameplate

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

Compressor Nameplate

On units with a single compressor on each circuit, the compressor includes one compressor nameplate.

On units that utilize the tandem compressor design, each compressor includes an individual nameplate along with a nameplate identifying the tandem compressors.

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.

On units that utilize the tandem scroll compressor design, each compressor includes an individual nameplate along with a nameplate identifying the tandem compressors.

On units that utilize the tandem reciprocating design, each compressor includes an individual nameplate.

Hazard Identification Information

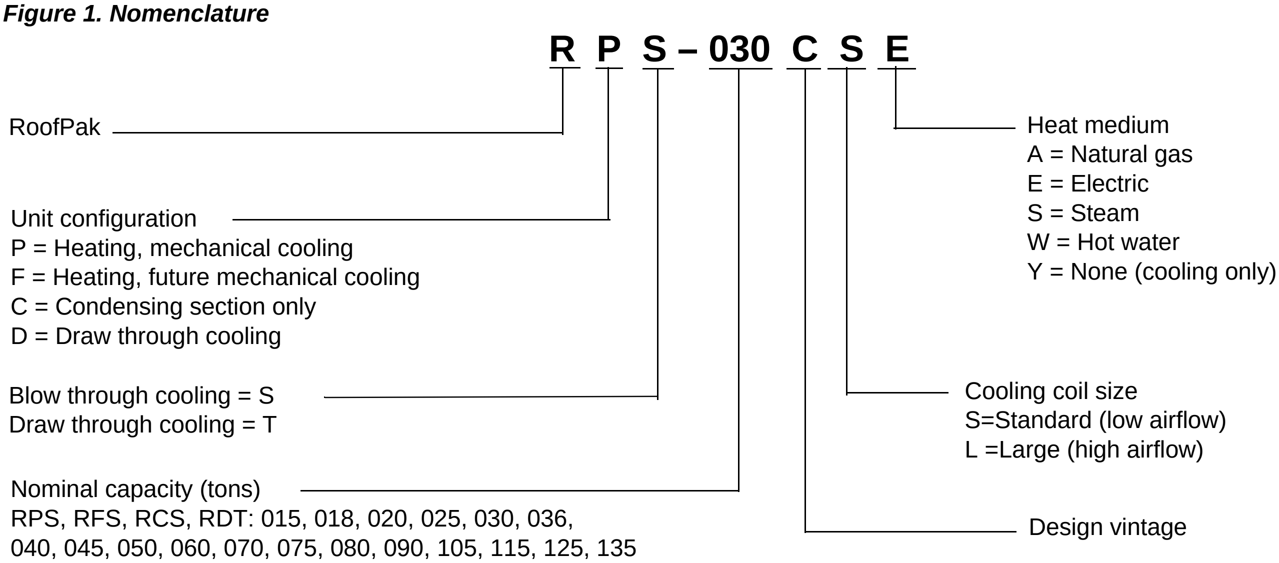
WARNING

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

CAUTION

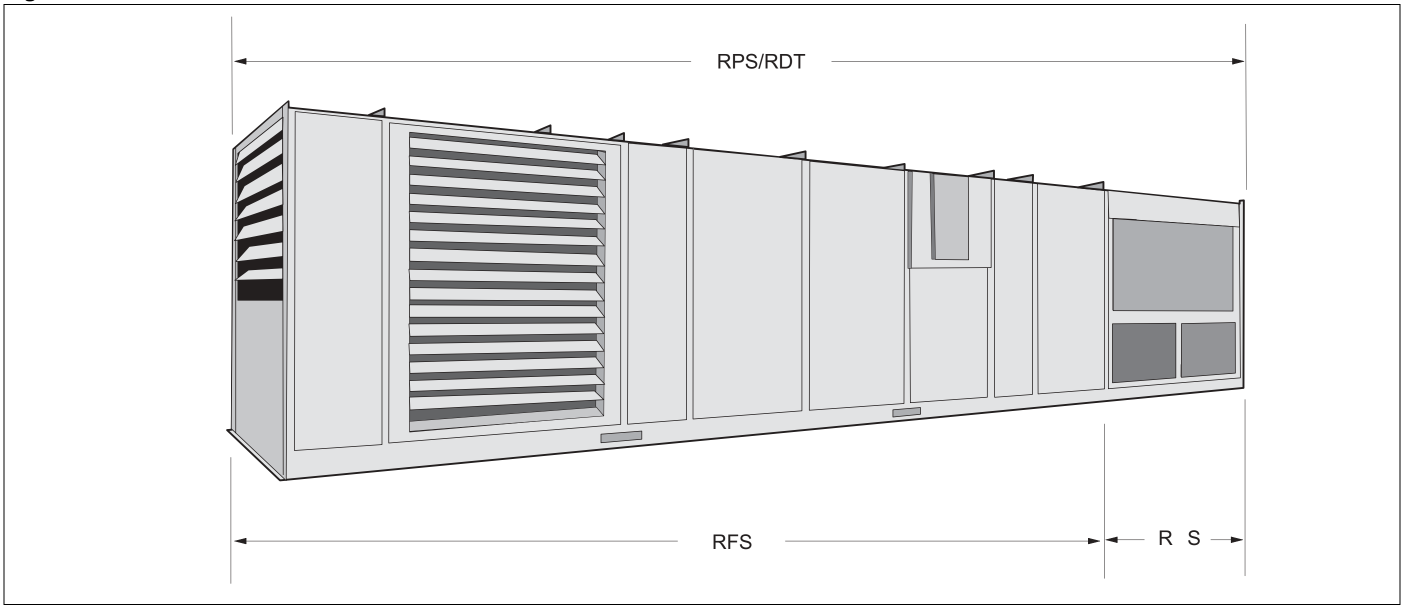
Cautions indicate potentially hazardous situations, which can result in personal injury or equipment damage if not avoided.

Figure 1. Nomenclature



Unit Description

Figure 2. RPS/RDT/RFS/RCS unit



Typical Component Locations

Figure 2 shows an RPS/RDT/RFS/RCS unit. Figure 3 shows a typical RPS unit with the locations of the major components. Figure 4 on page 3 shows a typical RDT 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 3. Typical component locations—RPS units

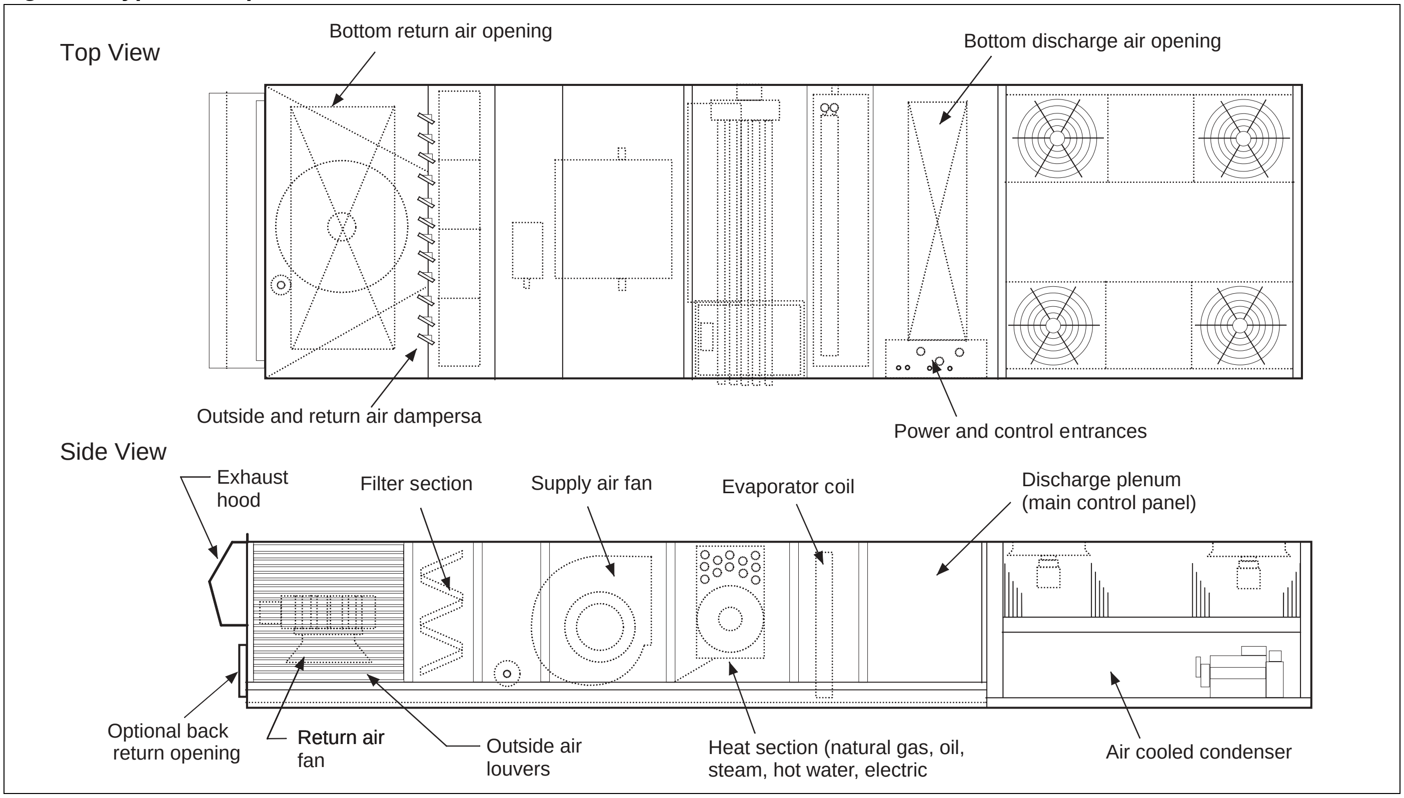
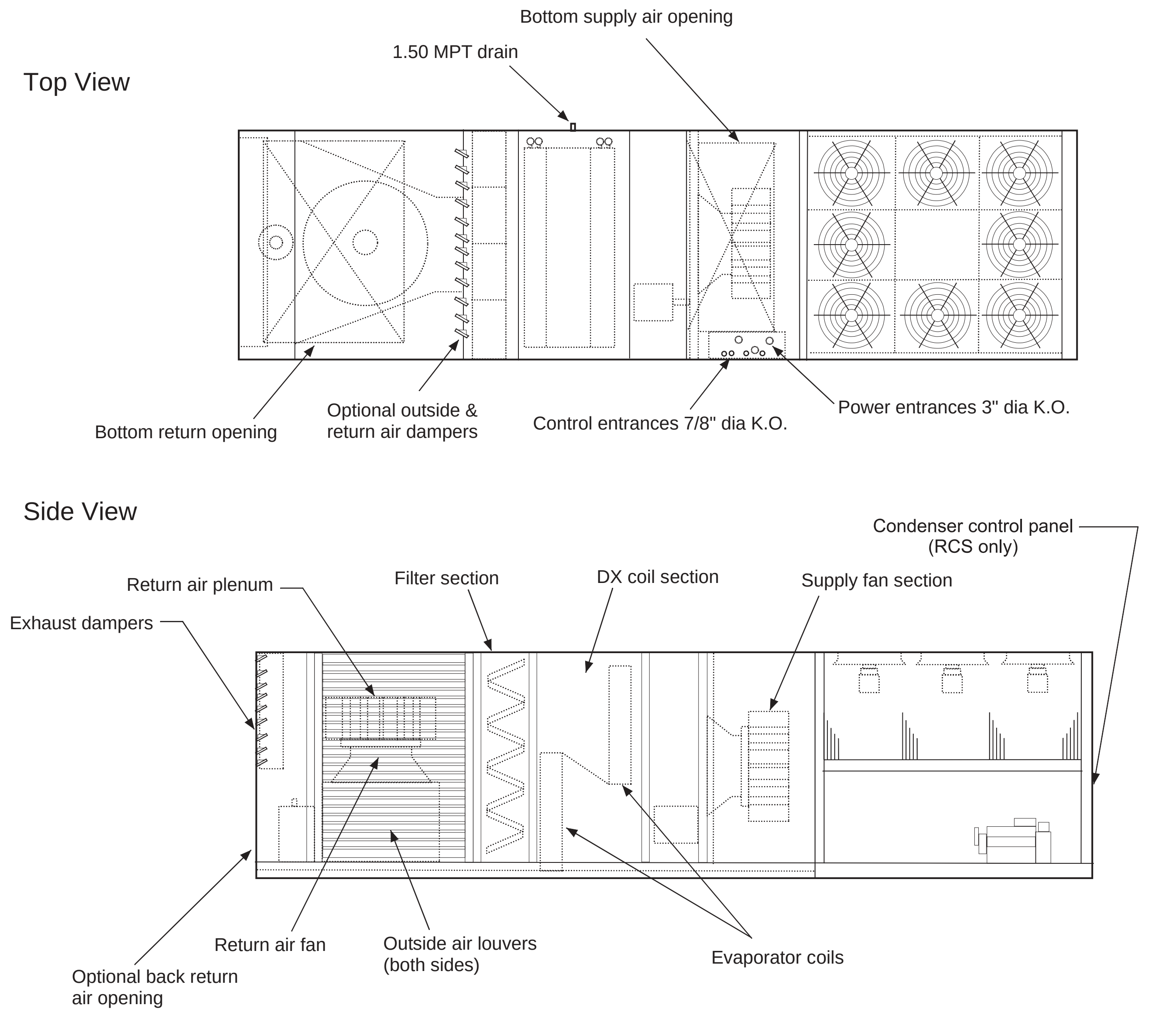


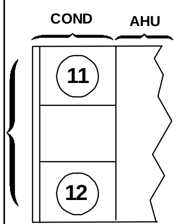
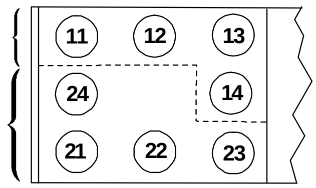
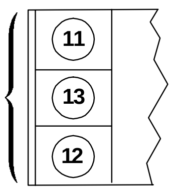
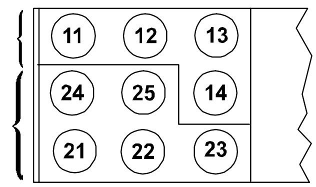
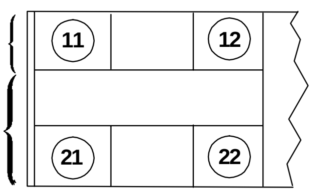
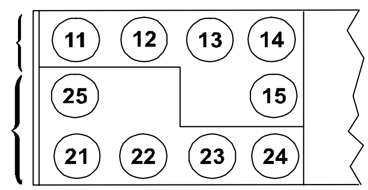
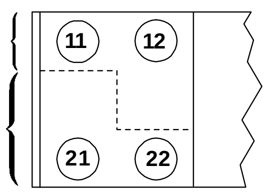
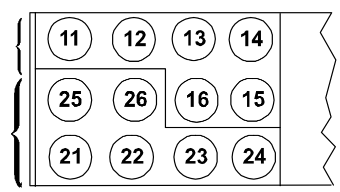
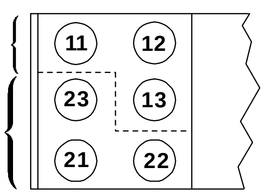
Figure 4. Component locations—RDT units



Condenser Fan Arrangement

Table 2 below shows the condenser fan numbering conventions and locations for each unit size.

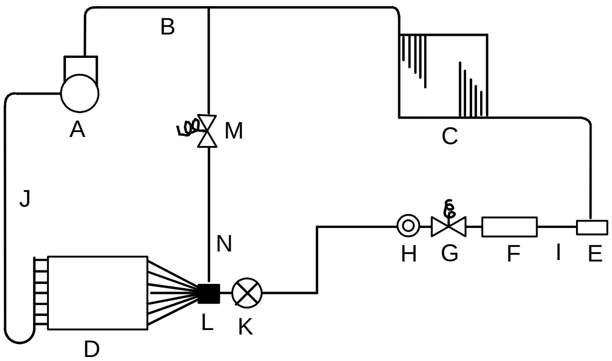
Table 2: Condenser fan arrangement

Unit size	Refrigerant circuit	Arrangement	Unit size	Refrigerant circuit	Arrangement
015C 018C 020C	1 or 2		075C 080C 090C	1 2	
025C 030C	1 or 2		105C	1 2	
036C 040C	1 2		115C	1 2	
045C 050C	1 2		125C 135C	1 2	
060C 070C	1 2				

Refrigeration Piping

This section presents the unit refrigeration piping diagrams for the various available configurations.

Figure 5. Circuit schematic



A Compressor (1, 2, or 3 per circuit)†
B Discharge line †
C Condenser coil †
D Evaporator coil*
E Manual shutoff valve†
F Filter-drier*
G Liquid line solenoid valve*
H Sightglass*
I Liquid line*†
J Suction line
K Thermal expansion valve*
L Distributor*
M Hot gas bypass and solenoid valve (optional)*†
N Hot gas bypass lines (optional)* †

*Supplied on RFS units
†Supplied on RCS units

Figure 6. Condenser piping, scroll compressors, one to three compressors per circuit are provided (015 to 105C)

Legend

1 - Discharge shut-off valve—Circuit #1
2 - Liquid shut-off valve—Circuit #1
3 - Liquid shut-off valve—Circuit #2
4 - Discharge shut-off valve—Circuit #2

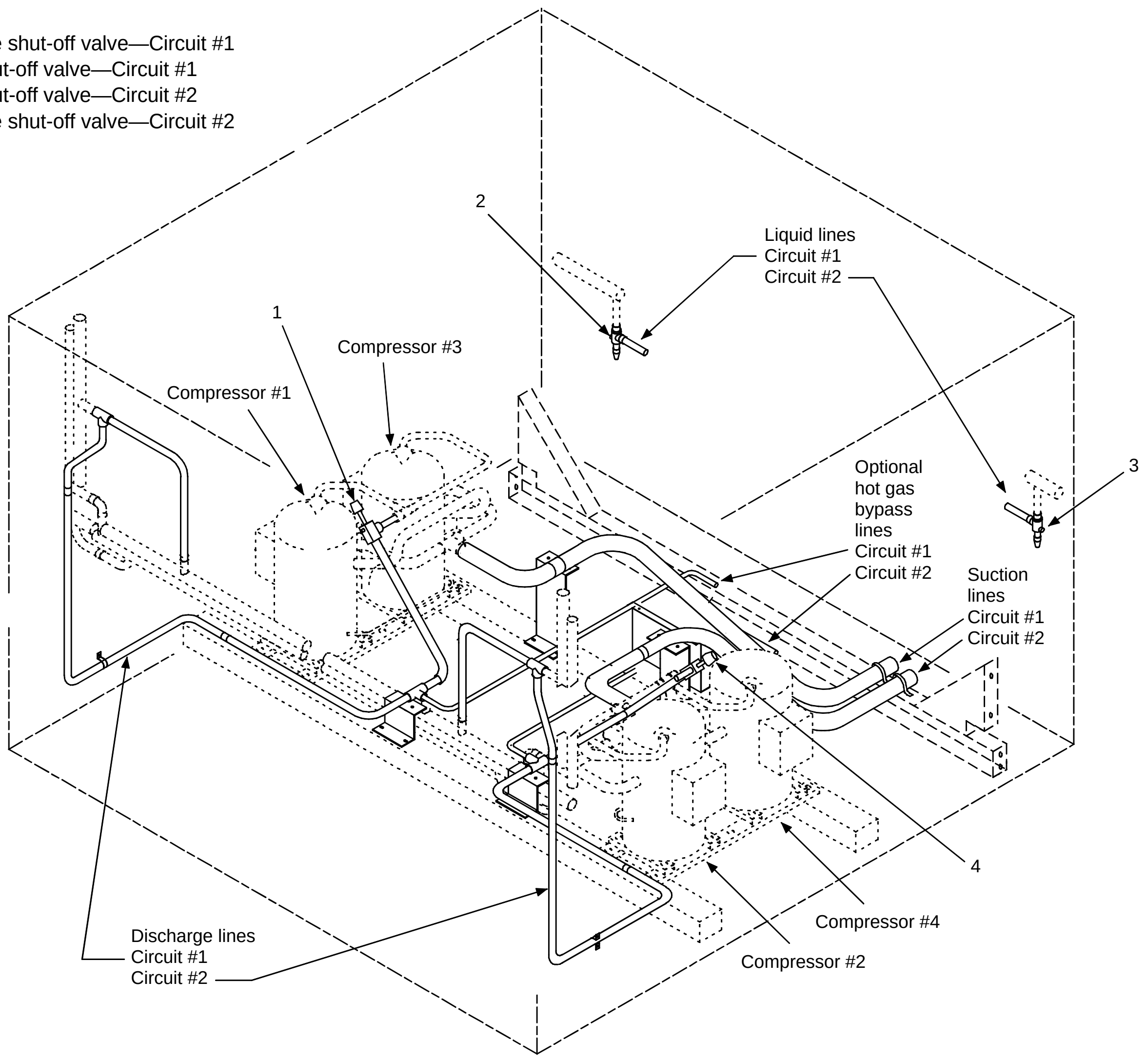
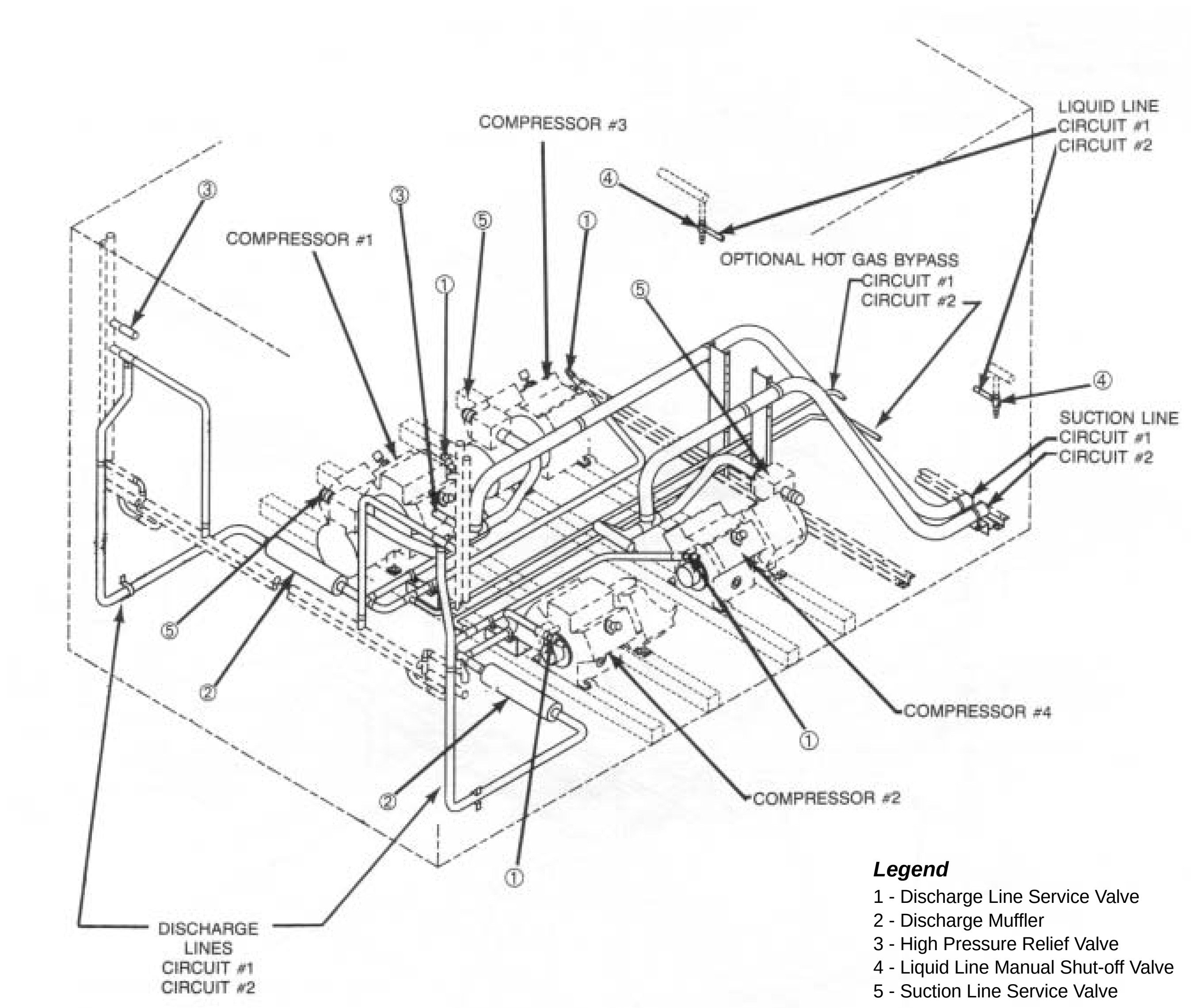


Figure 7. Condenser piping, four reciprocating compressors (115 to 135C)



Legend

1 - Discharge Line Service Valve
2 - Discharge Muffler
3 - High Pressure Relief Valve
4 - Liquid Line Manual Shut-off Valve
5 - Suction Line Service Valve

Figure 8. Air handler piping (flat DX)

Legend

1 - Filter-drier
2 - Liquid line solenoid valve
3 - Sightglass
4 - Hot gas bypass
and solenoid valve (optional)
5 - Thermostatic
expansion valve
6 - Distributor

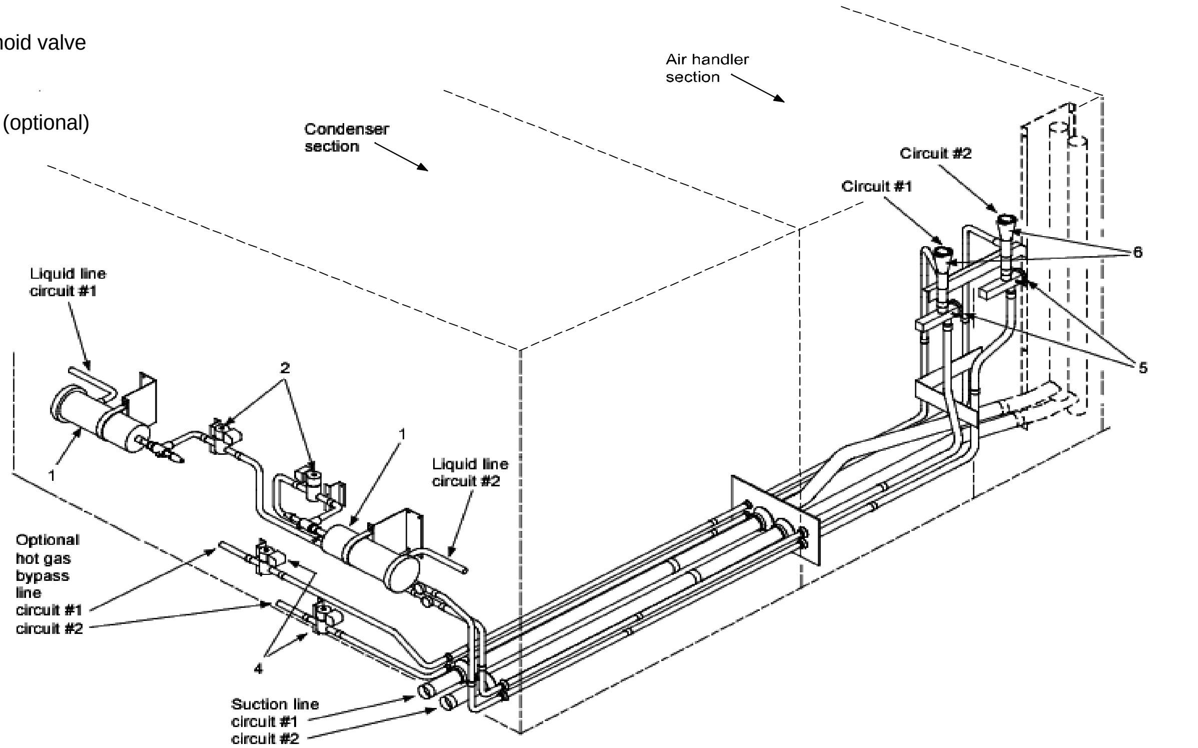
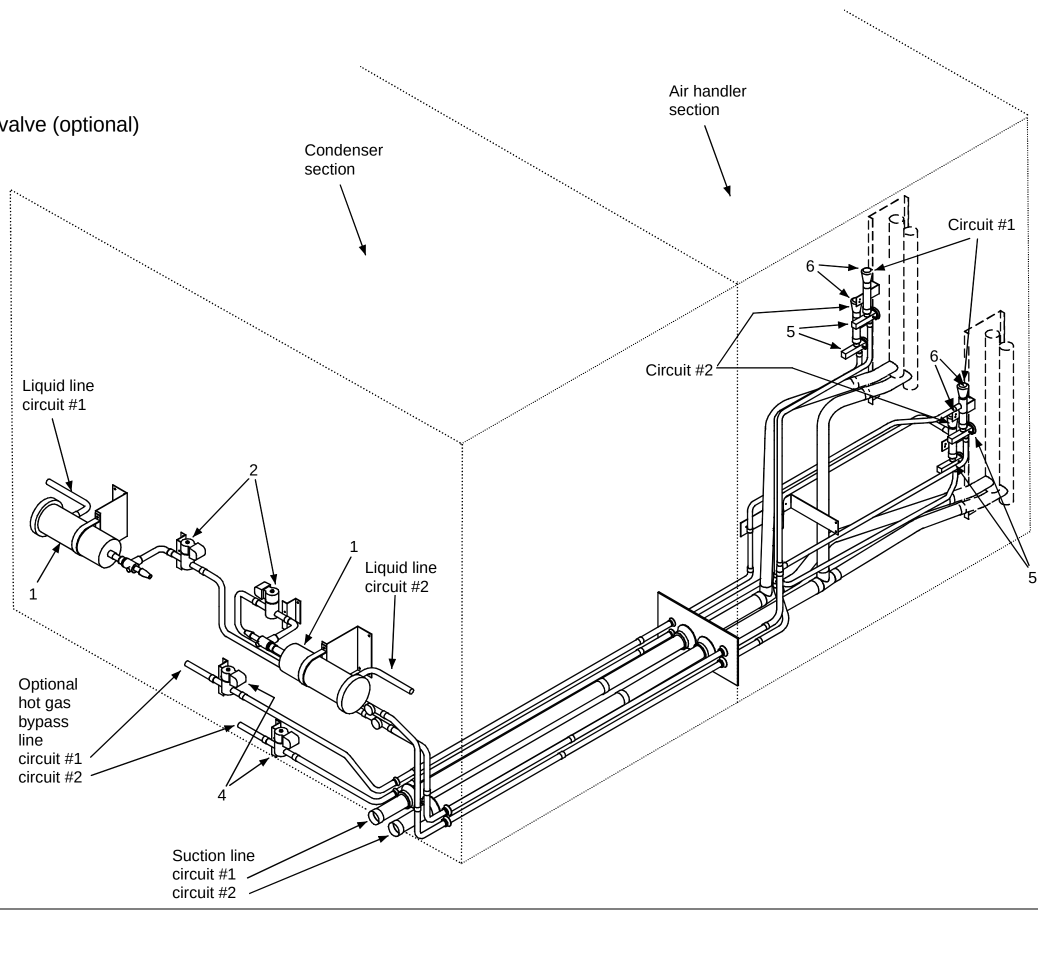


Figure 9. Air handler piping (staggered DX)

Legend

1 - Filter-drier
2 - Liquid line solenoid valve
3 - Sightglass
4 - Hot gas bypass and solenoid valve (optional)
5 - Thermostatic expansion valve
6 - Distributor



Control Locations

Figure 10 (RPS Units) and Figure 11 on page 9 (RDT Units) show the locations of the various control components mounted throughout the units. See “Control Panel” on page 10 for the locations of control components mounted in control panels.

Additional information is included in Table 3 on page 18 and the wiring diagram legend, which is included in “Wiring Diagrams” on page 62.

Figure 10. Control locations—RPS units

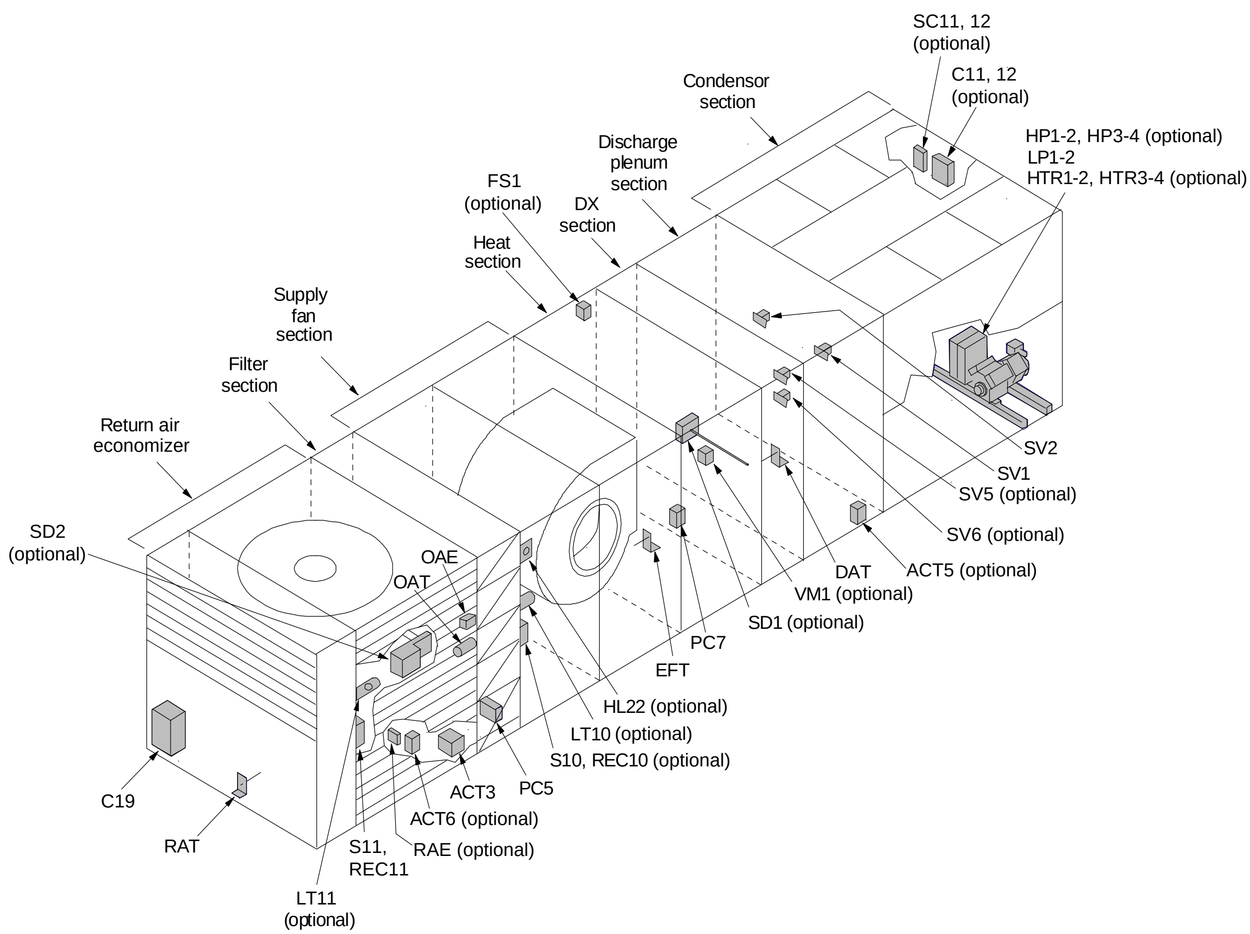
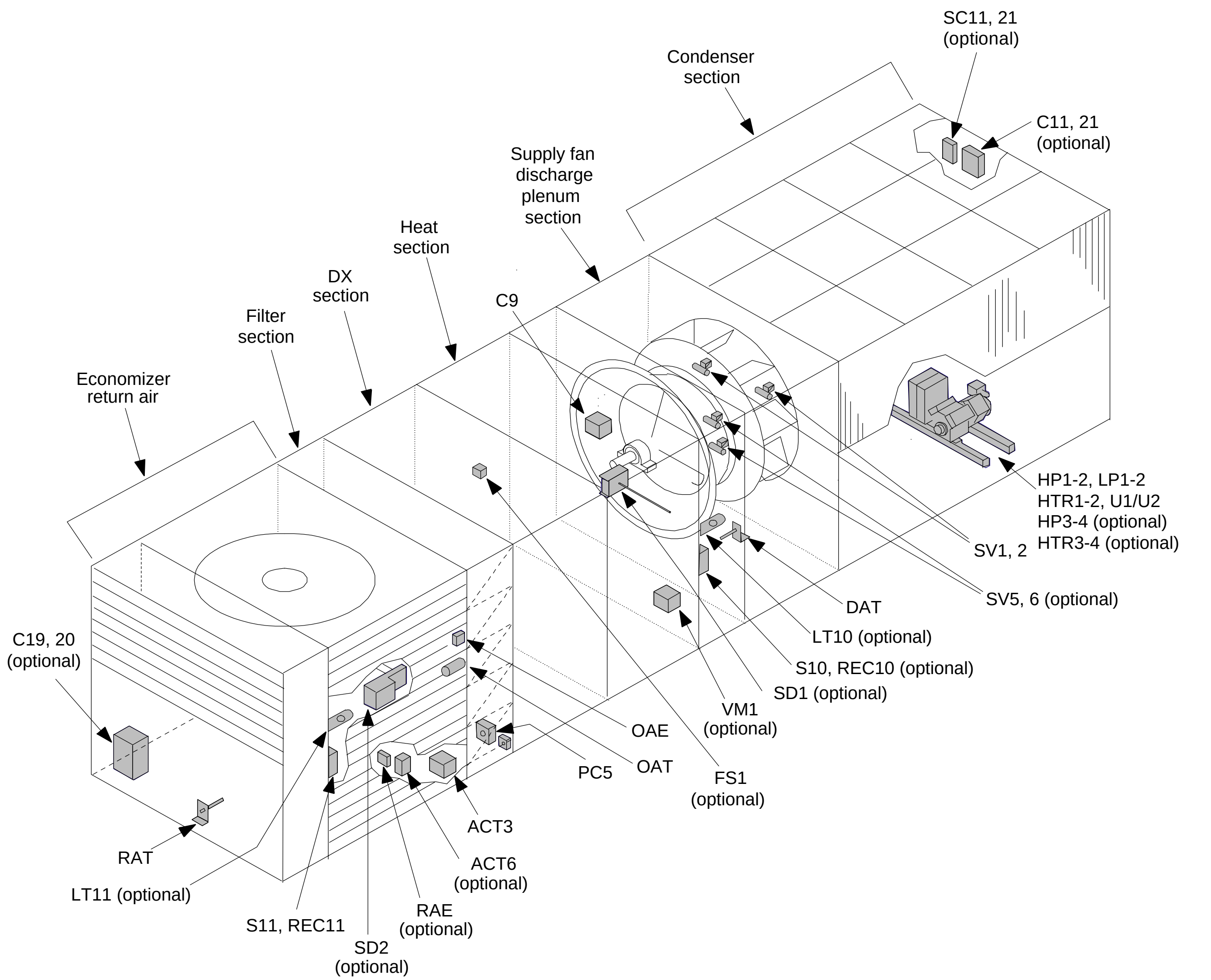


Figure 11. Control locations—RDT units



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. See "Wiring Diagrams" on page 62 for the legend and component description.

Figure 12. Control panel locations

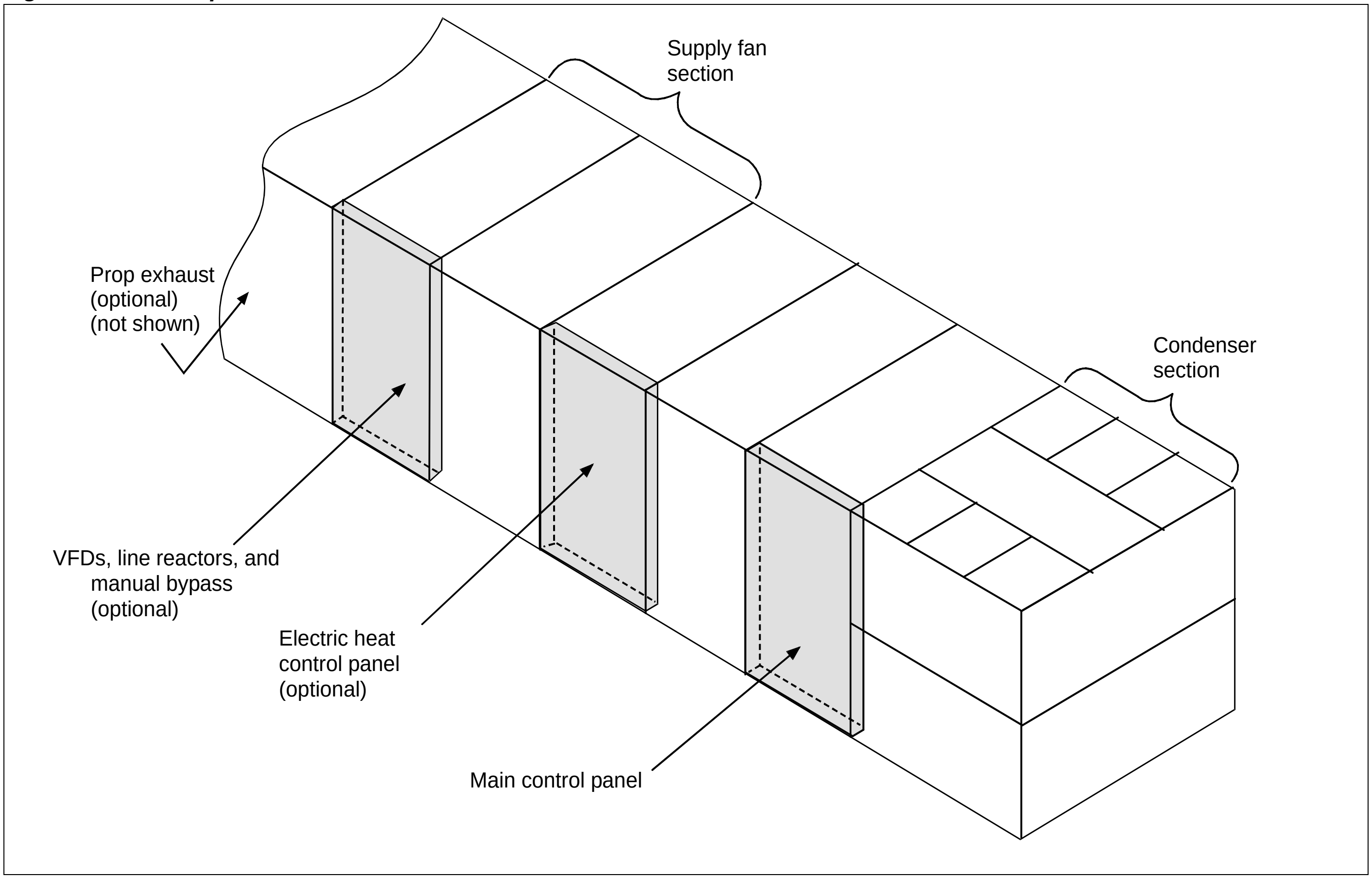


Figure 13. Typical main control panel, 015 to 040, 460 volt

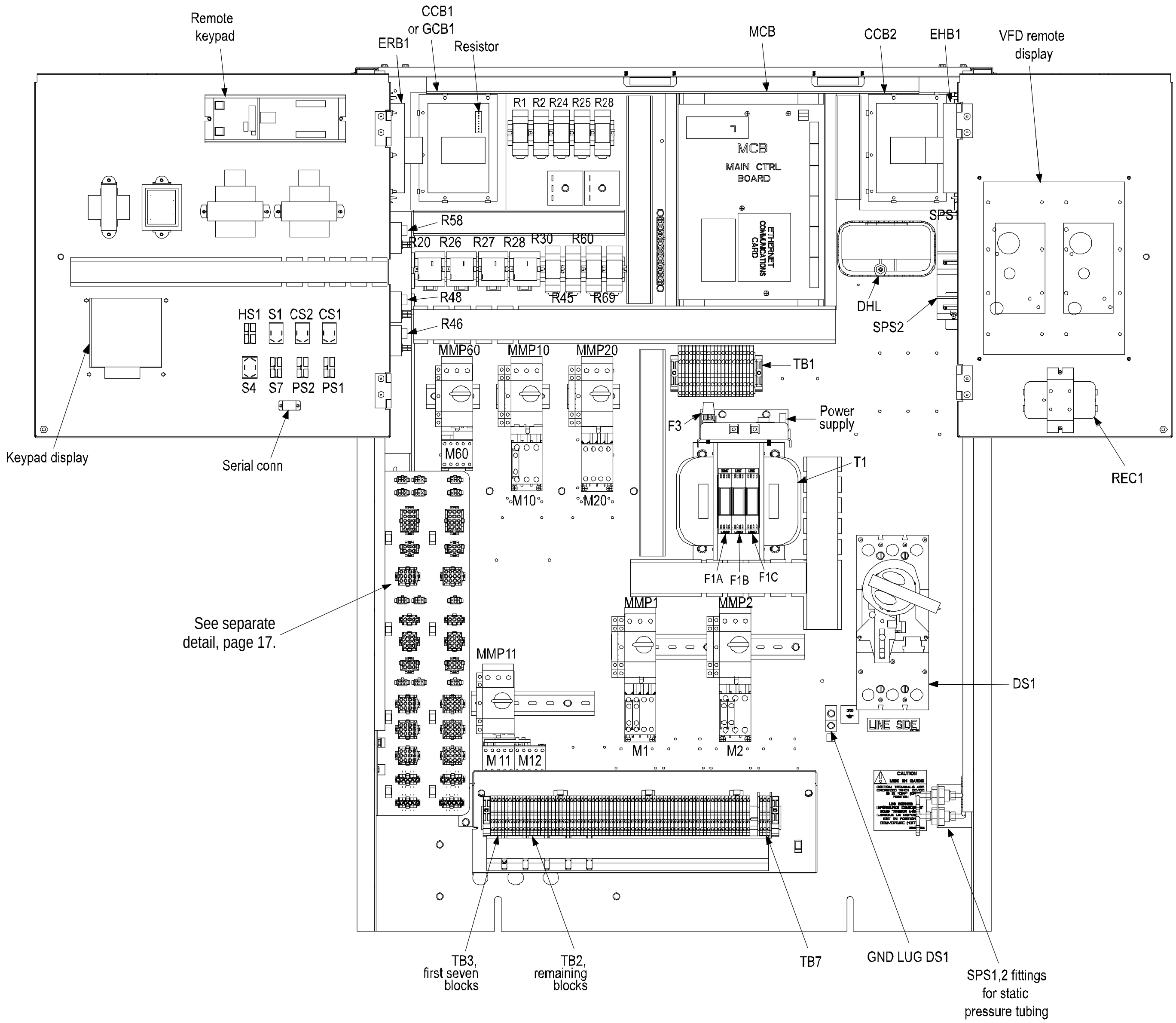


Figure 14. Typical main control panel, 045 to 075, 460 volt

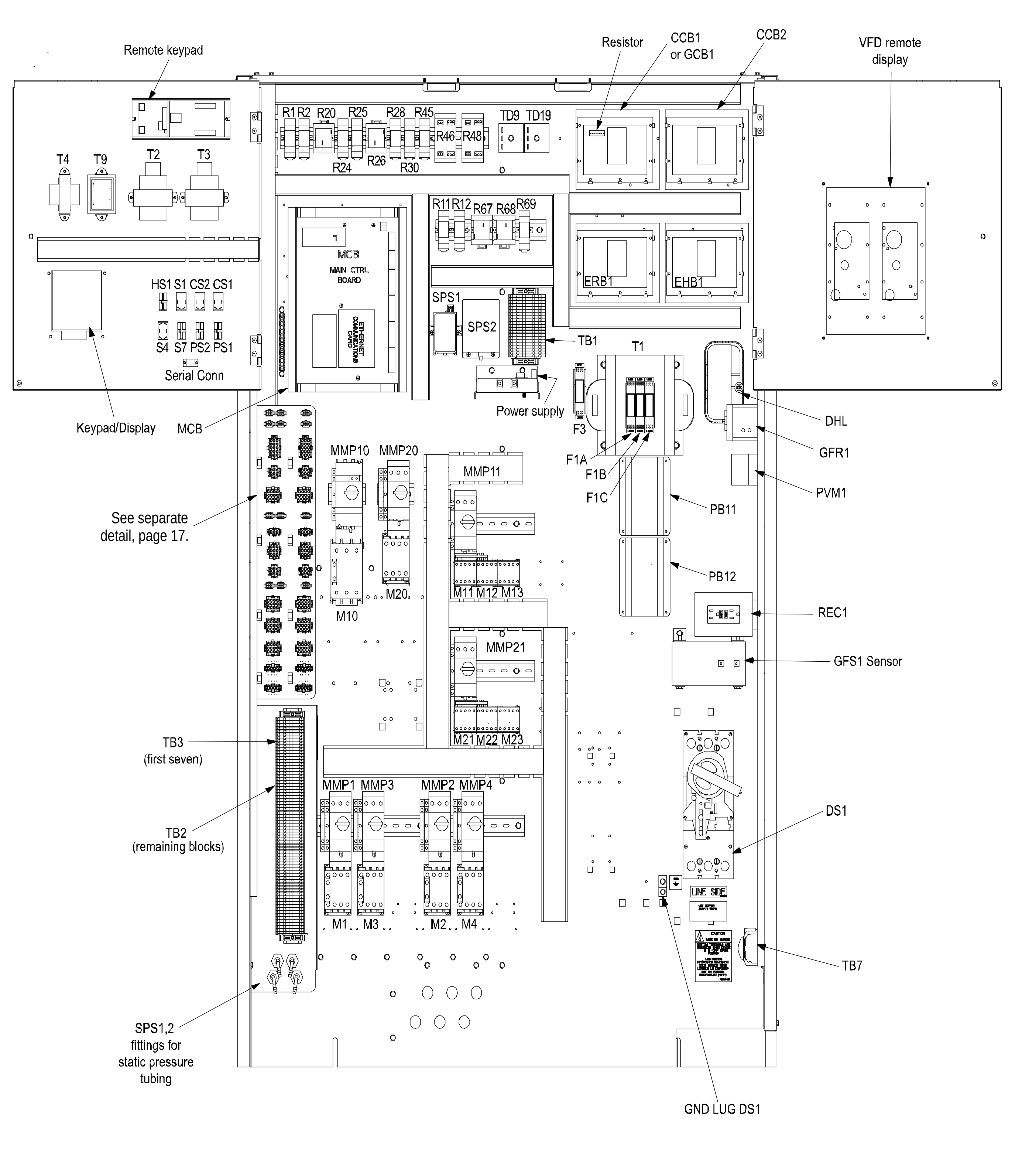


Figure 15. Typical main control panel, 080 to 135, 460 volt

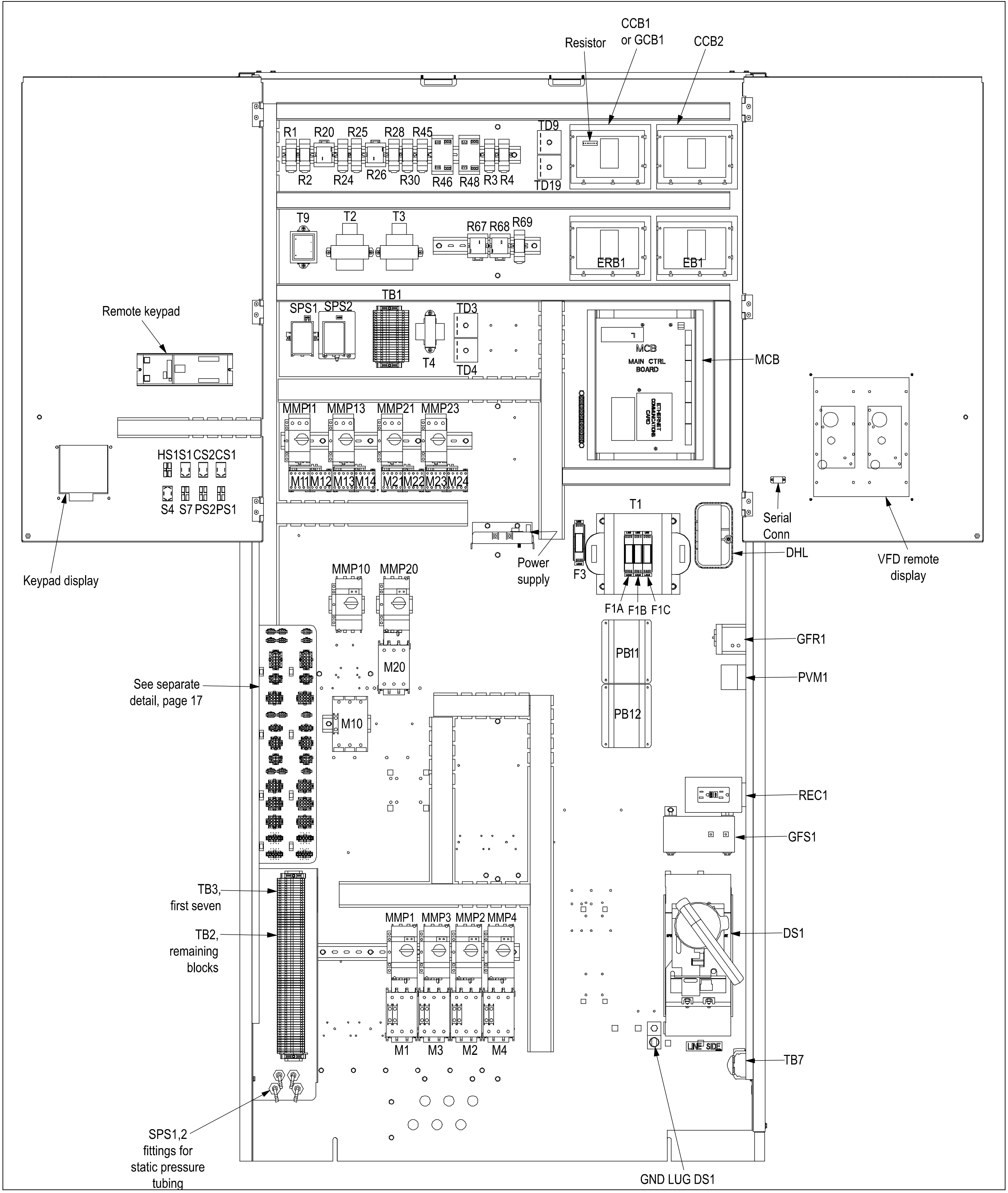


Figure 16. Typical gas heat panel, 1000 MBH

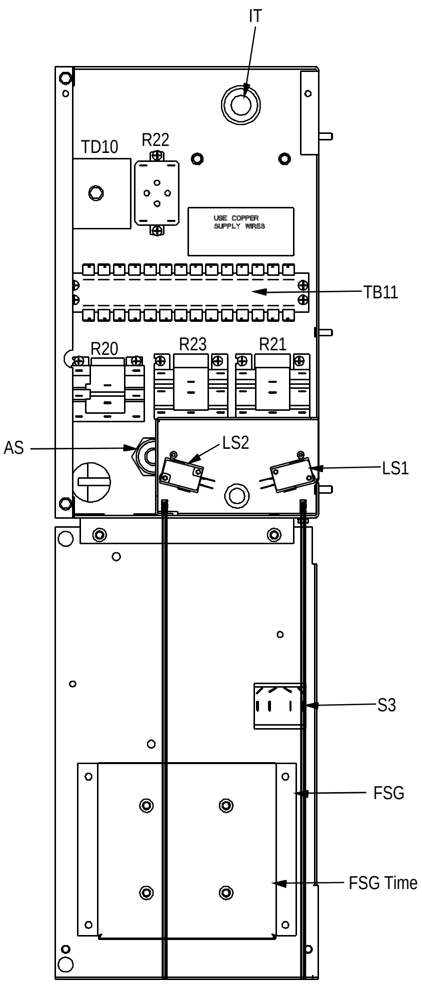


Figure 17. Typical propeller exhaust panel, three fans, 460 volt

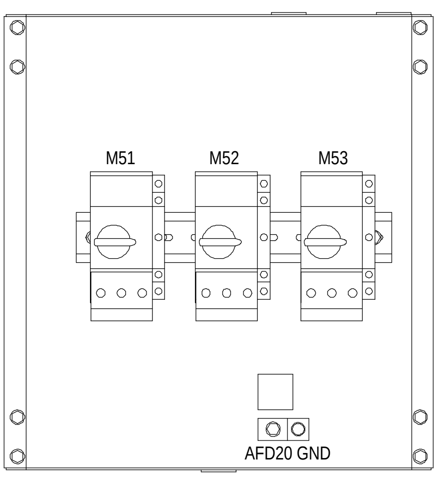


Figure 18. VFD bypass panel, 40 HP, 460 volt)

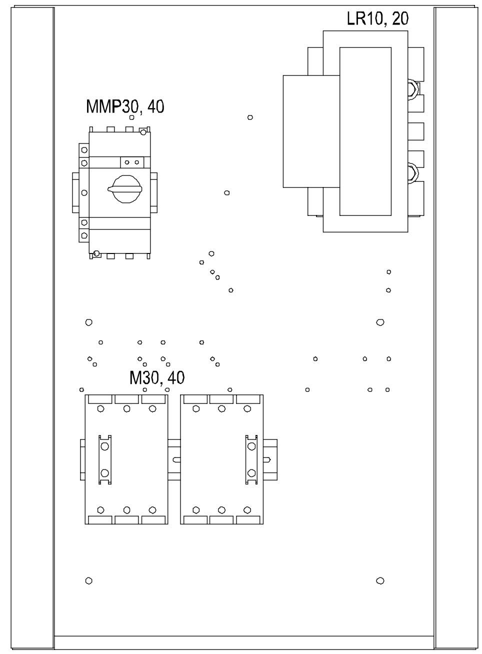


Figure 19. RCS control panel with MicroTech II, 015 to 040C

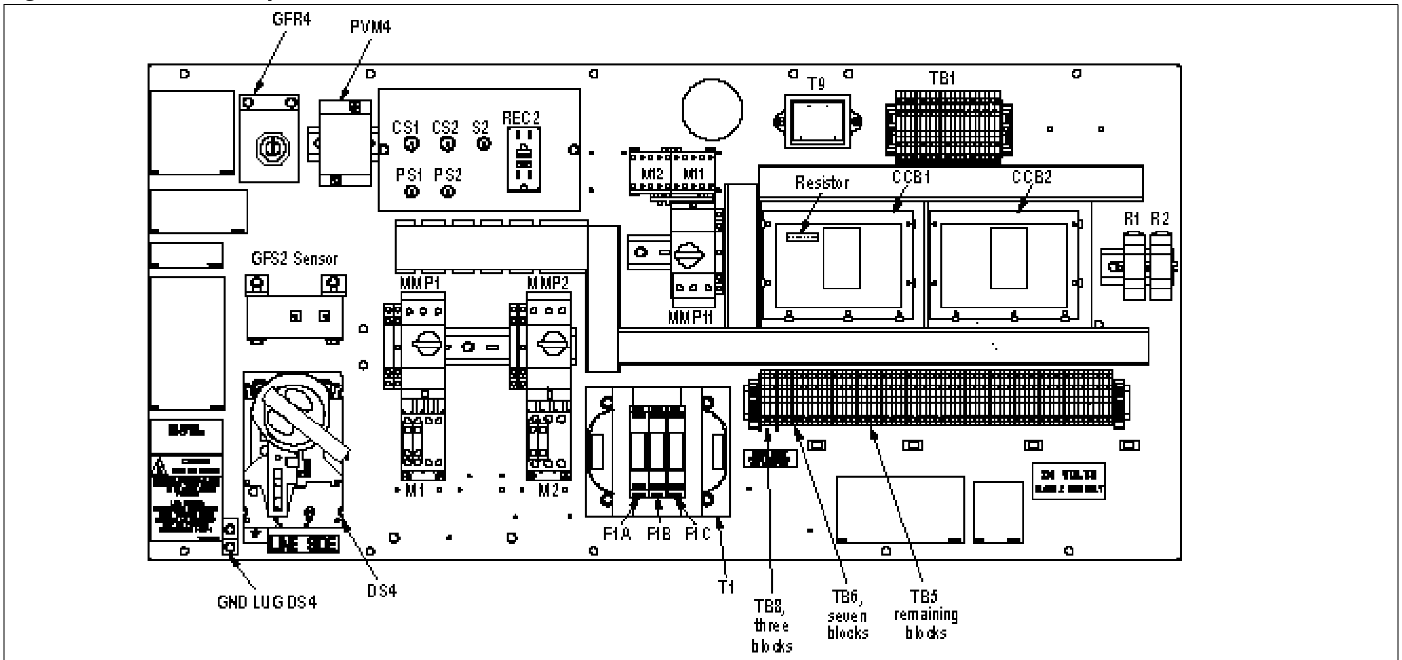


Figure 20. RCS control panel with MicroTech II, RPS 045 to 075C

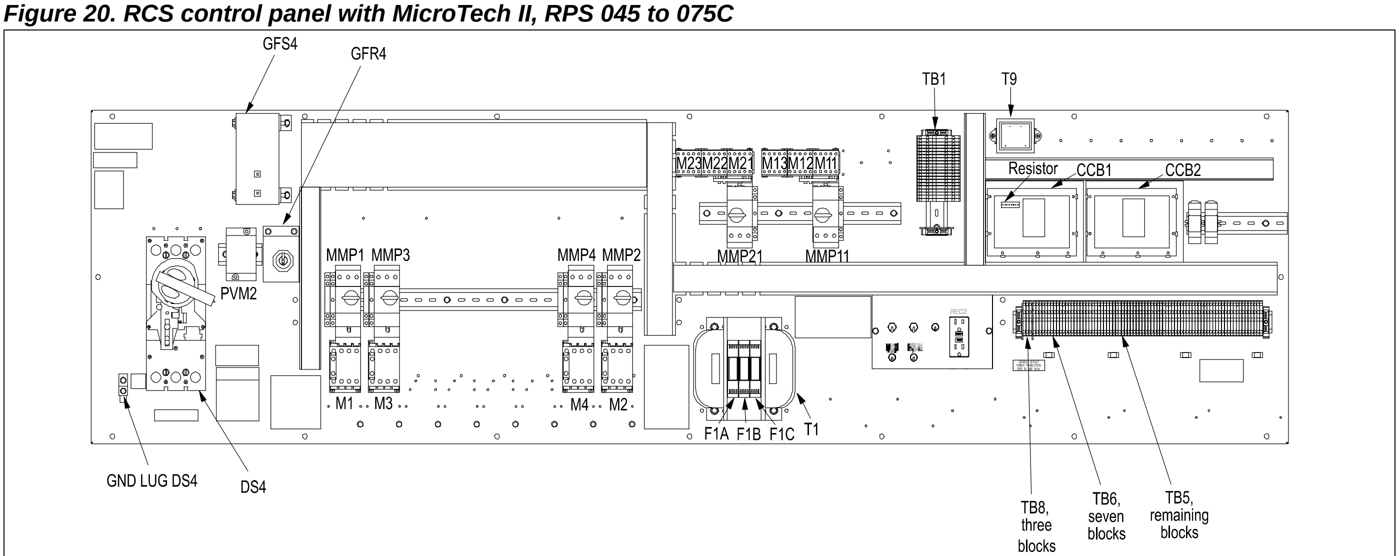


Figure 21. RCS control panel with MicroTech II, RPS 080 to 135C

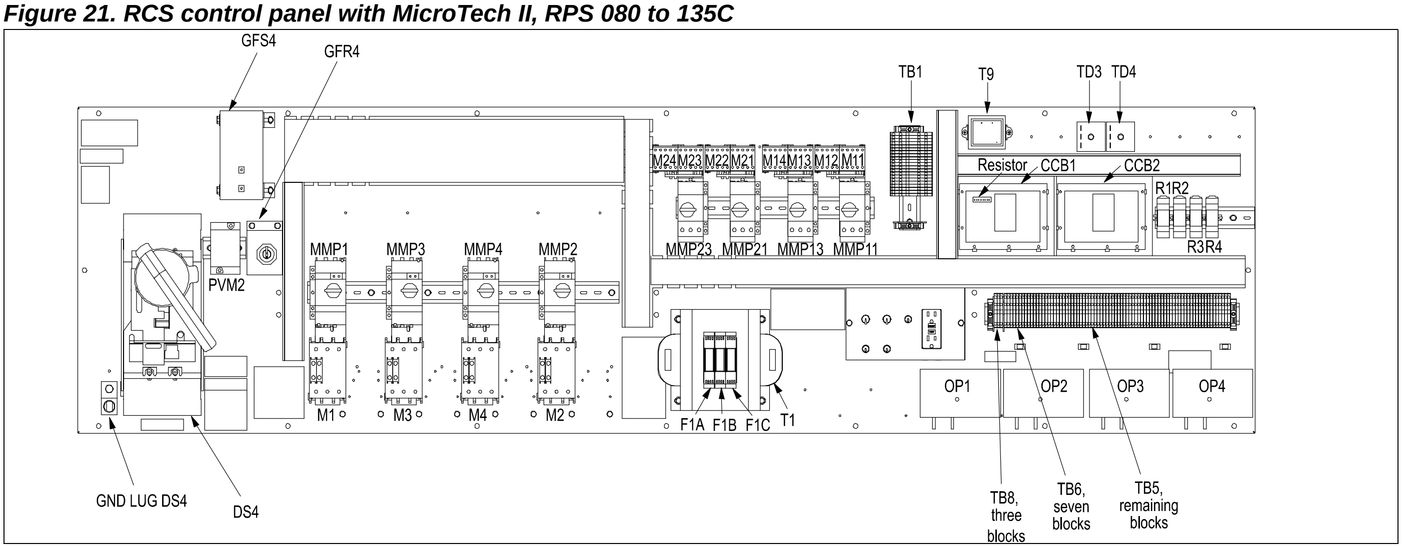


Figure 22. Electric heat panel, sizes 15 to 40C

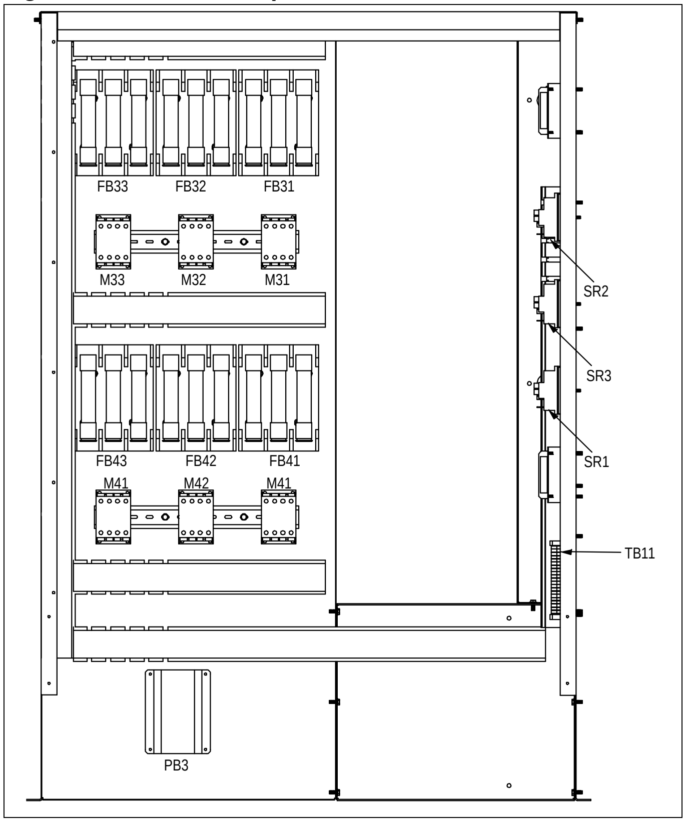


Figure 23. Electric heat panel, sizes 45 to 75C

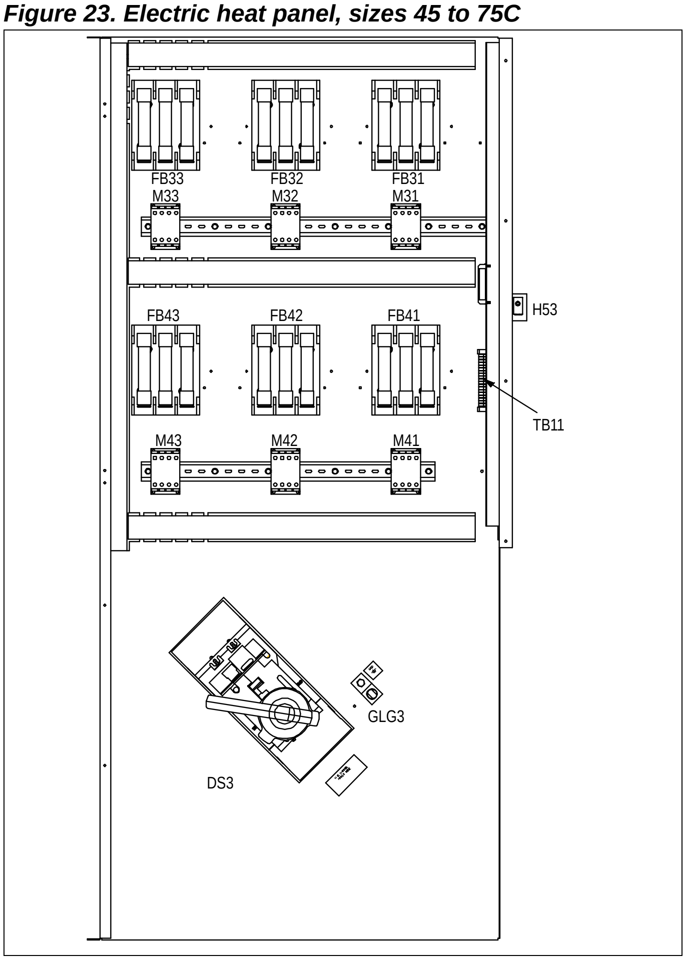


Figure 24. Electric heat panel, sizes 80 to 135

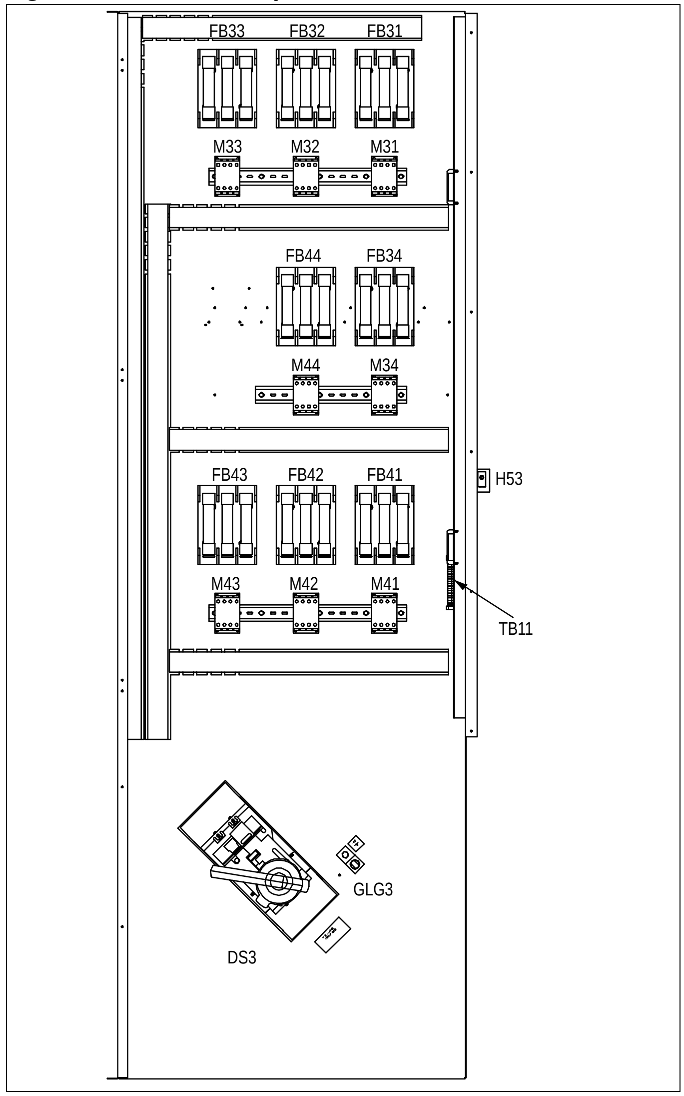
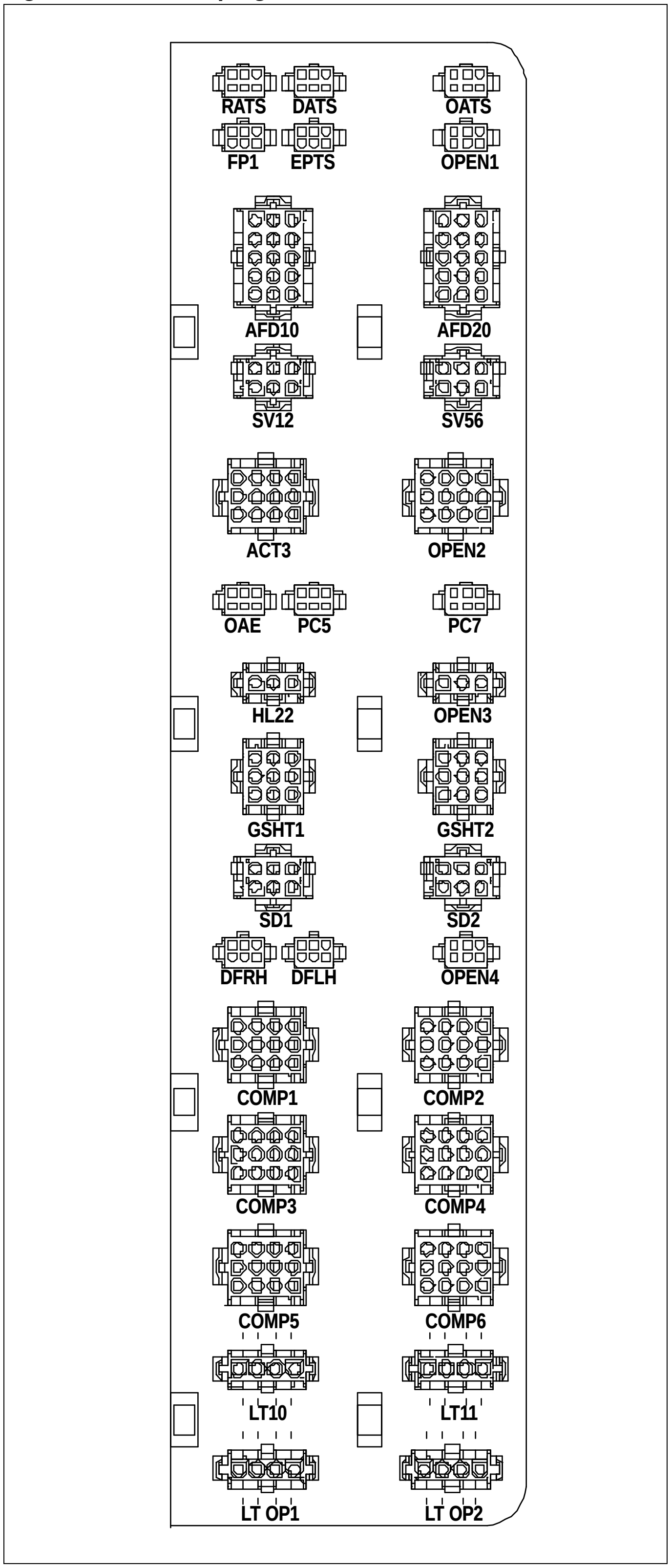


Figure 25. Harness plug connector detail



Controls, Settings, and Functions

Table 3 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 3: Controls, settings, and functions

Symbol	Description	Function	Reset	Location	Setting	Range	Differential	Part no.
CS1 & 2	Switch (toggle), refrigerant circuit	Shuts off compressor control circuits manually	N/A	Main control panel	N/A	N/A	N/A	01355000
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
HP1, 2, 3 & 4	High pressure control	Stops compressor when refrigerant discharge pressure is too high	Manual (relay latched)	Compressor	See page 117.	N/A	100 psi (689 kPa)	047356120
LP1, 2	Low pressure control	Stops compressor when suction pressure is too low (used for pumpdown)	Auto	Compressor	See page 117.	N/A	25 psi (172 kPa)	047356111
MCB	Main control board	Processes input information	N/A	Main control box	N/A	N/A	N/A	060006101
MP1–6	Compressor motor protector	Senses motor winding temperature, shuts off compressor on high temperature. Notes: 1.Unit size 018C compressors include internal motor protector. 2.Unit sizes 020C–036C, circuit #1 compressors include internal motor protector (refer to unit wiring diagram).	Auto at 3400 ohms	Compressor junction box	9 K–18 K ohms	700 ohms cold	N/A	044691509
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

Table 3: Controls, settings, and functions (continued)

Symbol	Description	Function	Reset	Location	Setting	Range	Differential	Part no.
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
PS1, 2	Pumpdown switch	Used to manually pump down compressor	N/A	Condenser control box	N/A	N/A	N/A	01355000
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
SV1, 2	Solenoid valve (liquid line)	Closes liquid line for pumpdown	N/A	Condenser section	N/A	N/A	N/A	See parts catalog
SV5, 6	Solenoid valve (hot gas bypass)	Closes hot gas bypass line for pump-down	N/A	Condenser section	N/A	N/A	N/A	111011001
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	

FanTrol

The FanTrol, provided on all units, is a method of head pressure control that automatically cycles the condenser fans in response to ambient air temperature. This feature maintains head pressure and allows the unit to run at low ambient air temperatures.

RPS/RDT and RCS units have two independent refrigerant circuits with one to four condenser fans being controlled independently by the ambient air temperature of each circuit. See the following sections for sequence of operation for condenser fans with FanTrol.

Table 4: R-22 FanTrol setpoints in °F with MicroTech II controls

RPS RCS RDT RPR	Degrees Farenheit							
	B05		B06		B07		B08	
	Setpoint	Differential	Setpoint	Differential	Setpoint	Differential	Setpoint	Differential
015 to 020C	0	5	60	5	—	—	—	—
025 to 030C	0	5	65	5	—	—	—	—
036	0	5	70	5	—	—	—	—
045 to 045C	0	5	65	5	—	—	—	—
050	0	5	60	5	—	—	—	—
060	0	5	25	5	70	5	—	—
070	0	5	40	5	70	5	—	—
075 to 090C	0	5	65	5	75	5	0	5
105	0	5	0	5	58	5	70	5
115	0	5	0	5	55	5	75	5
125	0	5	65	5	35	5	80	5
135	0	5	55	5	25	5	65	5

Table 5: R-407C FanTrol setpoints in °F with MicroTech II controls

RPS, RCS, RDT	Degrees Farenheit							
	B05		B06		B07		B08	
	Setpoint	Differential	Setpoint	Differential	Setpoint	Differential	Setpoint	Differential
015	0	5	60	5				
018 to 020C	0	5	0	5	—	—	—	—
025 to 036C	0	5	65	5	—	—	—	—
040	0	5	60	6				
045	0	5	55	5	—	—	—	—
050	0	5	50	5			—	—
060	0	5	15	5	70	5	—	—
070	0	5	30	5	70	5	—	—
075	0	5	65	5	75	5	0	5
080 to 090C	0	5	65	5	75	5	0	5
105	0	5	0	5	52	5	70	5
115	0	5	0	5	45	5	75	5
125	0	5	55	5	30	5	80	5
135	0	5	45	5	20	5	65	5

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.

Note: Low head pressure may lead to poor, erratic refrigerant feed control at the thermostatic expansion valve. The units have automatic control of the condenser fans which should provide adequate head pressure control down to 50°F (10°C) provided the unit is not exposed to windy conditions. The system designer is responsible for assuring the condensing section is not exposed to excessive wind or air recirculation.

⚠ 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.

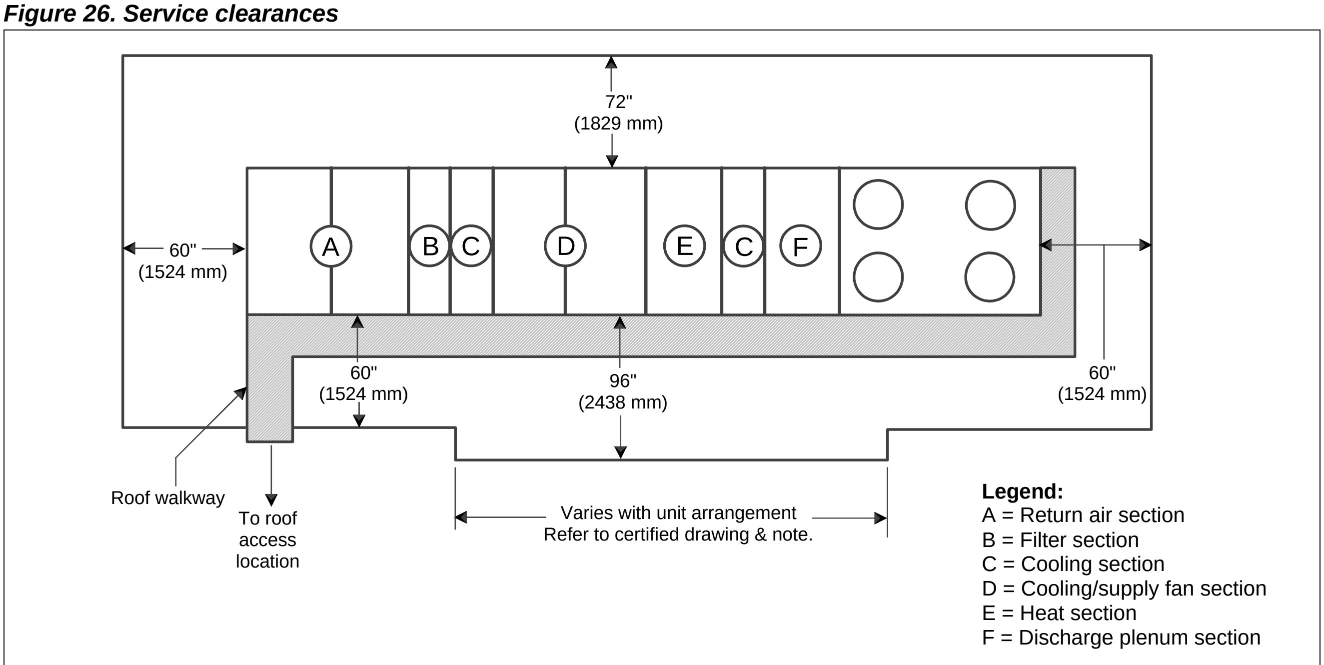
Before unloading the unit, check the unit nameplate to make sure the voltage complies with the power supply available.

Unit Clearances

Service Clearance

Allow service clearance approximately as indicated in Figure 26. Also, Daikin 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 26. Service clearances



Ventilation Clearance

Below are minimum ventilation clearance recommendations. The system designer must consider each application and provide adequate ventilation. If this is not done, the unit 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 21. See also Figure 26 on page 21.
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).

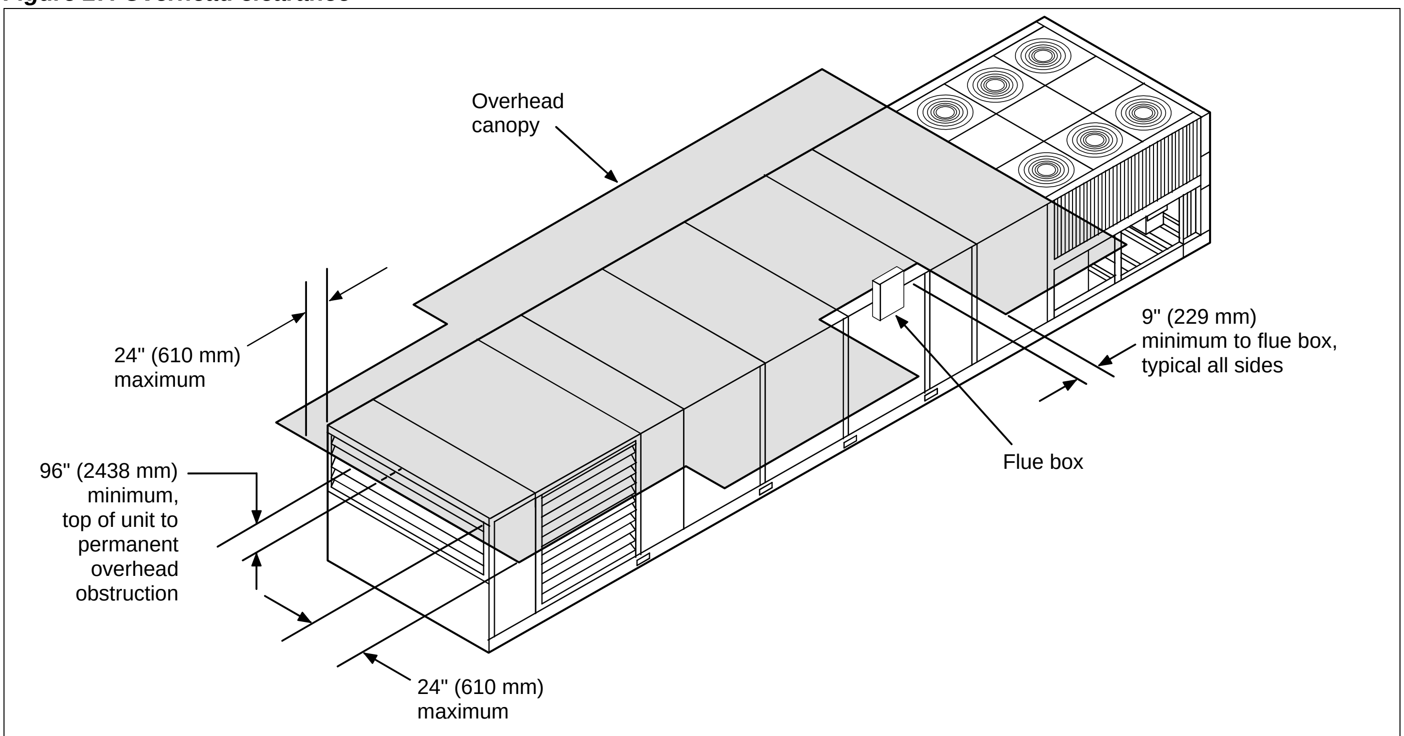
Do not locate outside air intakes near exhaust vents or other sources of contaminated air.

If the unit is installed where windy conditions are common, install wind screens around the unit, maintaining the clearances specified (see Figure 27). 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.

Overhead Clearance

1. Unit(s) surrounded by screens or solid walls must have no overhead obstructions over any part of the unit.
2. The area above the condenser must be unobstructed in all installations to allow vertical air discharge.
3. The following restrictions must be observed for overhead obstructions above the air handler section (see Figure 27):
   - **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 27. Overhead clearance



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 RPS/RFS 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. See “Installing Ductwork” on page 49 for details on duct connections. It is critical that the condensate drain side of the unit be no higher than the opposite side.

Assembly of a typical RPS/RDT roof curb is shown in Figure 29 on page 24. Parts A through K 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. Figure 28 shows the assembly of the RCS roof curb.

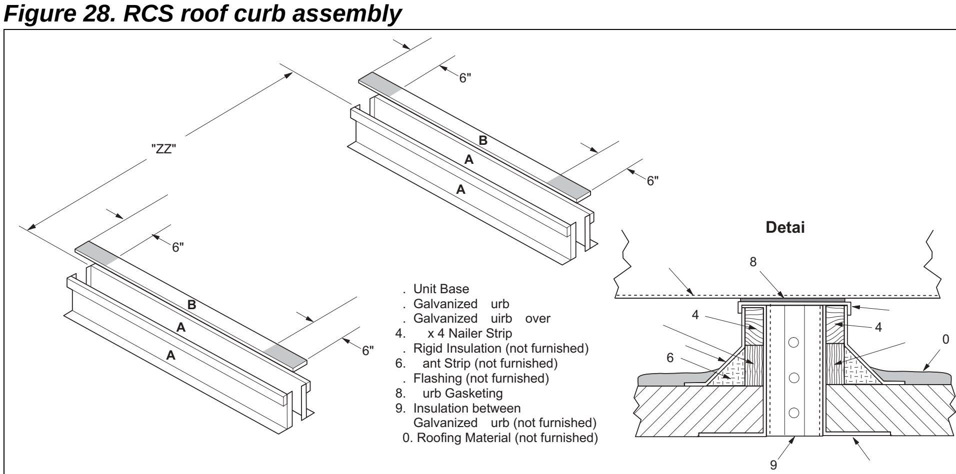
RPS/RDT Assembly instructions (Figure 29 on page 24)

1. Set curbing parts A through K 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 30).

RCS Assembly instructions (Figure 28)

1. Set curbing parts (A) in place making sure that the orientation complies with the assembly instructions. Check alignment of all mating bolt holes.
2. Bolt curbing parts together using fasteners provided.
3. Curb must be level from side to side and over its length.
4. Weld curbing in place. Caulk all seams watertight and insulate between channels.
5. Flash curbing into roof as shown in Detail C.

Figure 28. RCS roof curb assembly



RCS unit size	ZZ	
	in.	mm
015C–030C	31.0	787
036C & 040C	94.0	2057
045C–060C	62.0	1575
070C–105C	100.0	2540
115C–135C	120.0	3048

Figure 29. RPS/RFS roof curb assembly

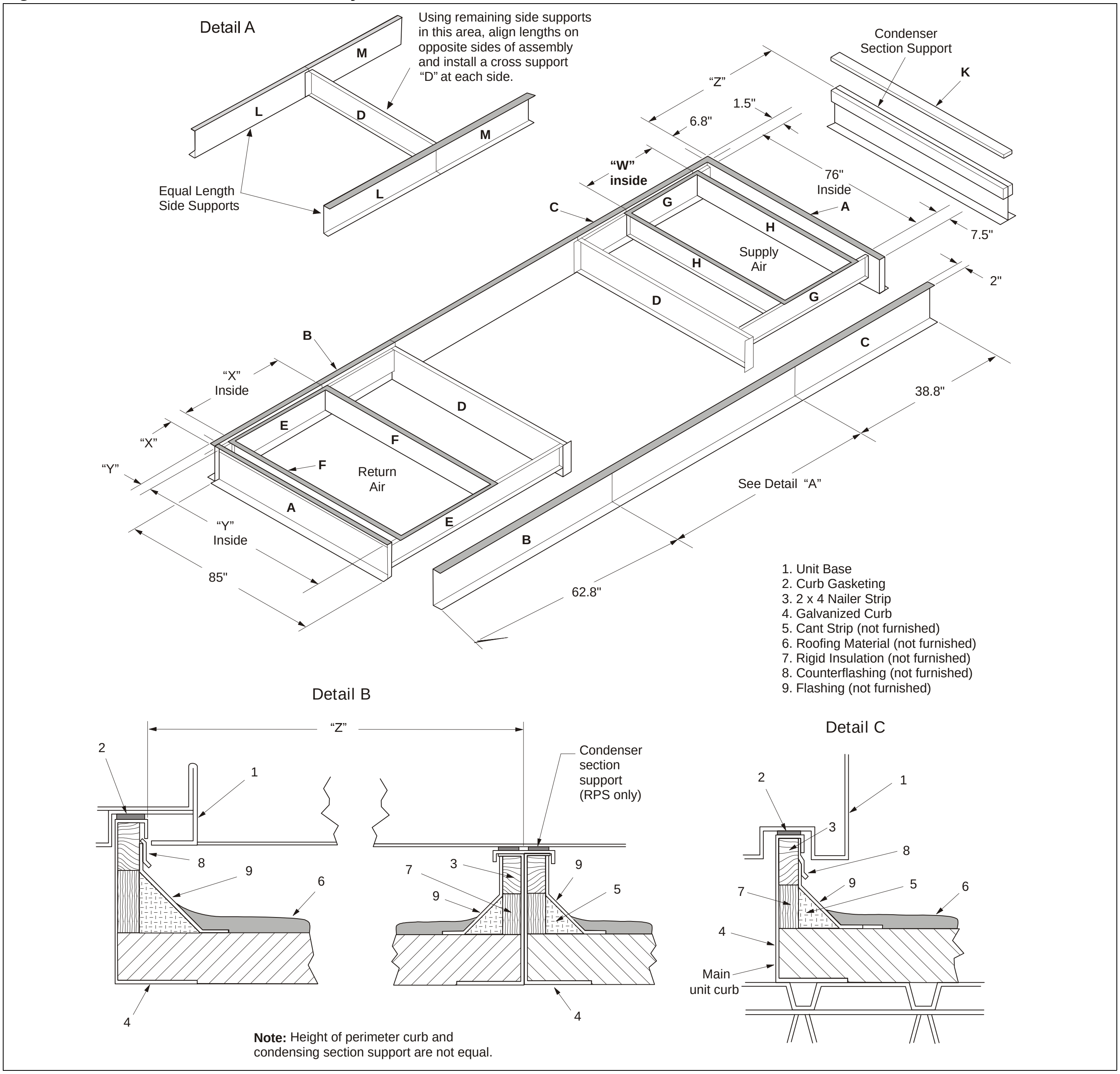


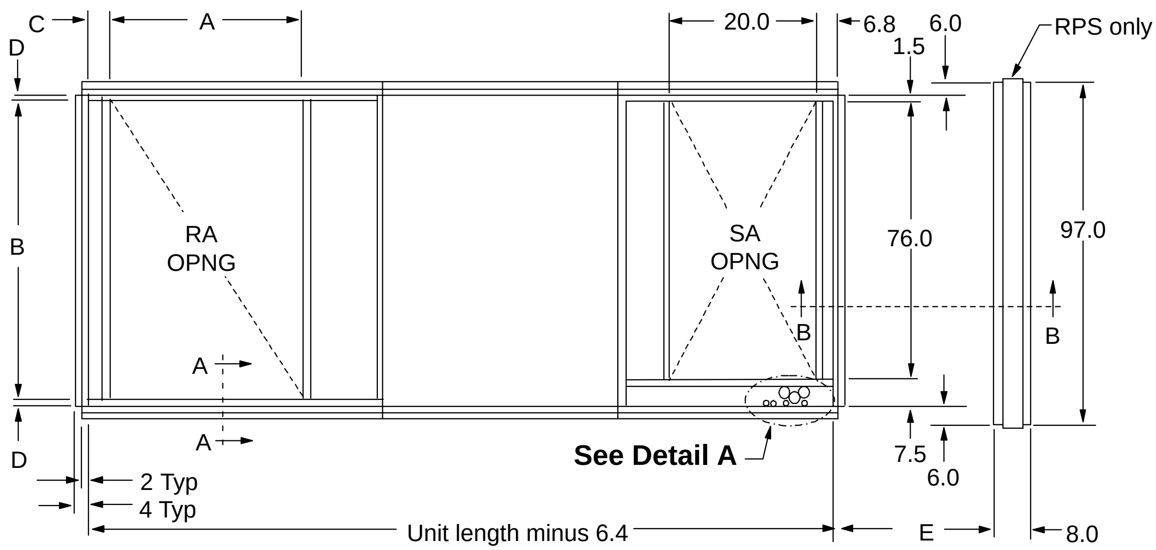
Table 6: Roof curb assembly dimensionsRPS/RFS dimensions

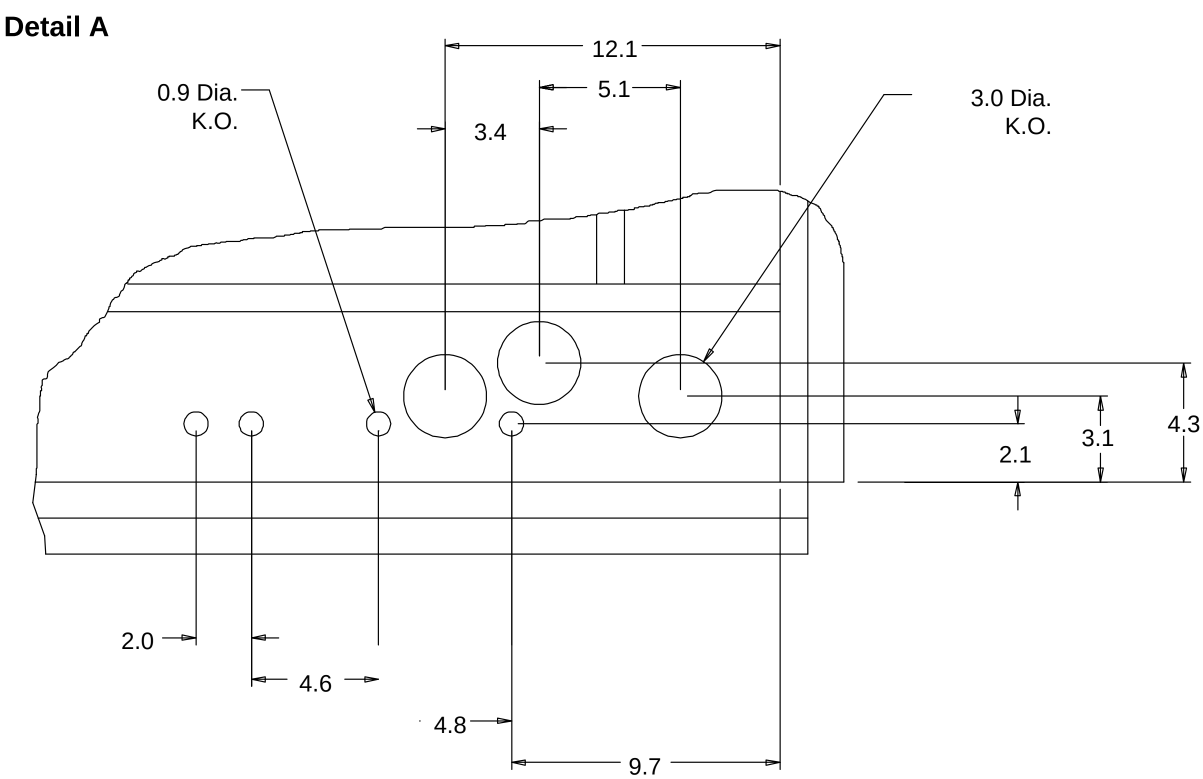
Unit size	Fan	X		Y		XX		YY	
		in	mm	in	mm	in	mm	in	mm
015–040C	None	24.0	610	82.0	2083	6.8	173	1.5	38
	(2) 15" FC	24.0	610	82.0	2083	6.8	173	1.5	38
	30" AF	30.0	762	76.0	1930	6.8	173	4.5	114
	40" AF	36.0	914	78.0	1981	14.8	376	3.5	89
045C–075C	All units	38.0	965	87.0	2210	8.8	222	3.5	89
80C–135C	All units	62.0	1575	87.0	2210	8.8	222	3.5	89

Note: These dimensions do not apply to units with energy recovery wheels.

Unit size	Z		W	
	in	mm	in	mm
015C–030C	45.9	1165	20.0	508
036C and 040C	94.0	2388	20.0	508
045C–075C	77.0	1956	28.0	712
80C–90C	113	2870	38.0	965
105C—135C	113	2870	46.0	1168

Figure 30. Typical power wire entrance, curb view (RPS/RFS 015C to 040C shown, see project certified drawings)





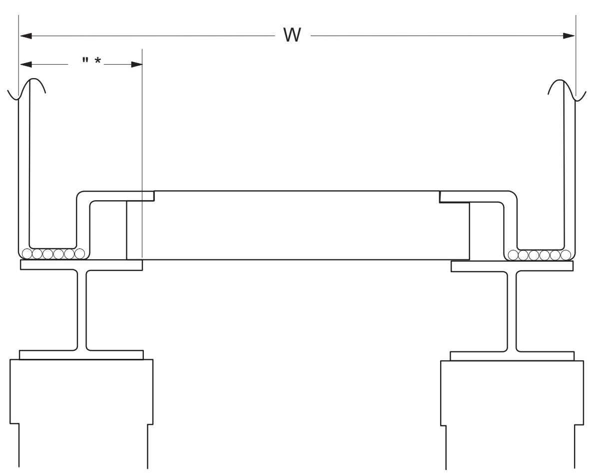
Post and Rail Mounting

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 31, 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 31. Post and rail mounting



Maximum recommended width for structural member is 5" (127 mm) to allow for adequate space for duct connections and electrical entry.

Table 7: W dimension (Figure 31)

Unit	Dimension W	
	inches	mm
015C-040C	94	2388
045C-135C	99	2538

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 32 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.

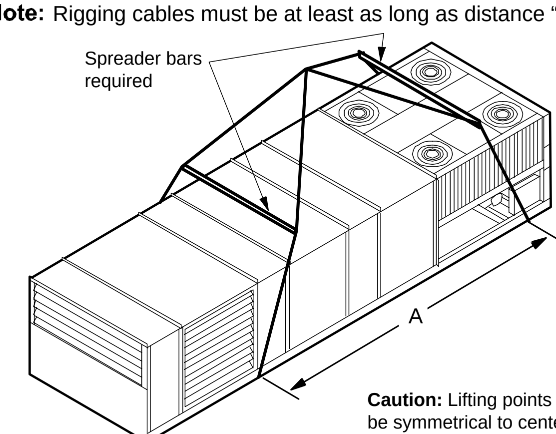
Figure 32. Rigging and handling instruction label

Rigging and Handling Instructions

Unit has either four or six lifting points (four-point shown below).

Caution: All lifting points must be used.

Note: Rigging cables must be at least as long as distance “A.”



Lift only as indicated

Caution: Lifting points may not be symmetrical to center of gravity of unit. Balast or unequal cable lengths may be required.

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

Lifting Points

To determine the required lifting cable lengths and whether four-or six-point lifting is required, use Tables 8 and 9 and Figures 33 and 34.

Referring to Figure 33 and Figure 34, 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 8for this dimension).

Y = Refer to Table 9 for this dimension (see Figure 33 and Figure 34).If A ≤ 288" (7315 mm), 4-point lifting is sufficient.

If A > 288" (7315 mm), 6-point lifting is required.

Table 8: X dimension (Figure 33 and Figure 34)

Outdoor/return air section	015C–030C		036C–040C		045C–075C		080C–135C	
	in	mm	in	mm	in	mm	in	mm
100 O.A.	0	0	0	0	0	0	0	0
Plenum	40	1016	52	1321	48	1259	72	1829
0–30% O.A.	40	1016	52	1321	48	1259	72	1829
0–100% economizer	40	1016	52	1321	72	1829	96	2438
0–100% economizer with 15” return fan	62	1575	—	—	—	—	—	—
0–100% economizer with 30” return fan	52	1321	52	1321	—	—	—	—
0–100% economizer with 40” return fan	—	—	80	2032	—	—	—	—
0–100% economizer with return fan	—	—	—	—	72	1829	96	2438

Table 9: Y dimension (Figure 33 and Figure 34)

RPS unit size	Dimension Y
015C–030C	49.5" (1257 mm)
036C & 040C	38.2" (970 mm)
045C–090C	39.5" (1003 mm)
105C	30.5" (775 mm)
115C–135C	39.5‘” (1003 mm)

Figure 33. Unit type RPS/RDT lifting points

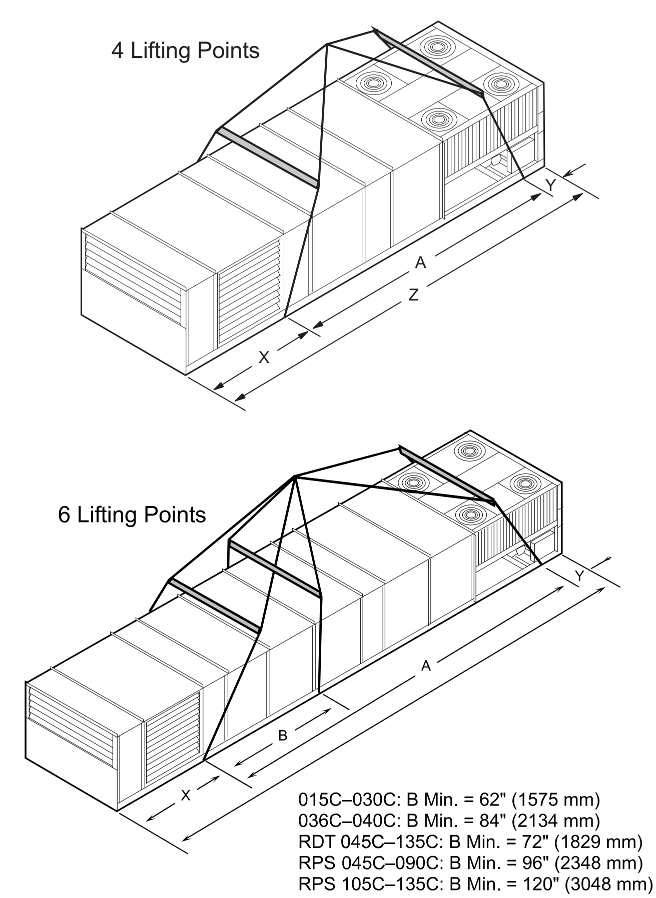


Figure 34. Unit type RFS or RPS/RDT factory split at condenser

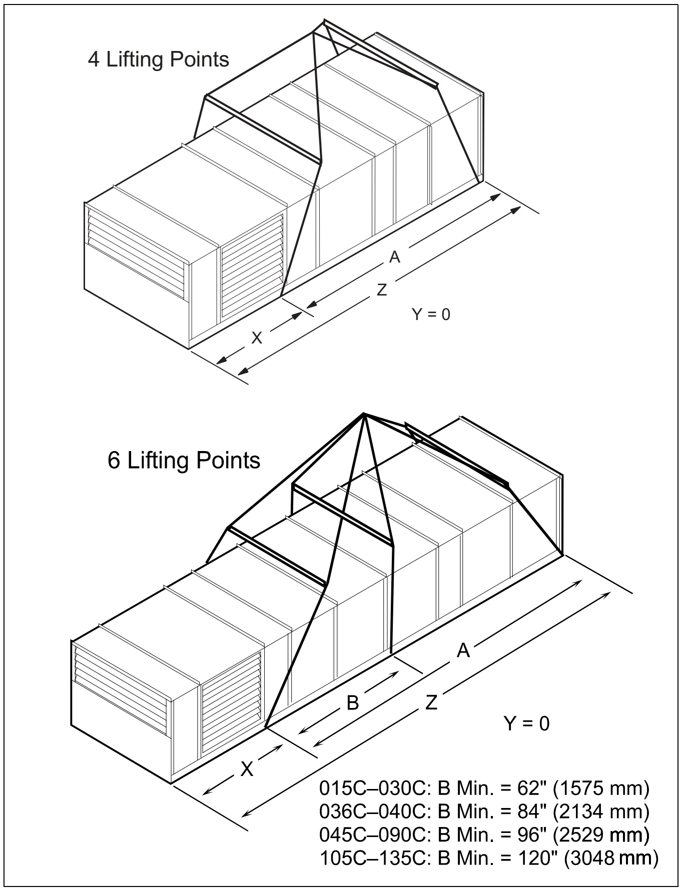


Figure 35. Unit type RCS

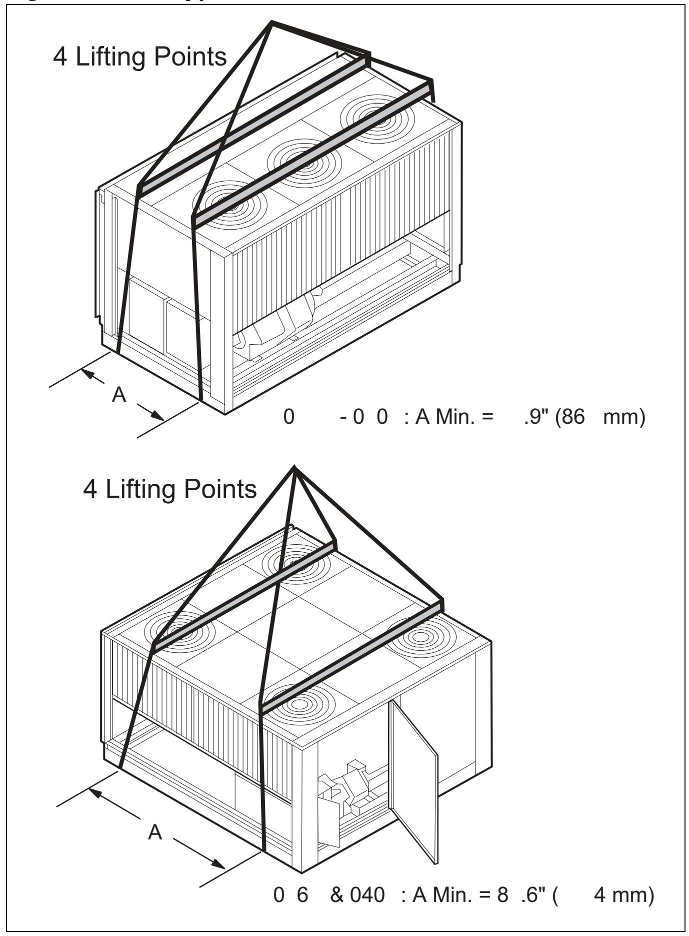


Figure 36. Unit type RCS or condenser section from RPS/RDT factory split at condenser

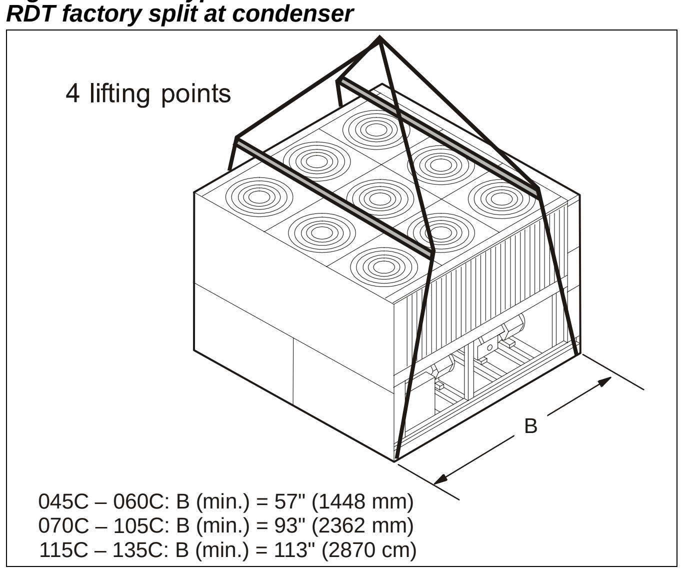
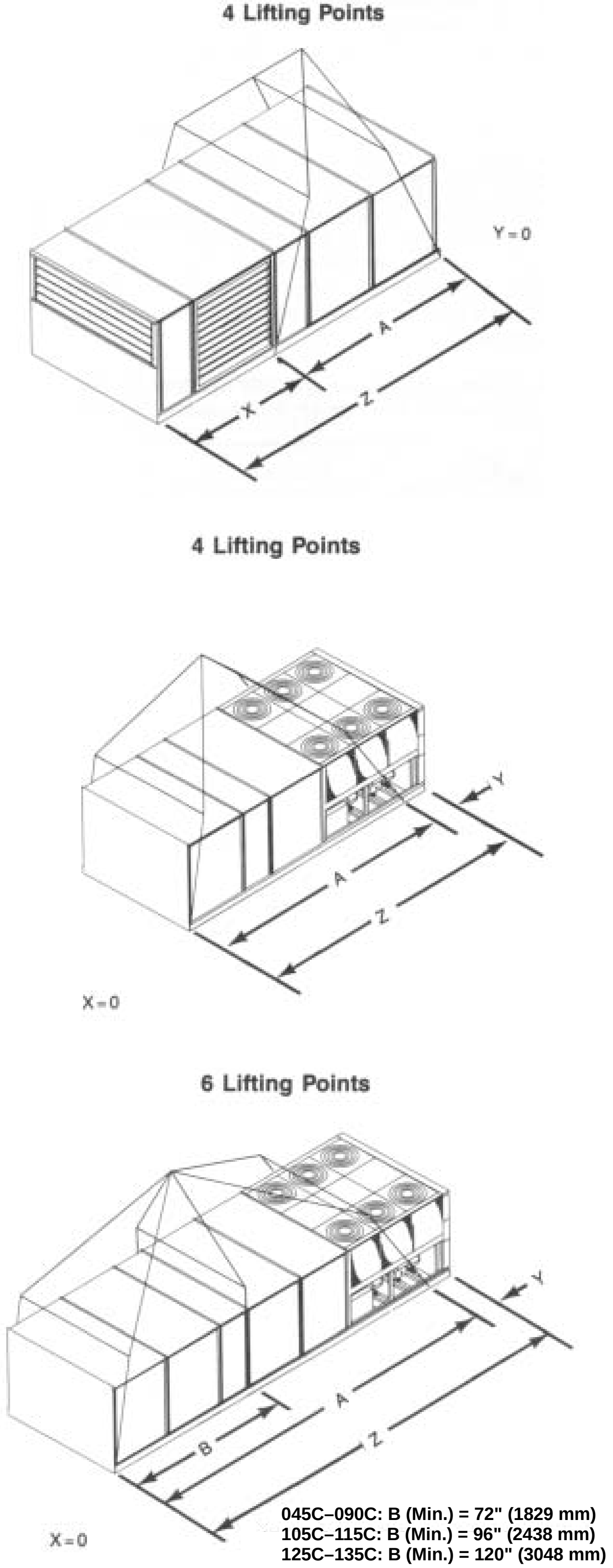


Figure 37. RPS factory split at supply fan section



Reassembly of Split Units

Although RoofPak units typically ship from the factory as complete units, they may be split at the factory in one of three possible configurations.

1 The RFS air handler section and RCS condenser section ship as two separate units, each with its own power supply and unit nameplate. This configuration is ordered when the condenser is intended to remain remote from the air handler because of space or structural constraints.

   On all units except the RFS with end discharge, refrigerant piping is stubbed out the exterior of the cabinet for convenient field piping between the RCS and RFS units, and all necessary refrigeration components are provided. Detailed instructions are on pages 39 to 43.

2 The RPS/RDT unit factory split at the condenser ships as an air handler section and a condenser section that is recoupled together on the roof. This configuration is ordered if a packaged RPS unit is desired, but cannot go to the job site because of shipping length or weight limitations. A single nameplate is attached to the air handler section and power is fed to both sections through the main control box, as in a non-split RPS/RDT unit. Detailed instructions are on pages 33 to 38.

   All interconnecting piping and refrigeration components are provided so that when the sections are coupled together only field-provided couplings are required to connect the piping.

3 The RPS unit factory split at the fan ships as two pieces, split at the supply fan bulkhead, to recouple together on the roof. Like the RPS/RDT unit factory split at the condenser, this configuration is ordered if shipping length or weight limitation prevents a packaged RPS/RDT from being ordered. Splitting at the fan has the advantage of leaving all factory refrigerant piping intact so field evacuation and charging is not required. Detailed instructions are on pages 30 to 32.

   A single nameplate is attached to the air handler section and power is fed to both sections through the main control box, as in a non-split RPS/RDT unit.

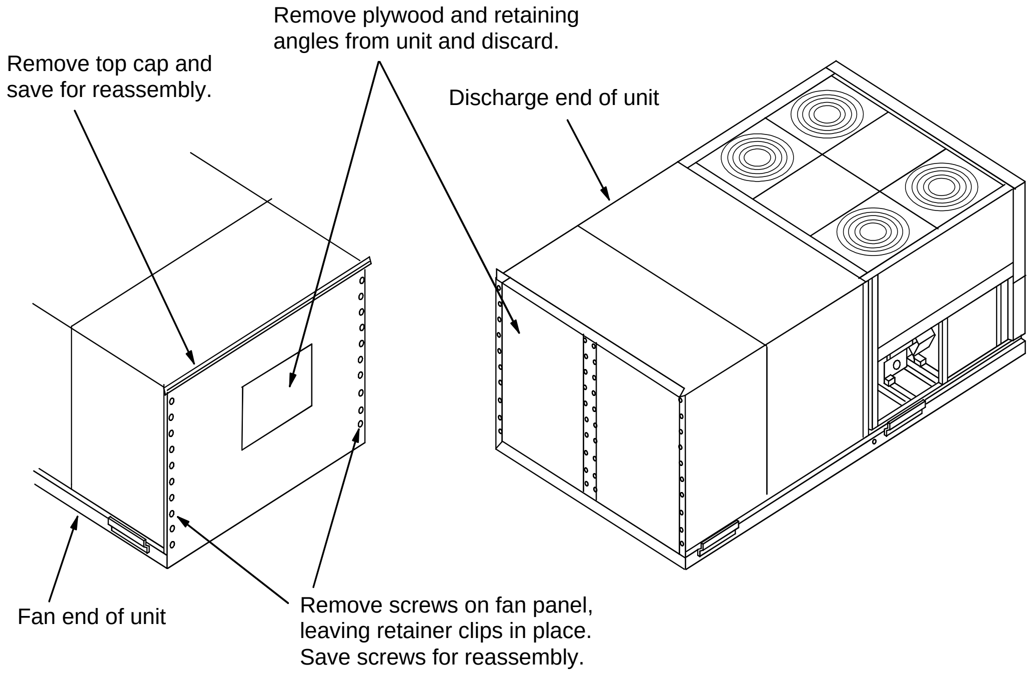
RPS Factory Split at Fan

Field reassembly of an RPS/RDT 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 (*Figure 38*)

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 Phase II, Step5.
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.

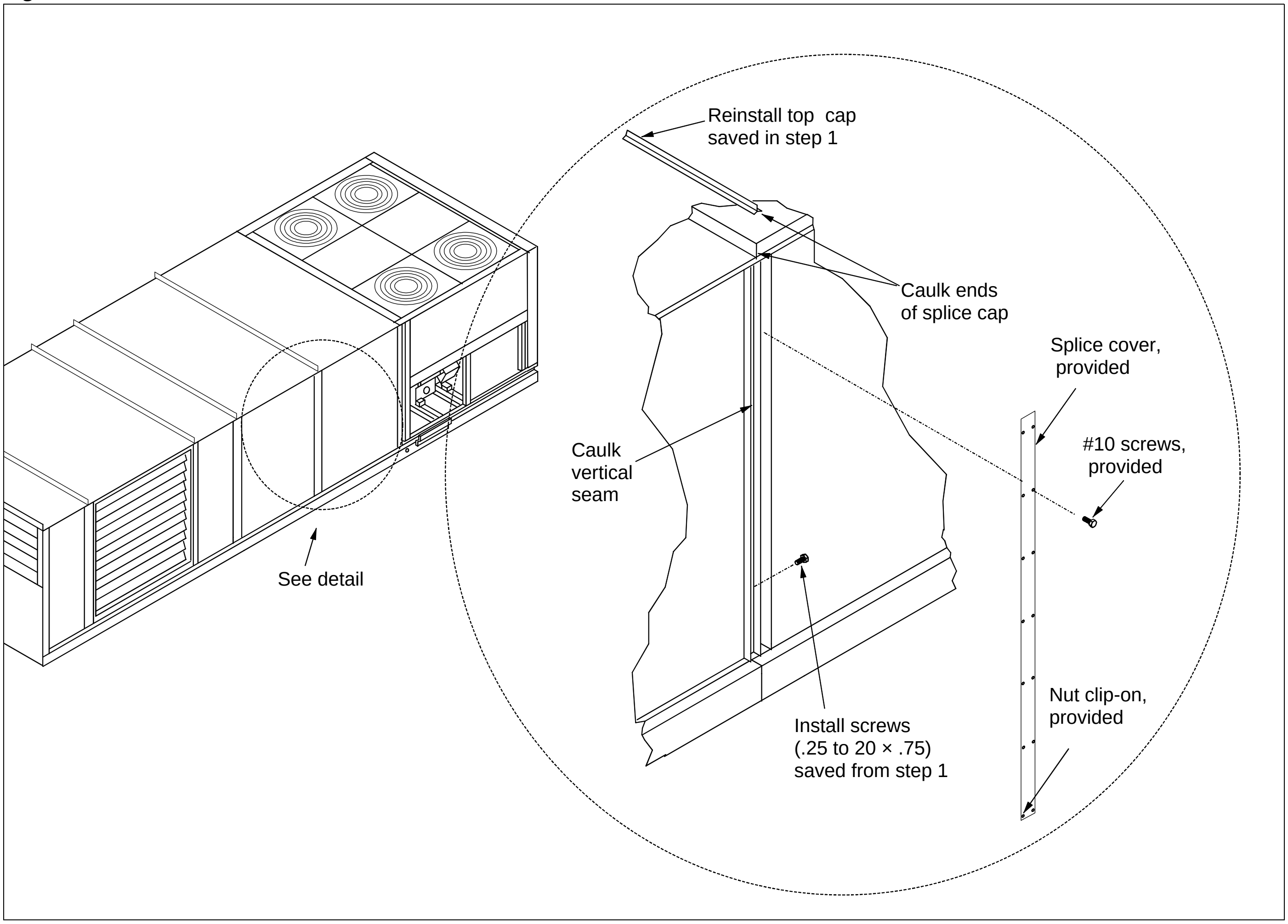
Figure 38. Set sections



Phase II. Reassemble cabinet (Figure 39)

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
6. Install splice cover (provided).

Figure 39. Reassemble cabinet



7

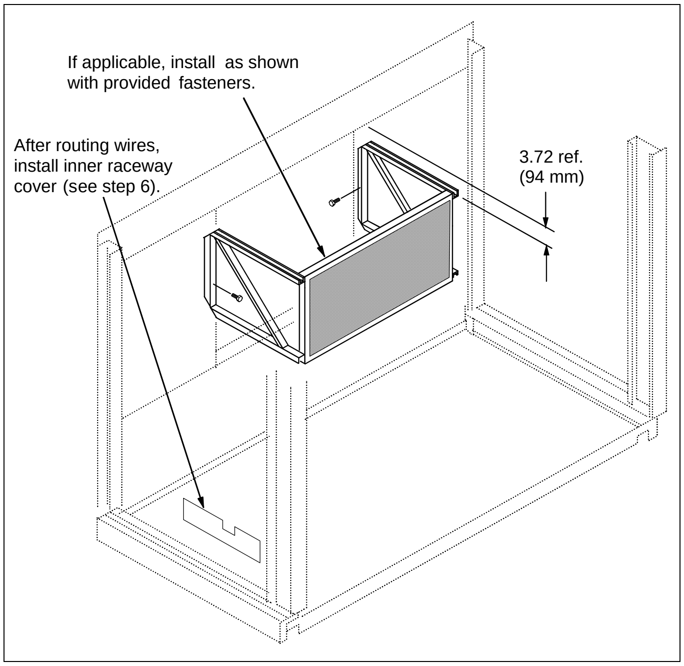
Phase III. Reconnect power and control wiring

The DX coil/condenser section contains power and control harnesses that have their excess length in the blank or heat section, which normally is immediately downstream of the fan. 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.

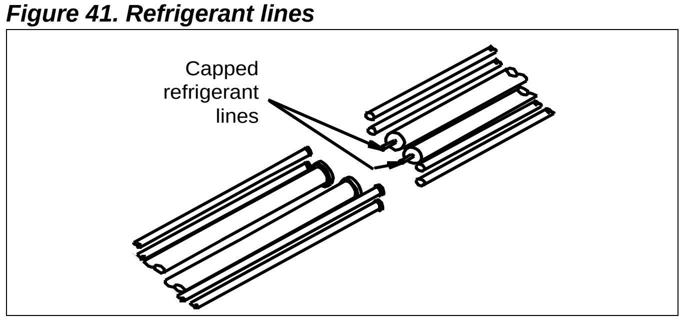
1. Make electrical connections and reinstall inner raceway cover as shown in Figure 40.

Figure 40. 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 40 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 DX 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.
7. Draw through cooling coils only. Reconnect refrigerant piping. These refrigerant circuits for these units are shipped with a holding charge only. Figure 41 illustrates what the installer sees at the shipping split
   a. To bridge the gap and connect the piping, remove the refrigerant piping caps and add fittings and copper tubing, as required.
   b. Evacuate and charge the unit. See page 39 for further details.

Figure 41. Refrigerant lines



RPS/RDT Factory Split at Condensing Unit

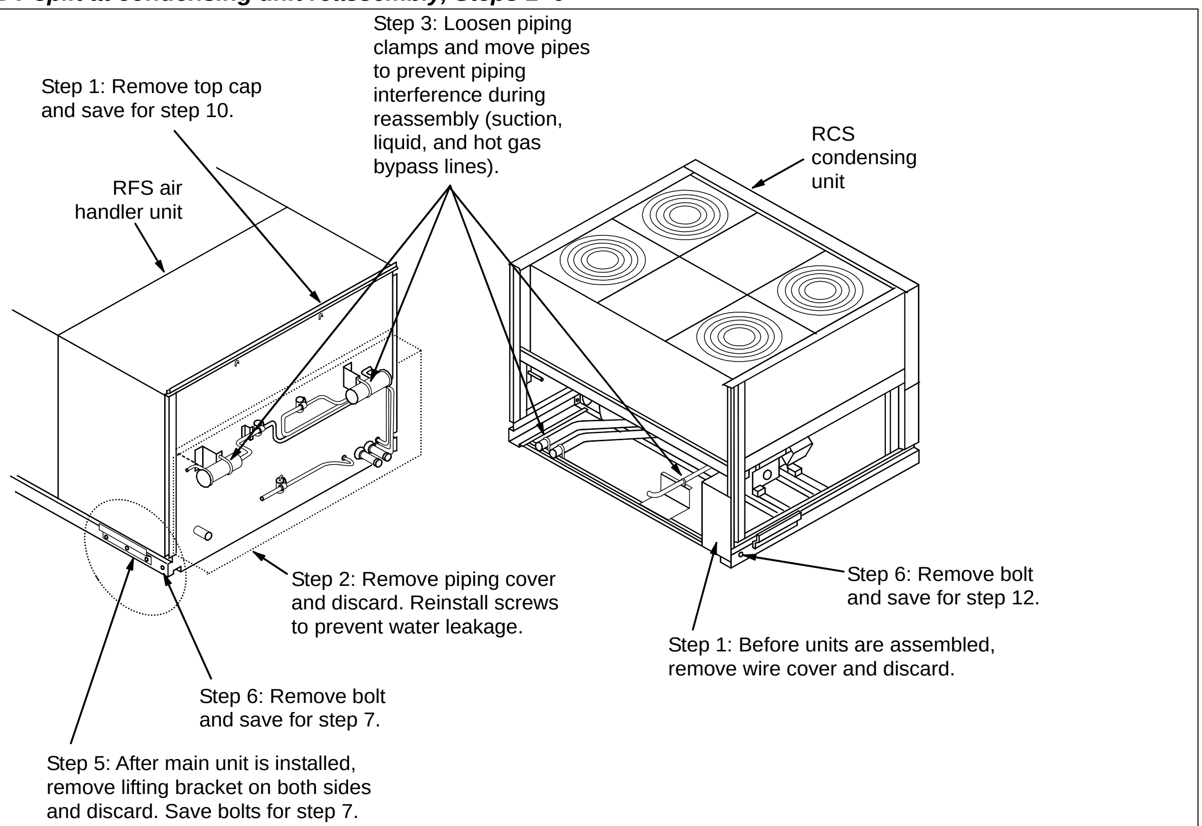
Field reassembly of an RPS/RDT unit that has shipped split at the condenser takes place in three phases: (1) setting the sections and mechanically recoupling the cabinet, (2) reconnecting refrigerant piping, and (3) reconnecting power and control wiring.

Phase I. Set sections and reassemble cabinet

1. Before setting sections together, remove top cap on air handler section and wire cover on condensing section. See Figure 42. Discard wire cover.
2. Remove piping cover and discard. Reinstall screws in holes to prevent water leakage.
3. Loosen piping brackets and clamps on both sections so refrigerant lines can be moved out of the way to prevent interference and damage as the sections are set together. See Figure 42.
4. Physically rig the air handler section into place.
5. After air handler is installed, remove lifting bracket and adjacent bolts on air handler unit (see Figure 42) and save for step 7. Discard lifting bracket.

   If unit is post-and-rail mounted on a structural beam that runs the full length of the unit, leave bolts and lifting brackets in place.
6. On condenser unit, remove bolts adjacent to lifting bracket and save for step 12.

Figure 42. RPS/RDT split at condensing unit reassembly, Steps 1–6

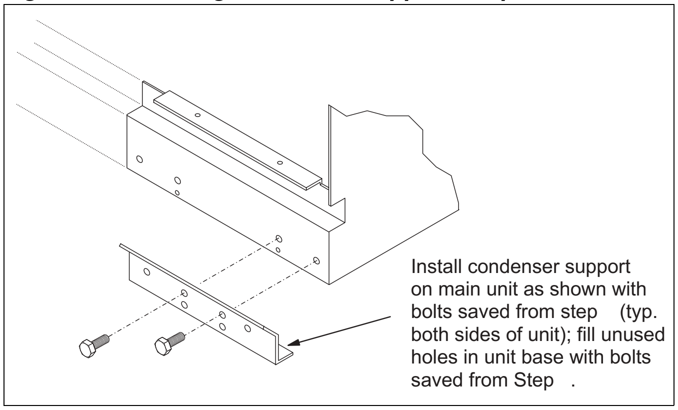


Note: RFS units with front discharge do NOT include refrigerant piping to the DX coil. Field piping is required.

7 Install condenser support on air handler unit as shown in Figure 43. Fill unused holes in unit base with bolts saved intep 6.

If unit is post-and-rail mounted on a structural beam that runs the full length of the unit, bolts and lifting brackets were not removed. Omit this step.

Figure 43. Installing condenser support, Step 7



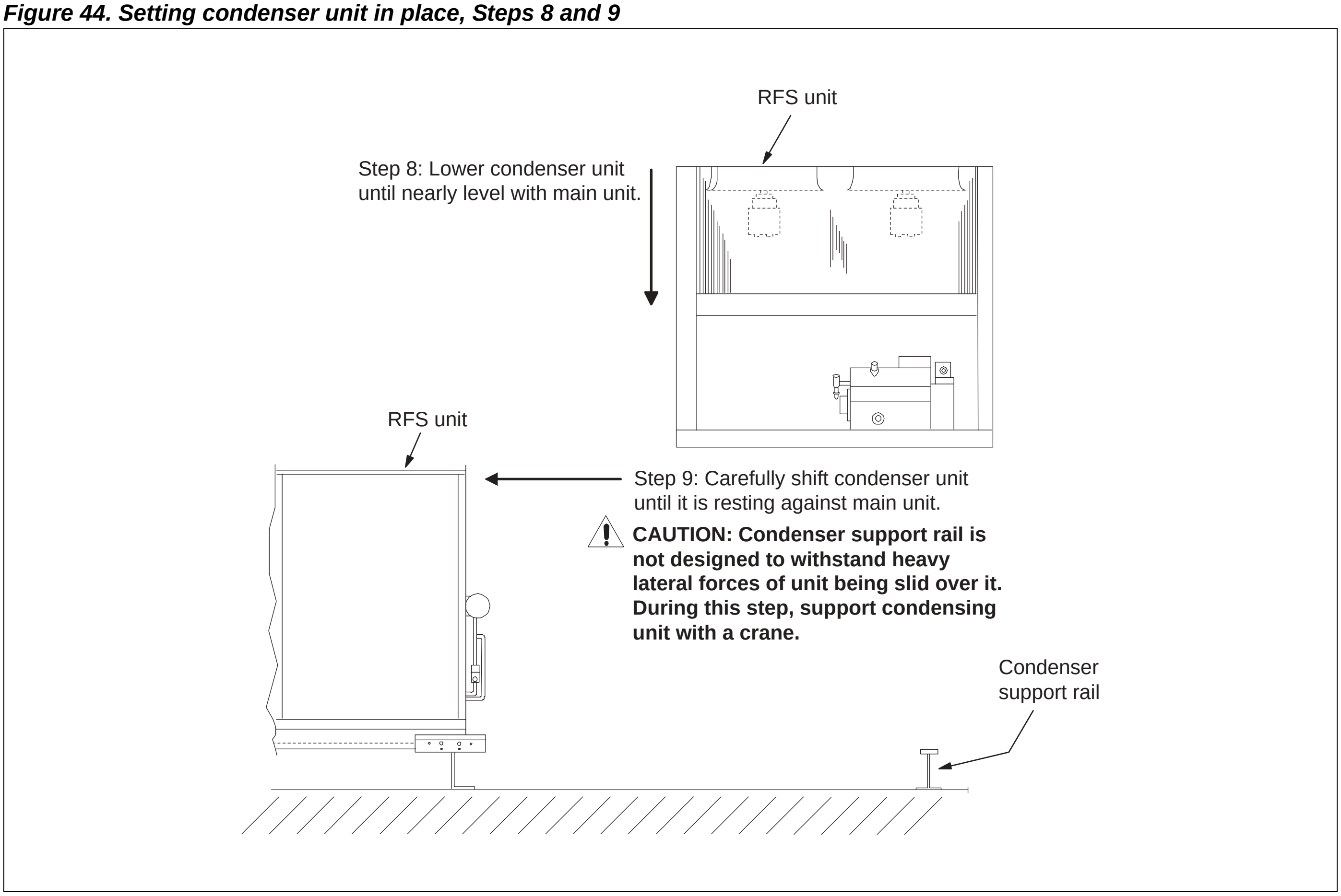
8 Lower the condenser unit until nearly level with main unit. See Figure 44.

9 Carefully shift condenser unit until it rests against the main unit. See Figure 44.

> ⚠ **CAUTION**
>
> Do not damage piping components while setting condensing unit in place.

> ⚠ **CAUTION**
>
> Support condenser unit by crane during step 9 since condenser support rail is not designed to withstand the heavy lateral forces of a unit being slid over it.

Figure 44. Setting condenser unit in place, Steps 8 and 9



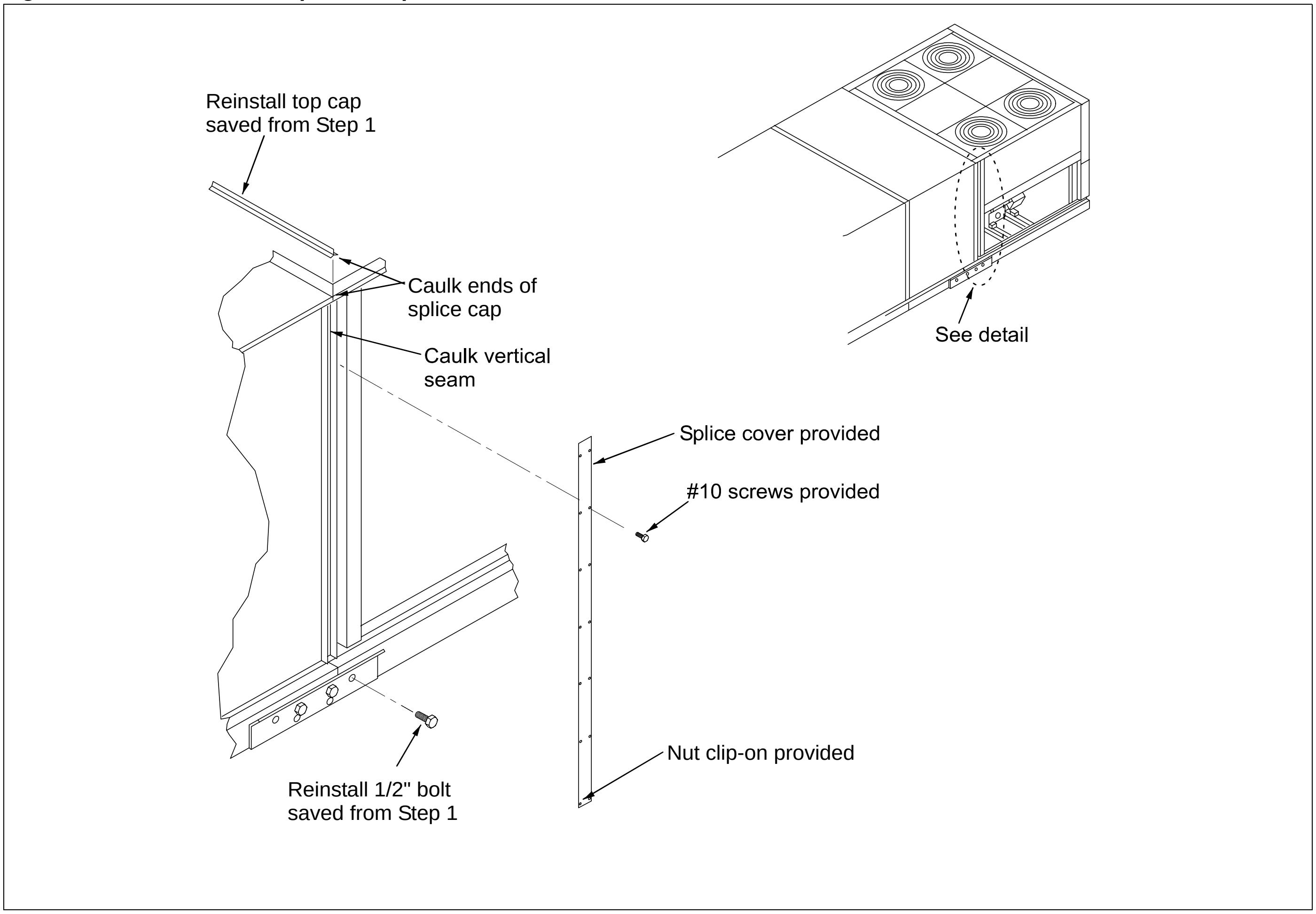
10 After condenser unit is set in place, install the top cap saved in Step 1. See Figure 45.

11 Caulk (watertight) ends of splice cap and vertical seam. See Figure 45.

12 Install 1/2" bolt removed in Step 5. See Figure 45.

13 Install splice cover (provided), see Figure 45.

Figure 45. Caulk and install parts, Steps 10–13



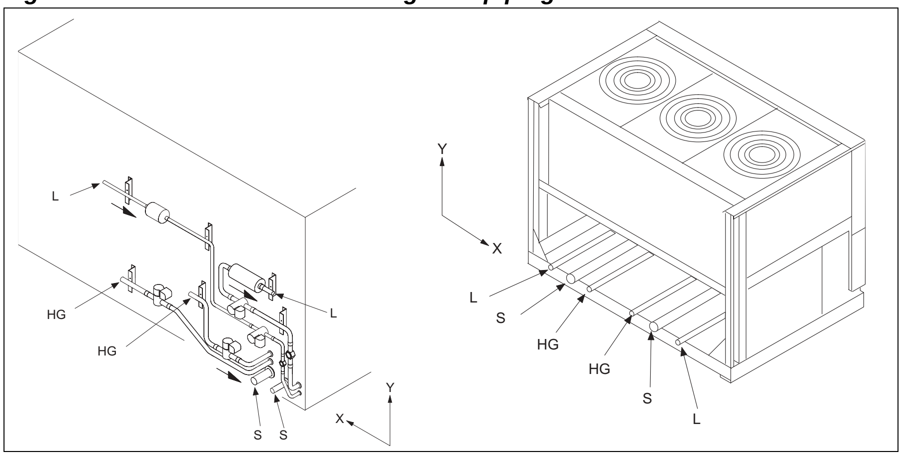
Phase II. Reconnect refrigerant piping

All refrigerant piping required to reconnect the two sections is provided so when the piping closures are cut off, piping from the air handler and condenser sections lines up.

1. Connect piping using field-supplied couplings.
2. As with RFS/RCS units, both sections of the RPS/RDT split-at-condenser unit ship from the factory with a holding charge. Before removing the piping closures, inspect the unit for line breakage or loosening of fittings.
3. Perform pressure testing as described in the "Leak Testing" section on page 39.
4. Perform evacuation, charging the system, and refrigerant charge requirements for the split-at-condenser unit per procedures on page 39.

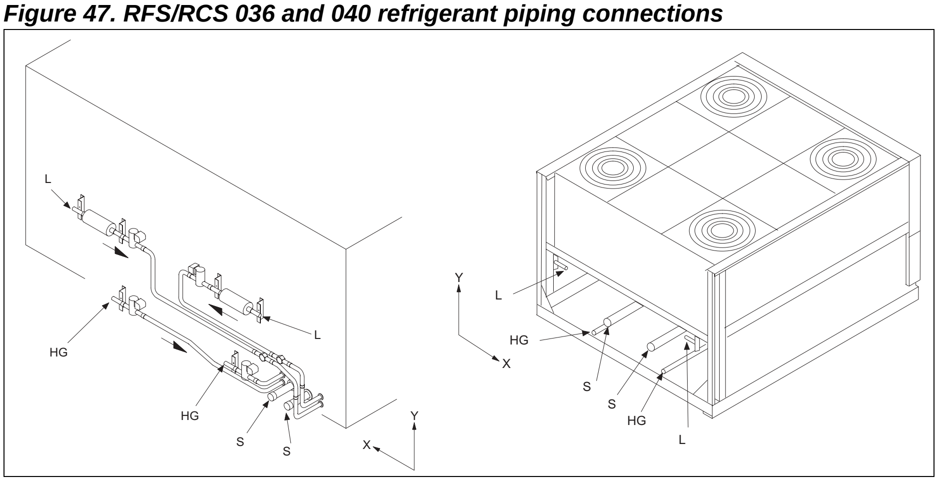
Note: Use Tables 13 to 16 on pages 40 to 41 to determine refrigerant charge requirements for the RPS/RDT split-at-condenser. Because no field-installed refrigerant piping is required, the total charge per circuit is the sum of the base R-22 charge and the DX coil charge.

Figure 46. RFS/RCS 015 to 030 refrigerant piping connections



Note: RFS units with front discharge do NOT include refrigerant piping to the DX coil. Field piping is required.

Figure 47. RFS/RCS 036 and 040 refrigerant piping connections

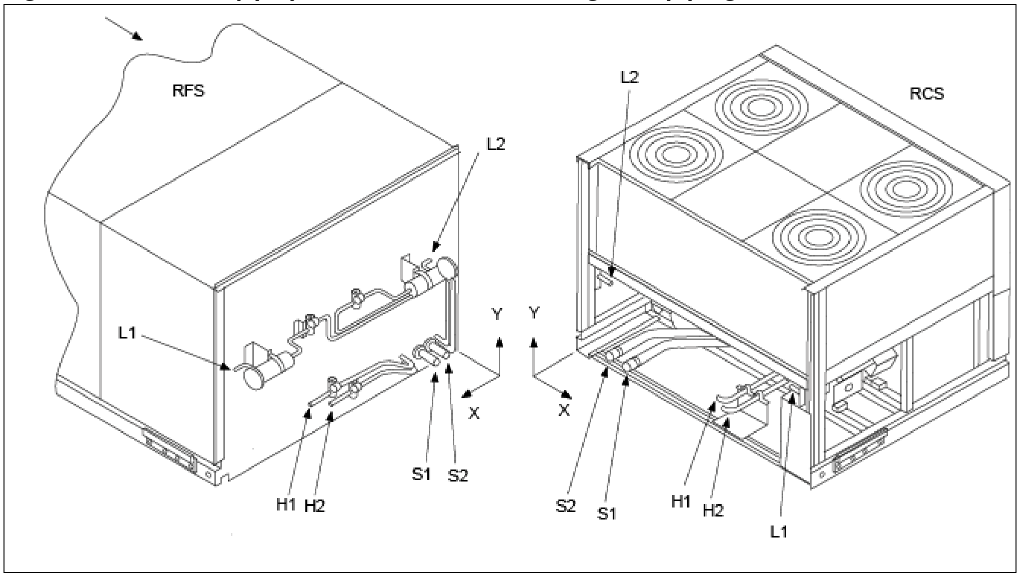


Note: RFS units with front discharge do NOT include refrigerant piping to the DX coil. Field piping is required.

Table 10: Connection sizes and locations, Figures 46 and 47

Component circuit			Connection sizes				Connection locations							
			015C	020C	025C	030Cto 040C	RFS 015 to 030		RCS 015 to 030		RFS 036 and 040		RCS 036 and 040	
							X (in.)	Y (in.)	X (in.)	Y (in.)	X (in.)	Y (in.)	X (in.)	Y (in.)
S1	Suction line	Ckt.1	1 1/8	1 1/8	1 5/8	1 5/8	9.00	5.70	67.60	6.25	8.25	5.70	59.50	19.30
S2	Suction line	Ckt.2	1 3/8	1 5/8	1 3/8	1 5/8	14.00	5.70	28.00	6.25	13.25	5.70	34.60	19.30
L1	Liquid line	Ckt.1	5/8	5/8	7/8	7/8	56.00	32.00	75.00	6.25	79.00	25.00	70.50	25.00
L2	Liquid line	Ckt.2	7/8	7/8	7/8	7/8	7.60	28.00	21.00	6.25	15.00	25.00	23.50	25.00
HG1	HGBP line	Ckt.1	7/8	7/8	7/8	7/8	52.00	10.00	60.80	6.25	67.00	6.70	64.60	6.60
HG2	HGBP line	Ckt.2	7/8	7/8	7/8	7/8	36.00	16.00	35.50	6.25	32.00	6.70	29.50	6.00

Figure 48. RPS/RDT (split)/RFS/RCS 045 to 135 refrigerant piping connections



Note: RFS units with front discharge do NOT include refrigerant piping to the DX coil. Field piping is required.

Table 11: Connection sizes and locations, Figure 48

Component circuit			Connection sizes				Connection locations					
			045C	050C to 075C	080C to 90C	105C to 135C	RPS (split) and RFS 045 to 075C		RCS 045 to 075C		080 to 135C	
							X (in.)	Y (in.)	X (in.)	Y (in.)	X (in.)	Y (in.)
S1	Suction line	Ckt.1	1 5/8	2 1/8	2 1/8	2 5/8	11.7	5.2	21.	7.0	5.7	11.7
S2	Suction line	Ckt.2	1 5/8	2 1/8	2 1/8	2 5/8	7.5	5.2	16.5	7.0	5.7	7.5
L1	Liquid line	Ckt.1	7/8	7/8	1-1/8	1 1/8	81.5	29.1	81.5	29.1	29.1	81.4
L2	Liquid line	Ckt.2	7/8	7/8	1 1/8	1 1/8	10.3	29.1	10.3	29.1	29.1	10.4
HG1	HGBP line	Ckt.1	7/8	7/8	7/8	7/8	52.1	10.4	52.1	10.4	10.4	52.1
HG2	HGBP line	Ckt.2	7/8	7/8	7/8	7/8	40.9	4.7	40.9	4.7	4.7	40.9

Phase III. Reconnecting power and control wiring

The wire harnesses are coiled in the condenser section base rail (see Figure 49). The power wires into the lower base rail raceway and the control wires into the upper raceway.

1. Uncoil the harnesses and feed them through the base rail of the air handler section and make the proper connections. The power wires terminate to the load side of the contactors; the control wires plug into the plug patch panel.
2. The liquid line solenoid valve harness is split into two harnesses. Install one half in the plug patch panel in the main control box (see Figure 49).
3. The other half of the harness is located in conduit on the bulkhead of the air handler section (see Figure 49).
4. Terminate the conduit to the vertical raceway in the condenser section (see Figure 50).
5. Wire nut the ends of the two harnesses together.
6. The optional hot gas bypass solenoid valve harness is coiled in the upper raceway of the condenser base rail (see Figure 50). Route the plug end of the harness through the air handler raceway and into the main control cabinet and plug into the plug patch panel.

Figure 49. Connecting power and control wiring (015 to 040)

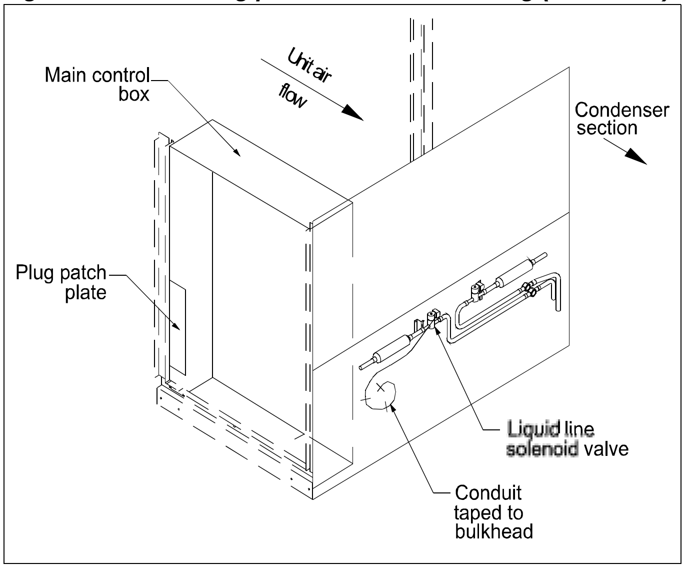
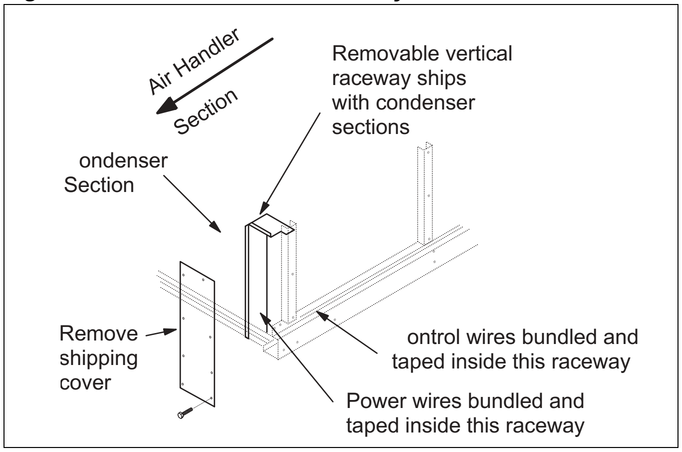


Figure 50. Remove vertical raceway



RFS/RCS Permanent Split Systems

Piping Recommendations

1. Use type K or L clean copper tubing. Thoroughly clean or braze all joints with high temperature solder. Make sure nitrogen is flowing through the tubes while brazing to minimize the formation of oxide contaminants.
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 12.
5. 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. The RFS unit includes a factory installed filter-drier, solenoid valve, and sightglass in each liquid line, upstream of the thermostatic expansion valve.

Table 12: Minimum tonnage (R-22 or R407C) 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

Holding Charge

The RFS unit and RCS unit ship with a nitrogen holding charge. At the time the unit was received, a visual inspection of the unit piping should have been made to be sure no breakage had occurred or that the fittings had not loosened. A pressure test on the RCS units should indicate a positive pressure in the unit. If no pressure is evident, the unit will have to be leak tested and the leak repair ed. This should be noted and reported to the Daikin sales representative and freight carrier if the loss is due to shipping damage.

⚠ WARNING

Before applying heat to remove brazed piping caps and plugs, *always* vent piping to atmosphere. Failure to do so can cause hazardous pressures, explosion, severe personal injuries, or death.

RCS—Vent to atmosphere by opening gauge ports at the compressors and liquid line shutoff valves. Make sure manual valves are not back seated to shut off the gauge ports.

RFS—Vent to atmosphere by cutting off the process tubes on the suction line caps.

The RFS unit does not have gauge ports for pressure measurement. If no positive pressure is detected when cutting off the process tubes and removing the tubing caps, the unit should be leak tested as described below, after the interconnecting piping has been brazed in place. This test will also confirm the integrity of the field braze joints.

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 18 on page 42 shows the relationship between pressure, microns, atmospheres, and the boiling point of water.

⚠ CAUTION

To prevent liquid return and damage to the compressor on systems with optional hot gas bypass, locate the bypass solenoid valve on the RCS, not on the RFS unit.

⚠ CAUTION

Before replacing refrigerant sensors or protective devices, see "Refrigerant Charge" on page 43 for an important warning to prevent an abrupt loss of the entire charge.

⚠ CAUTION

To service liquid line components, the manual shutoff valve is closed and refrigerant is pumped into the condenser. 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 RFS and RCS units. Suitable means of containing the refrigerant is required.

Table 13: Approximate R22 refrigerant charge per circuit, 015 to 018, 020C to 040C

Unit size	Base charge lbs per circuit (less DX coil)		EVAP.coil (lbs/CKT/coil row)	Additional charge for heat section additional length		Condenser pumpdown capacity* (lbs)
	Circuit #1	Circuit #2		Circuit #1	Circuit #2	
015 to 018	11	18	0.8/1.5	.5	1	47
020C	11	18	0.8/1.5	1	1	47
025C	23	22	1.7	1	1	72
030C	23	21	1.7	1	1	72
036C	32	32	1.7	1	1	106
040C	33	32	1.7	1	1	106

* Condenser pumpdown capacity is the total charge for both circuits and is based on volume between condenser entrance and liquid line solenoid at 90°F, 90% full

Table 14: Approximate R22 refrigerant charge per circuit, 045C to 135C

Unit size	Base charge lbs per circuit (less DX coil)				DX coil charge lbs per circuit per coil row		Condenser pumpdown capacity** (lbs)
	RPS		RDT		DX=S*	DX=L*	
	Circuit #1	Circuit #2	Circuit #1	Circuit #2			
045C	34	33	34	28	2.5	—	108
050C	34	33	35	34	2.5	3.0	108
060C	35	34	35	34	2.5	3.0	108
070C	39	39	40	40	2.5	3.0	134
075C	39	39	40	40	2.5	3.0	134
080C	40	41	37	38	4.1	4.7	140
090C	46	47	44	47	4.1	4.7	160
105C	50	51	45	48	4.9	6.5	208
115C	59	60	60	63	4.9	6.5	208
125C	—	60	—	65	—	6.5	208
135C	—	60	—	65	—	6.5	208

* DX coil configuration (S = Standard, L = Large) is identified by the 8th digit of the RPS/RDT or RFS model number, found on the unit nameplate. For example, DX = L for unit model number RFSO6OCLY.

** Condenser pumpdown capacity is the total charge for both circuits and is based on volume between condenser entrance and liquid line solenoid at 90º F, 90% full.

Table 15: Approximate 407C refrigerant charge per circuit, 015C to 040C

Unit size	Base charge lbs per circuit (less DX coil)		Evaporator coil (lbs/CKT/coil row)	Additional charge for heat section additional length		Condenser pumpdown capacity* (lbs)
	Circuit 1	Circuit 2		Circuit 1	Circuit 2	
015C to 018C	10	16	0.7/1.4	.5	1	45
020C	10	16	0.7/1.4	1	1	45
025C	21	20	1.6	1	1	68
030C	21	19	1.6	1	1	68
036C	29	29	1.6	1	1	101
040C	30	29	1.6	1	1	101

* Condenser pumpdown capacity is the total charge for both circuits and is based on volume between condenser entrance and liquid line solenoid at 90°F, 90% full

Table 16: Approximate R407C refrigerant charge per circuit, 045C to 135C

Unit size	Base charge lbs per circuit (less DX coil)				DX coil charge lbs per circuit per coil row		Condenser pumpdown capacity** (lbs)
	RPS		RDT		DX=S*	DX=L*	
	Circuit #1	Circuit #2	Circuit #1	Circuit #2			
045C	31	30	31	26	2.3	—	103
050C	31	30	32	31	2.3	2.8	103
060C	32	31	32	31	2.3	2.8	103
070C	36	36	37	37	2.3	2.8	127
075C	36	36	37	37	2.3	2.8	127
080C	37	37	34	35	3.8	4.3	134
090C	42	43	41	43	3.8	4.3	152
105C	46	42	41	44	4.5	6.0	198
115C	54	55	55	58	4.5	6.0	198
125C	—	55	—	60	—	6.0	198
135C	—	55	—	60	—	6.0	198

* DX coil configuration (S = Standard, L = Large) is identified by the 8th digit of the RPS/RDT or RFS model number, found on the unit nameplate. For example, DX = L for unit model number RFSO6OCLY.

* Condenser pumpdown capacity is the total charge for both circuits and is based on volume between condenser entrance and liquid line solenoid at 90º F, 90% full.

Table 17: Weight of refrigerant 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	
		R22	R407	R22	R407	R22	R407	R22	R407
3/8"	0.054	3.84	3.64	0.20	0.46	0.052	0.047	0.077	0.071
1/2"	0.100	7.12	6.74	0.37	0.85	0.096	0.088	0.143	0.132
5/8"	0.162	11.53	10.92	0.61	1.38	0.156	0.142	0.232	0.214
7/8"	0.336	23.92	22.65	1.26	2.87	0.324	0.294	0.480	0.444
1 1/8"	0.573	40.80	38.62	2.14	4.89	0.552	0.501	0.819	0.756
1 3/8"	0.872	62.09	58.77	3.26	7.44	0.840	0.763	1.247	1.151
1 5/8"	1.237	88.07	83.37	4.63	10.55	1.191	1.082	1.769	1.633
2 1/8"	2.147	152.87	144.71	8.03	18.31	2.068	1.879	3.070	2.834
2 5/8"	3.312	235.81	223.23	12.38	28.25	3.189	2.898	4.736	4.372
3 1/8"	4.728	336.63	318.67	17.68	40.33	4.553	4.137	6.761	6.241
3 5/8"	6.398	455.54	431.23	23.92	54.57	6.161	5.598	9.149	8.445
4 1/8"	8.313	591.89	560.30	31.08	70.91	8.005	7.274	11.888	10.973

Table 18: Pressure-vacuum equivalents

Absolute pressure above zero		Vacuum below 1 atmosphere		Approximate fraction of 1 atmosphere	Boiling point of H2O at each pressure (^oF)
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

RCS 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, then contact the factory for authorization and advice for repairing the leak 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 midposition.
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. Refrigerant charging with Zeotropes—R-407C is a zeotropic mixture (see “Refrigerant Leaks” on page 117).

   During initial charging or “topping” off a system, it is important to remove the refrigerant from the charging cylinder in the liquid phase. Many of the cylinders for the newer refrigerants use a dip tube so that in the upright position liquid is drawn from the cylinder. DO NOT vapor charge out of a cylinder unless the entire cylinder is to be charged into the system. Refer to charging instructions provided by the refrigerant manufacturer.
5. 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.

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

⚠ CAUTION

Adding refrigerant to the suction must always be done by trained service personnel that are experienced with the risks associated with liquid-related damage to the compressor.

Take special care to add refrigerant slowly enough to the suction to prevent damage when first adding charge to the suction. Adjust the charging tank hand valve extremely slow such that only liquid leaves the tank but vapor enters the compressor.

This is especially true with R-407C because the charge must be drawn from the liquid portion of the tank.

⚠ CAUTION

Units purchased for R-22 operation must be charged only with R-22. Units purchased for R-407C operation must be charged only with R-407C.
Field mixing or changing of refrigerants can compromise performance and damage equipment.

Table 19: Acceptable refrigerant oils

R-22 (mineral oils) ***Note: Do not use mixtures of mineral oils and POE oils with R-22.***	**R-407C (polyolester [POE] oils)** ***Note: Do not use mineral oils with R-407C.***
Sunisco 3GS	Copeland ULtra 22 CC
Texaco WF32	Mobil EAL™ Arctic 22 CC
Calumet R015	ICI EMKARATE RL™ 32CL

Refrigerant Charge

Each unit is designed for use with R-22 or R-407C.The total charge per circuit is the sum of the following four values:

- Condenser section charge, see Table 13 on page 40.
- Evaporator coil charge, see Table 13 on page 40.
- Charge for length of unit piping to the evaporator coil, see Table 13 on page 40.
- Charge for length of interconnecting piping between the RCS and RFS units, installed by field, see Table 17 on page 41.

The exact charge for a one piece RPS/RDT is on the unit nameplate.

Note: The total operating charge per circuit should not exceed the pumpdown capacity per circuit, shown in Tables 13 to 17 on pages 40 to 41.

Table 20: 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

Subcooling

When field charging the unit, use the following to properly charge the unit:

- All compressors on each circuit operating at full capacity.
- Allowable subcooling ranges are between 13°F to 20°F.
- Be sure to measure pressure and temperature at the same location when finding/calculating subcooling. Compare the actual temperature and pressures to the saturated liquid temperature. R-407C example: A pressure of 250 psi is measured at the condenser outlet. From the R-407C chart, 250 psig is approximately 108°F saturated liquid temperature. If the actual refrigerant temperature is 98°F, the liquid is subcooled 10°F.
- Ambient temperature must be between 60°F and 105°F.
- Hot Gas Bypass NOT operating (only if unit is supplied with option)
- SpeedTrol motors operating at 100% (only if unit is supplied with option)

If any one of the above items is not followed, subcooling readings will not be accurate and the potential exists for over or undercharging of the refrigerant circuit.

Refrigeration Service Valves

The unit is shipped with all refrigeration service valves closed. RDT, RPS and RCS units have the following:

Sizes 15 to 105—One discharge valve is provided per refrigerant circuit, located between the compressors and condenser.

Sizes 115 to 135—One service valve is provided on the discharge and suction of each compressor.

All Units—One liquid valve is provided per refrigeration circuit, located at end of condensing section opposite condenser control box.

RFS units do not ship with service valves installed. Before attempting to start the compressors, all refrigeration service valves should be fully opened and backseated.

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

RPS units may have positive or negative pressure sections. Use traps in both cases with extra care given to negative pressure sections. In Figure 51, 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.

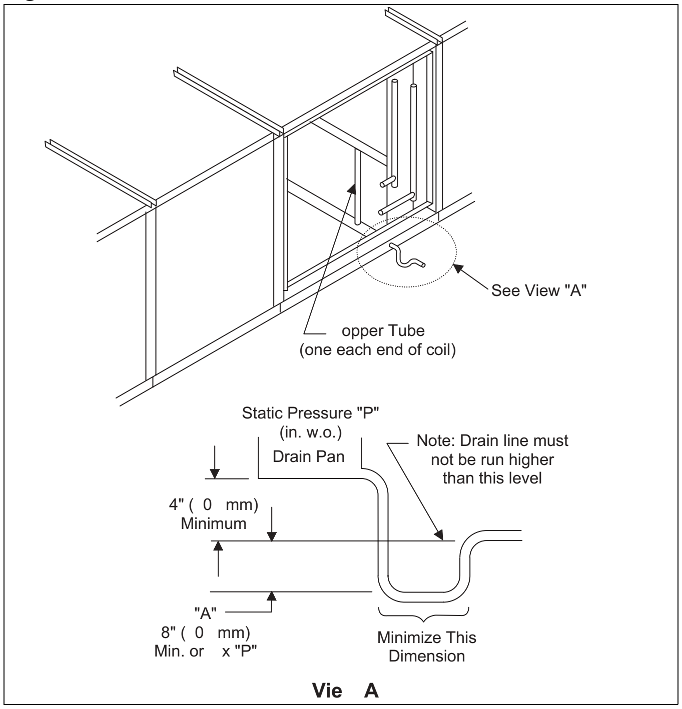
On units with staggered cooling coils, the upper drain pan drains into the lower coil drain pan through a copper tube near the center of the drain pan. Check that this tube is open before putting the unit into operation and as a part of routine maintenance.

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 51. Condensate drain connection



Gas Piping

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

Hot Water Coil Piping

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

Note: All coils have vents and drains factory installed.

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.

When no factory piping or valve is included, the coil connections are 1 5/8" ODM copper.

Note: With the factory piping and valve package, field piping connections are the same NPT size as the valve with female threading *(*see Figure 53 on page 45).

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.

Figure 52. Hot water heat section (shown with factory valve and piping)

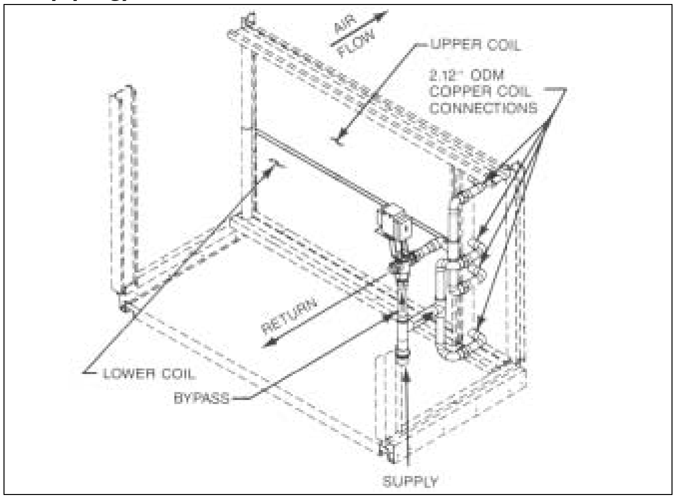
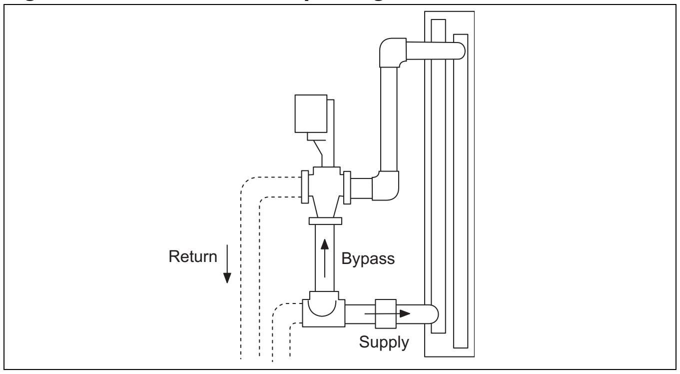


Figure 53. Hot water valve package



⚠ 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 Daikin Applied. Refer to “Winterizing Water Coils” on page 117.

Steam Coil Piping

Steam coils are provided without valves for field piping, or piped with two-way valves and actuator motors.

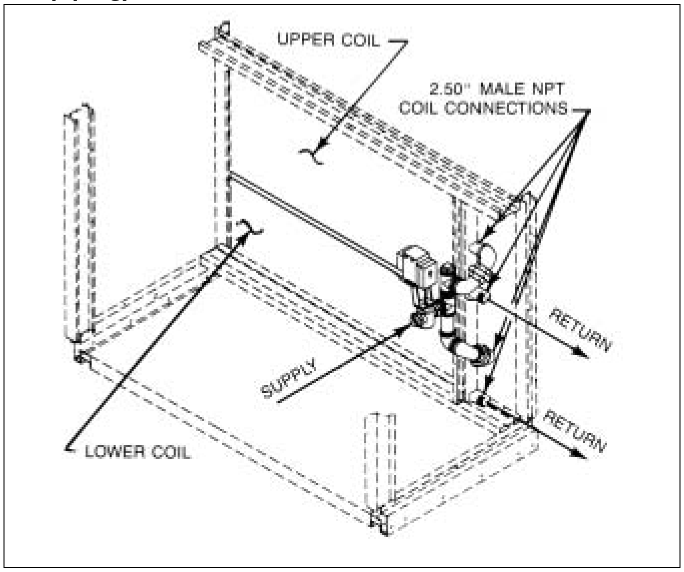
The steam heat coil is pitched at 1/8" (3 mm) per foot (305 mm) to provide positive condensate removal. When no factory piping or valve is included, the coil connections are 2.5" male NPT iron pipe.

With the factory piping and valve package, the field supply connection is the same NPT size as the valve with female threading (see Figure 56 on page 46).

Refer to the certified drawings for the recommended piping entrance locations. All piping penetrations must be sealed to prevent air and water leakage.

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

Figure 54. Steam heat section (shown with factory valve and piping)



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.
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.

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 91 for additional information.

Figure 55. Valve assembly

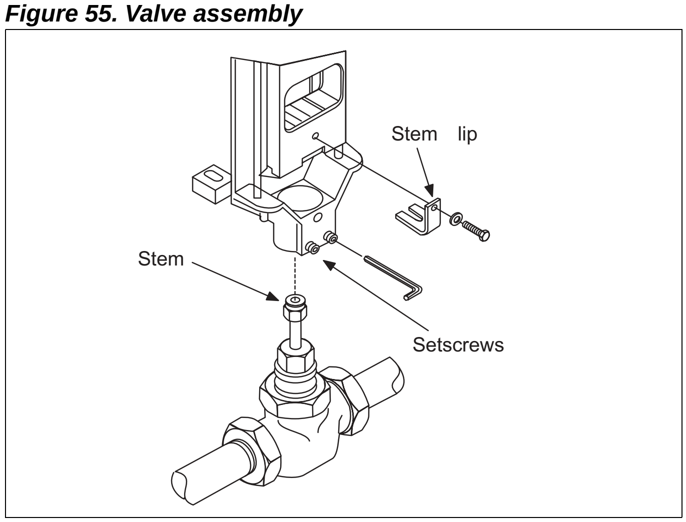
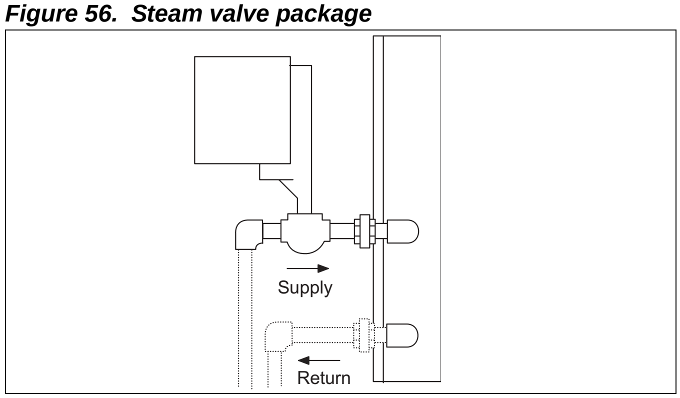


Figure 56. Steam valve package



Damper Assemblies

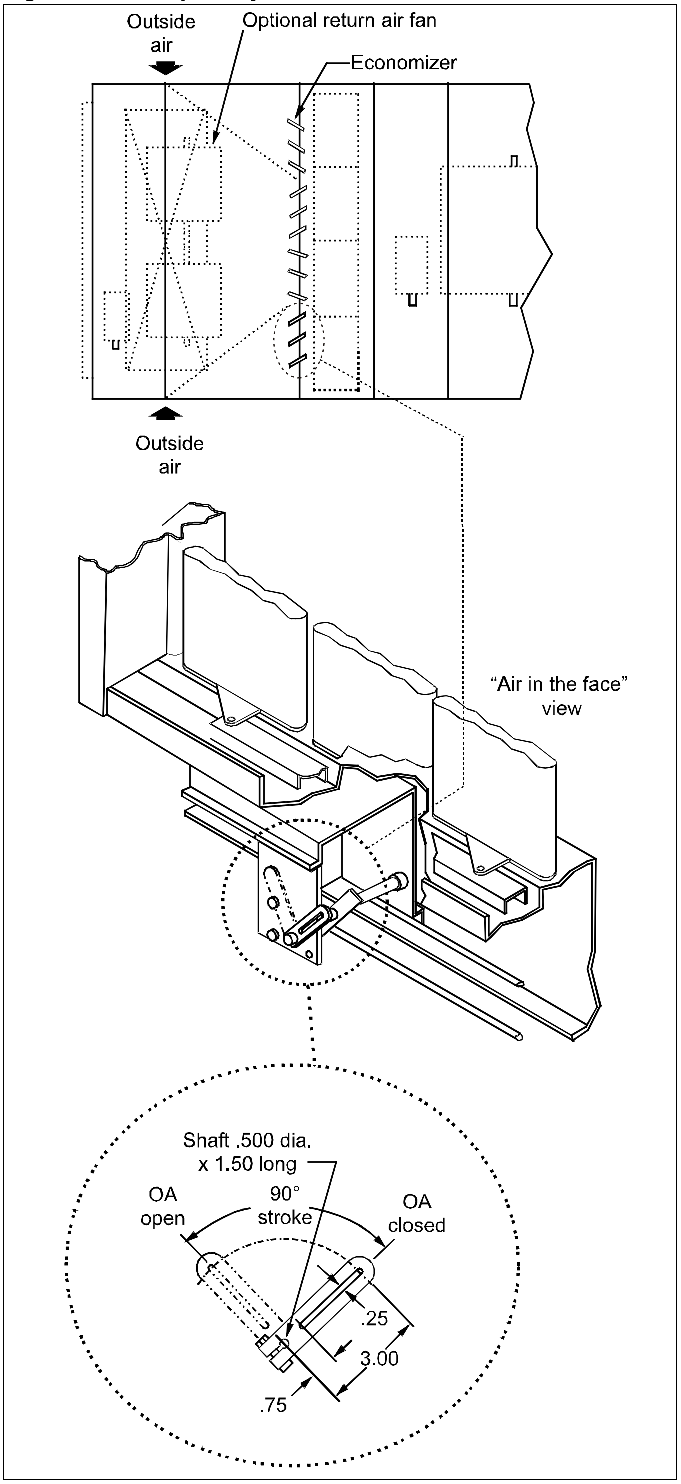
The optional damper assemblies described in this section normally are ordered with factory-installed actuators and linkages. The following sections describe operation and linkage adjustment of the factory option.

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 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 57). 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.

Figure 57. Damper adjustment



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 "overclose" 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.

Intake Hood Damper (0% to 100% outside air)

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 58. Damper linkage bar typical for all sizes, sizes 15C to 40C shown

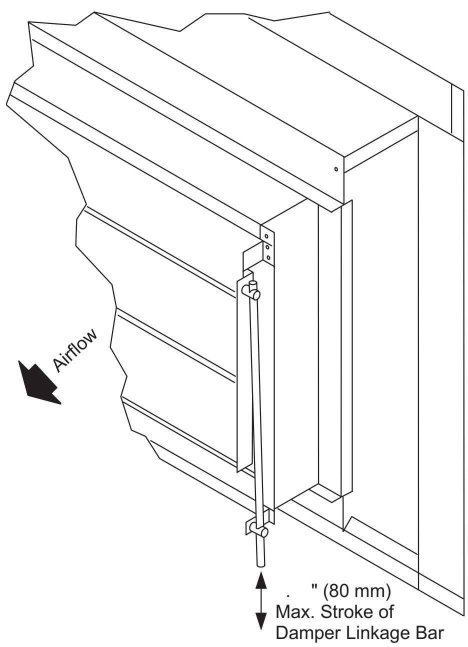
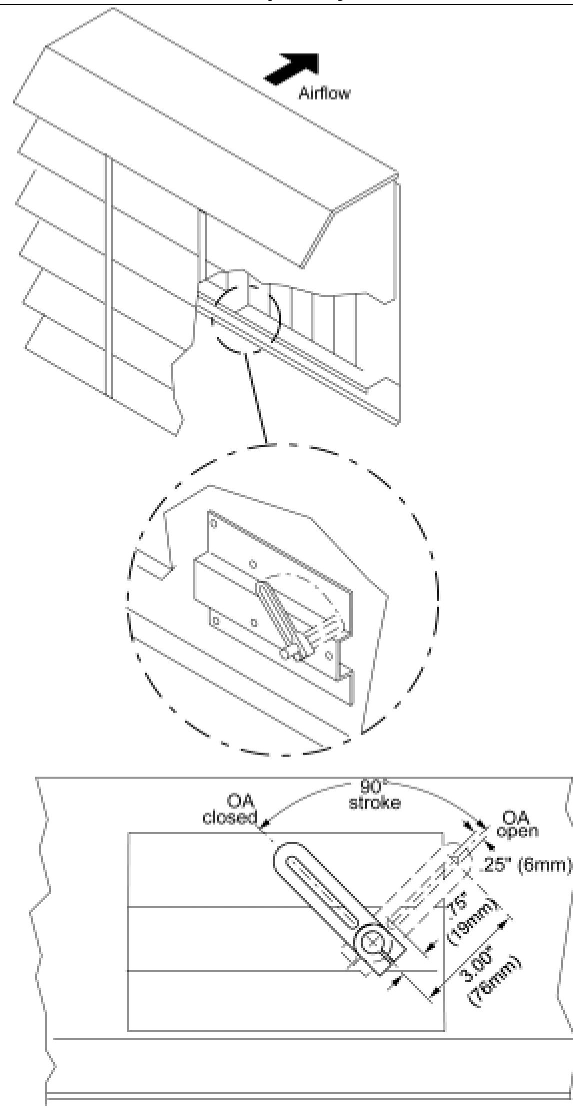


Figure 59. Intake hood damper adjustment



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.

Installing Ductwork

On bottom-supply/bottom-return units, if a Daikin 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 60.

Units with optional back return, side discharge, or end discharge (on RFS units) 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

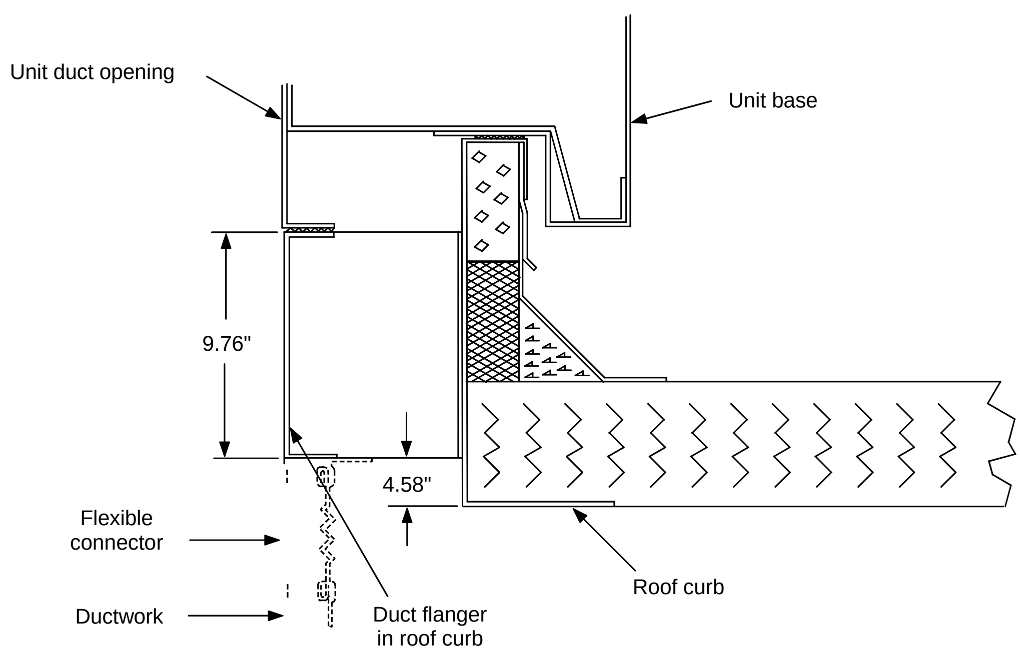
Mold can cause personal injury. Materials such as gypsum wall board can promote mold growth when damp. Such materials must be protected from moisture that can enter units during maintenance or normal operation.

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 60. Installing duct work



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 10).

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

1. Install a tee fitting with a leak-tight removable cap in each tube near the sensor fitting. This facilitates connecting a manometer or pressure gauge if testing is required.
2. Use different colored tubing for the duct pressure (HI) and reference pressure (LO) taps, or tag the tubes. Daikin recommends 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 62).
7. Locate the reference pressure (LO) tap somewhere near the duct pressure tap within the building (see Figure 61). 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 61). Connect the tubes to appropriate barbed fittings in the control panel. (Fittings are sized to accept ¼" plastic tubing.)

Figure 61. Static pressure tubing entrance location

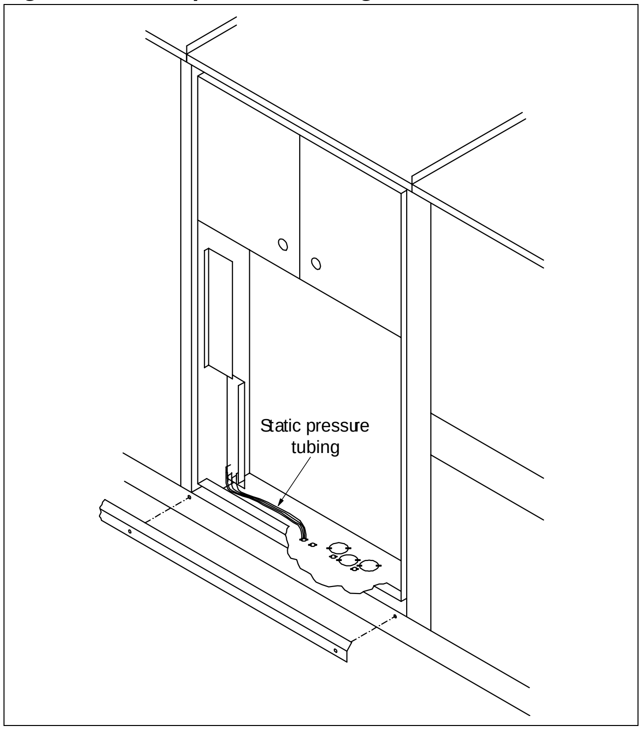
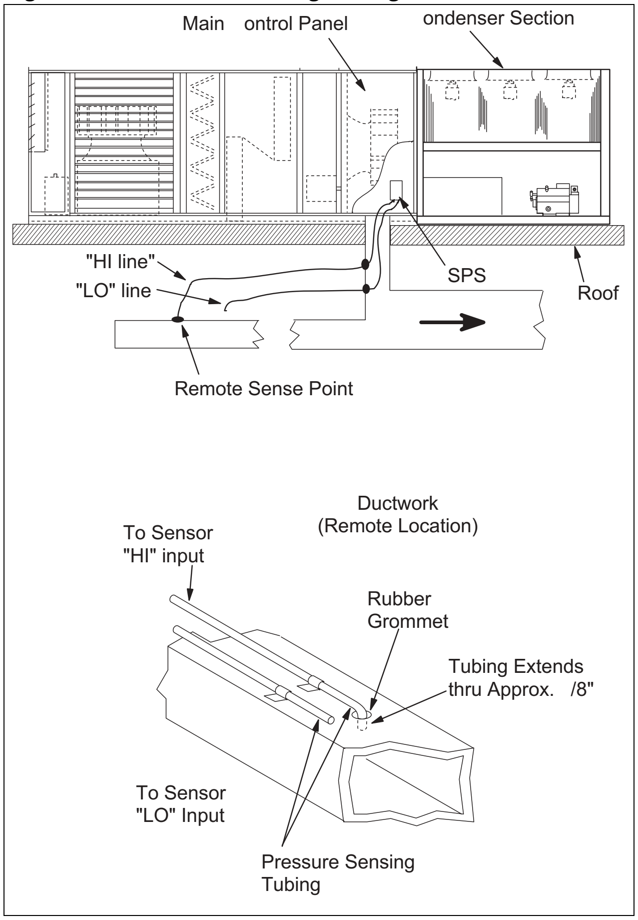


Figure 62. Pressure sensing tubing installation



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 61). 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 61 on page 50). 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 61).
7. Connect the tube to the ¼-inch HI fitting for sensor SPS2.

Electrical Installation

Field Power Wiring

Wiring must comply with all applicable codes and ordinances or in the absence of local codes, with the National Electrical Code ANSI/NFPA 70 and/or Canadian Electrical Code CSA C22.1. 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 compressor or 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 RPS, RFS, and RDT 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 63 and Table 22 on page 54.

⚠ 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 119. 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 63. RPS/RDT and RFSpower wiring connections

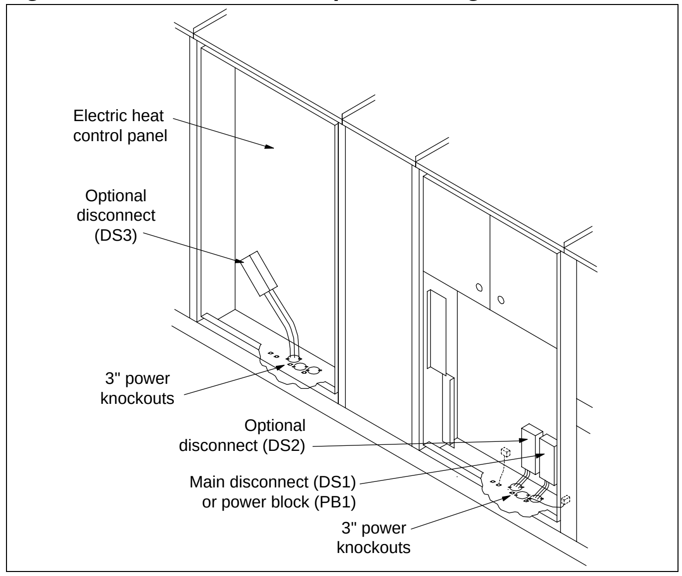
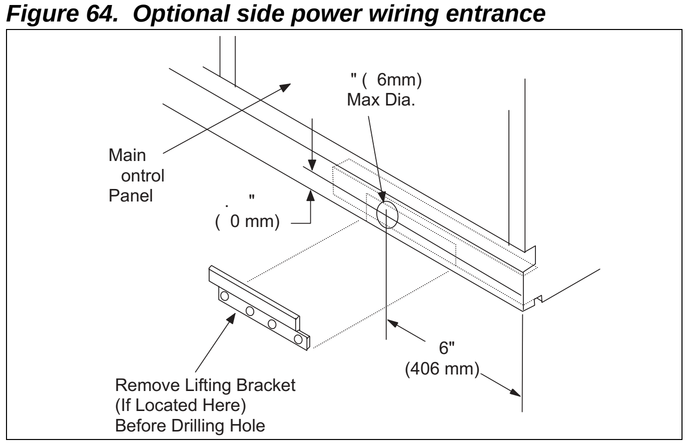


Figure 64. Optional side power wiring entrance



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

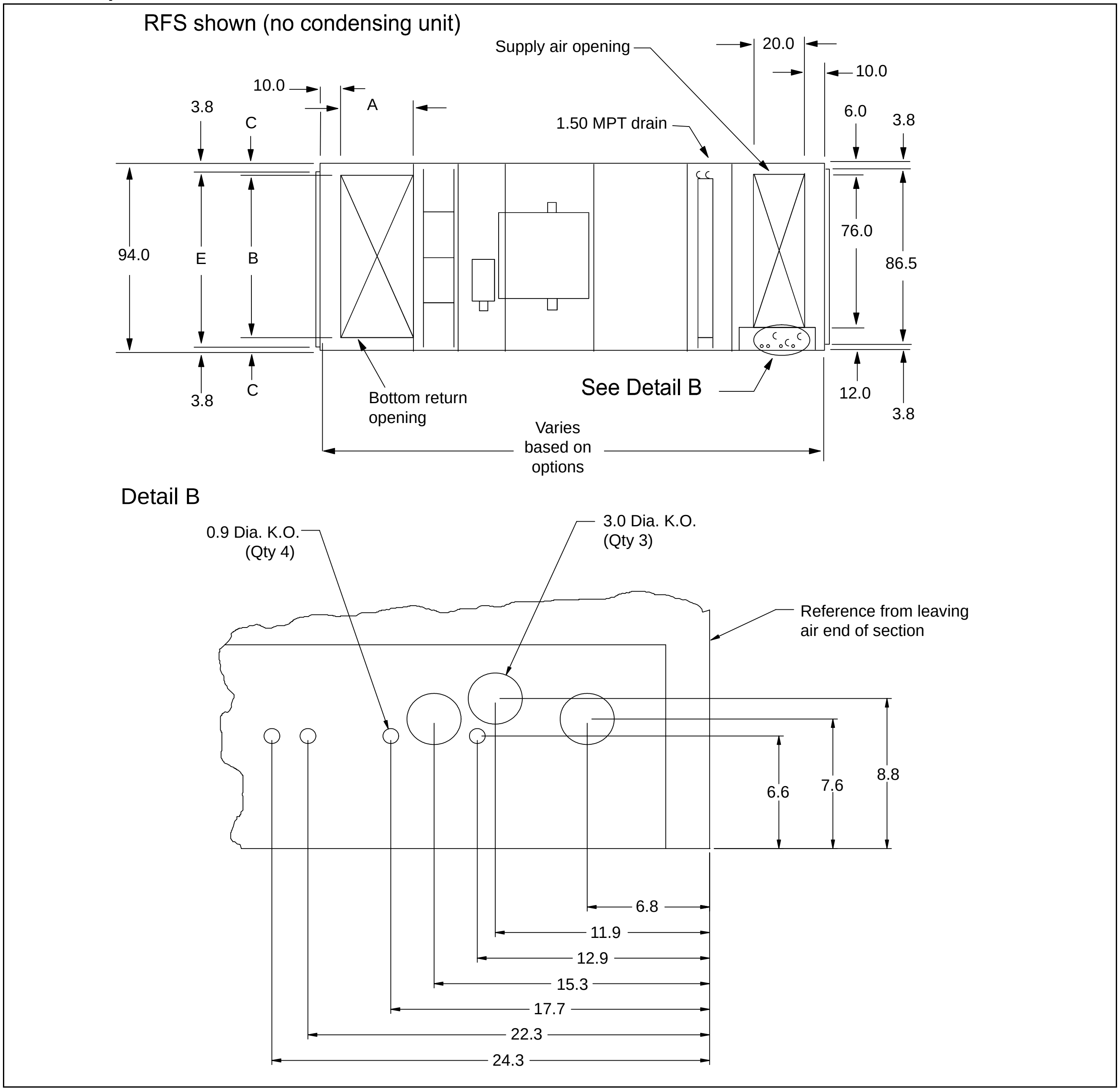
Wires are located in base rail. Move wires before drilling hole through base rail.

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.

RCS Units

Field power wiring is connected from the main control panel in the RFS unit to powerblock (PB4) or an optional disconnect switch (DS4) located in the condenser control panel of the RCS unit. Power leads enter the bottom left corner of the condenser control panel through the conduit hubs shipped with the unit. Refer to Figure 66 and Figure 67 on page 54.

Figure 65. Typical power wire entrance, unit view—RPS 015C to 040Cshown (actual opening shown on submittal documents)



All Units

The minimum circuit ampacity (wire sizing amps) is shown on the unit nameplate. Refer to Table 22 on page 54 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 into the RFS and RPS units through a 7/8" knockout in the bottom of the main control panel, near the power wire entry point.

Figure 66. RCS 015C–030C power wiring connections

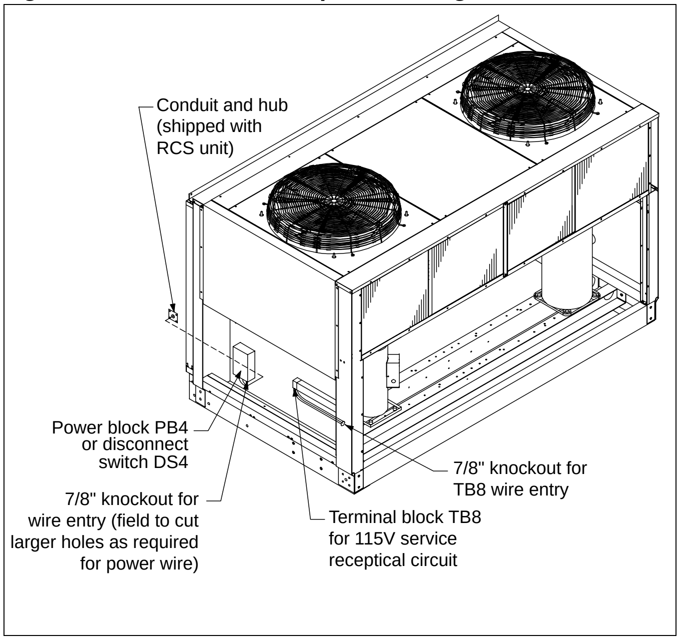


Figure 67. RCS 036C and 135C power wiring connections (number of condenser fans varies per unit size)

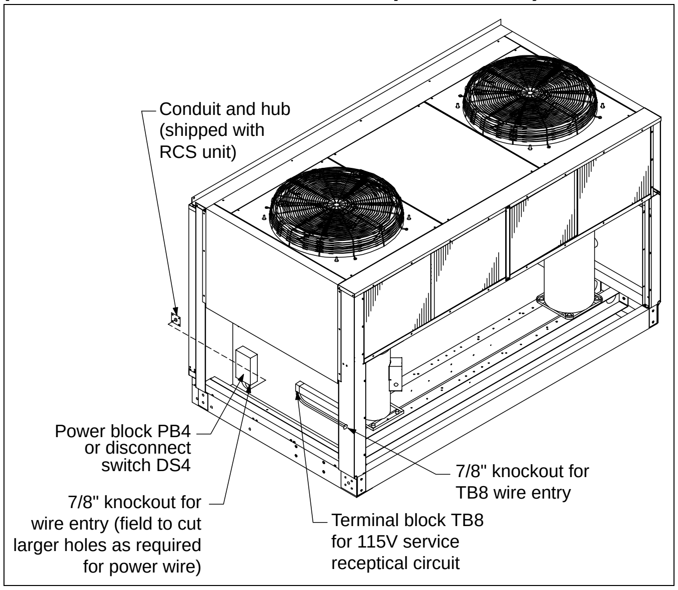


Table 21: Multiple point power connection options

Number of electrical circuits	Disconnect designation	Load	Location (see Figure 12 on page 10)
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
3	DS3	Electric heat	Electric heat control panel
	DS2	Supply and return fan motors plus controls	Main control panel
	DS1	Balance of unit	Main control panel

Table 22: 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

Notes:
1. All wire sizes assume separate conduit for each set of parallel conductors.
2. All wire sizes based on NEC Table 310-16 for 75°C THW wire (copper). Canadian electrical code wire ampacities may vary.
3. All wire sizes assume no voltage drop for short power leads.

Field Control Wiring

Roof Pak applied rooftop 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.

RPS, RDT, and RFS Units

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 68 and "Control Panel" on page 10**.** Two 7/8" knockouts are provided for wire entry.

RFS/RCS Units

The RCS unit receives 115V and 24V control circuit power and a number of control signals from the RFS unit. Two 7/8" knockouts are provided in the right side of the RCS control box.

Interconnecting wiring enters the RFSunit through 7/8" knockouts in the bottom of the main control panel. The interconnecting wiring is connected to TB4 in the RFSunitand TB5 in the RCS unit. Refer to Figure 69. A 7/8" knockout is also available in the end of the unit base as shown in Figure 68.

Note: If a single conduit containing 24V and 115V wiring is run above the roofline between the RFS and RCS unit, install the 24V wiring as an NEC Class I wiring system.

Figure 68. RDT, RFS, RPS field control wiring connections

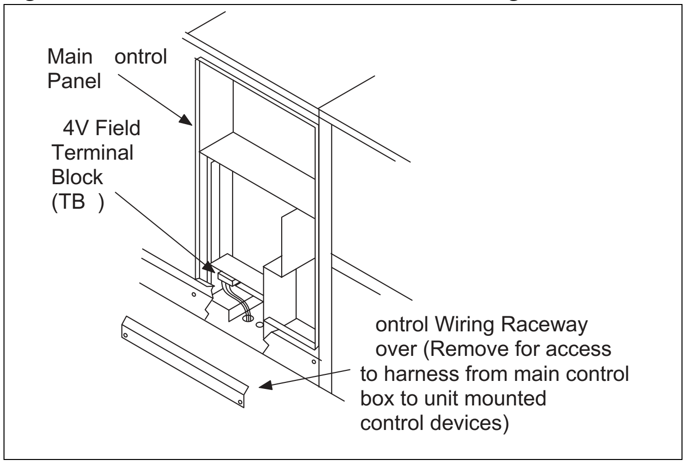
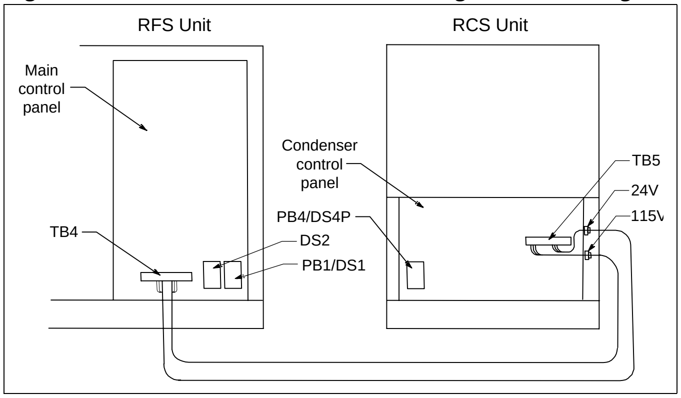


Figure 69. RFS and RPS interconnecting control wiring



⚠ WARNING

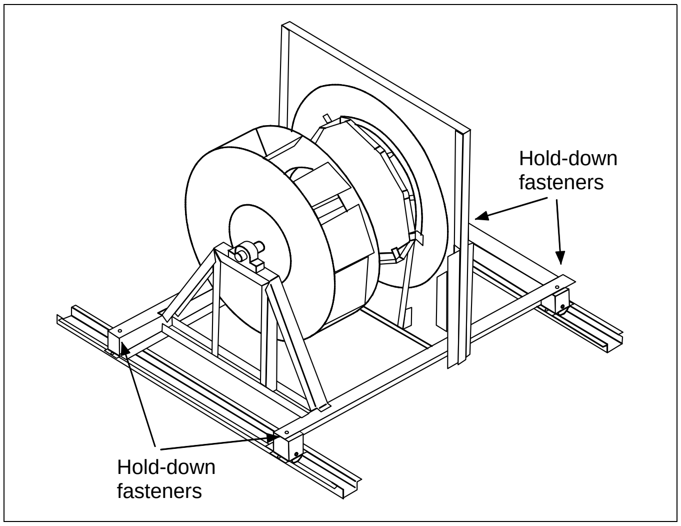
Electrical shock hazard. Can cause severe injury or death. Connect only low voltage NEC Class II circuits to terminal blocks TB2 and TB5.
Reinstall and secure all protective deadfront panels when the wiring installation is complete.

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 70. RDT 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 71 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 71. Spring mounted hold-down fasteners, all units

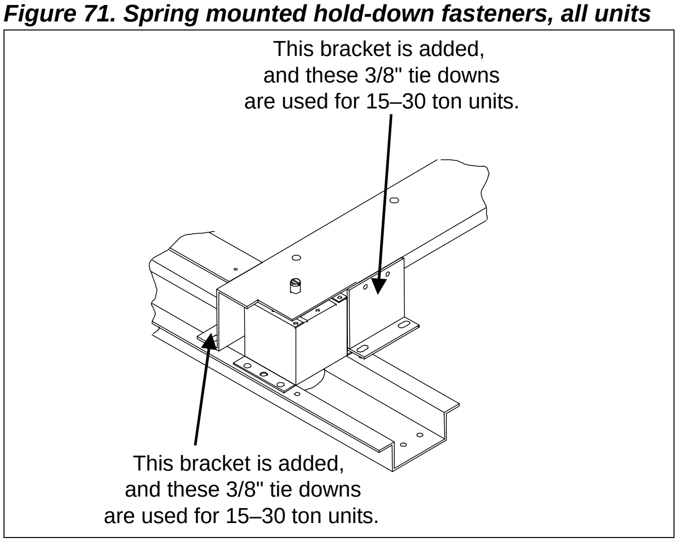
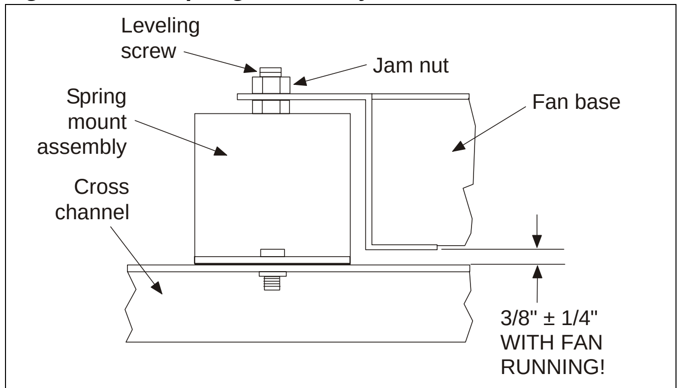


Figure 72. Fan spring mount adjustment



* 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 100. 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 72):

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.

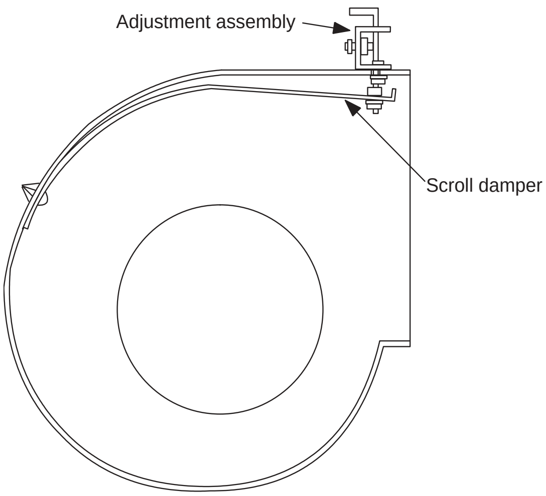
Relief Damper Tie-Down

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.

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 73) and slightly lowering the rod until air distribution between the fans is even.

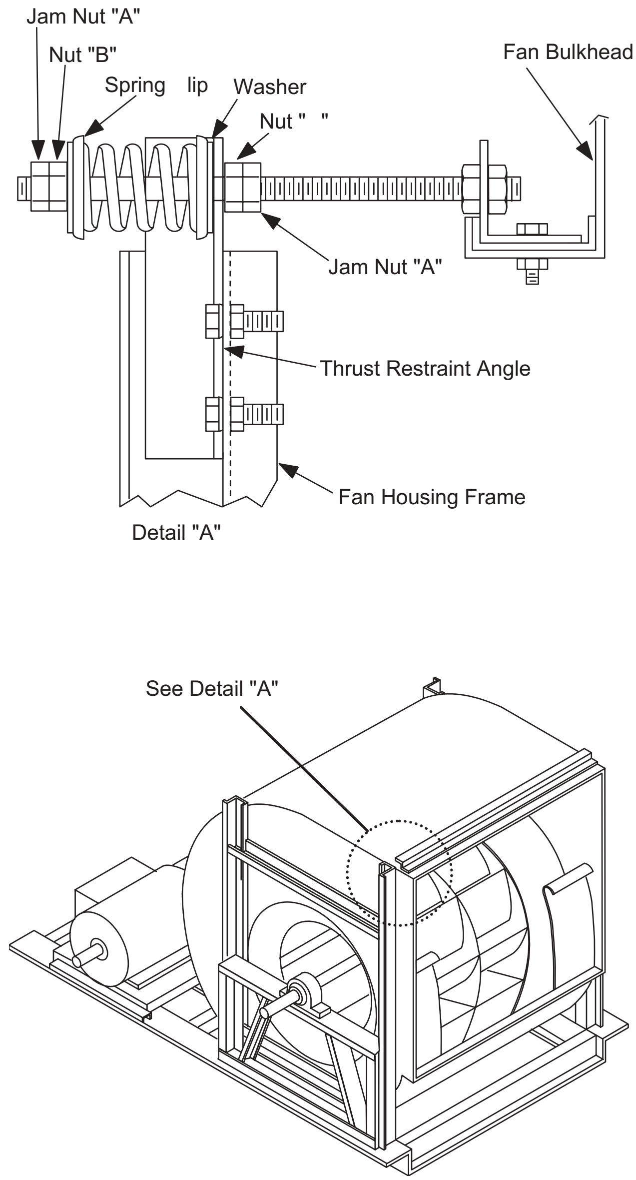
Figure 73. Scroll damper adjustment



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 74. When the fan is turned on, the fan moves back to a level position and the thrust restraint springs compresses.

Figure 74. 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.”

Sequences of Operation

The following sequences of operation are for a typical “C” vintage applied rooftop unit equipped with MicroTech II, an economizer, 4 compressor/4 stage cooling, 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 the wiring diagrams legend on page 62 and Figures 75–87 on pages 65–87 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.

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.

Mechanical Cooling Operation

4-Compressor/4 Stage Unit

Refer to “VAV control inputs” on page 71 and “RPS 135 condensing unit control (with reciprocating compressors)” on page 85 as you read this sequence of operation. In this configuration there are four equally sized compressors and two cooling circuits. In the following description, compressor #1 is lead. However, if Auto Lead/Lag Staging is selected on the keypad, the lead compressor is the one in the lead circuit with the least number of run hours.

When the unit disconnect is closed, 115 VAC power is supplied directly from control transformer T1 to the compressor crankcase heaters, HTR-1, 2, 3, and 4 (lines 815, 848, 820, 853) and motor protectors MP1, 2, 3, and 4 (lines 816, 849, 821, 854). This same 115 VAC source also goes through:

- System switch, S1 (line 203)
- The optional phase voltage monitors, PVM1 and 2 (lines 203, 802)
- The optional ground fault relays, GFR1 and 2 (lines 203, 802)
- Compressor control switches, CS1 and 2 (lines 823, 856)
- Transformer T9 is also powered (line 802)

Compressor control switches, CS1 and 2 provide 24 VAC from transformer T9 to compressor control boards CCB1 and CCB2 (lines 805, 838) as well as the following cooling circuit binary inputs:

- Frost protect FP1 to CCB1-BI8 (line 811)—Optional when no hot gas bypass is ordered on the unit
- Frost protect FP2 to CCB2-BI8 (line 844)—Optional when no hot gas bypass is ordered on the unit
- HP relay R1 to CCB1-BI7 (lines 807)
- HP relay R2 to CCB2-BI7 (lines 840)
- Compressor contactor status M1 to CCB1-BI9 (line 808)
- Compressor contactor status M2 to CCB2-BI9 (line 841)
- Compressor contactor status M3 to CCB1-BI10 (line 809)
- Compressor contactor status M4 to CCB2-BI10 (line 842)
- Circuit pump down switch PS1 to CCB1-BI11(line 812)
- Circuit pump down switch PS2 to CCB2-BI11(line 845)
- Cool enable from MCB-B07 to CCB1-BI12 and CCB2-BI12 (lines 813, 846)

When manual pumpdown switches PS1 and PS2 are closed, all four compressors are fully enabled and ready to start if commanded to by the MicroTech II control system.

Cross Circuit Loading

If cooling is enabled (MCB-BI3 is energized—line 220) and mechanical cooling is required, the MCB energizes cool enable output MCB-BO7 (line 813) to binary inputs CCB1-BI12 (line 813) and CCB2-BI12 (line 846). The MCB also sends a digital communications signal to CCB1 and 2 to enable cooling. CCB1-BO4 output energizes and opens liquid line solenoid valve SV1 (line 831), allowing refrigerant to flow into the evaporator coil. As the refrigerant evaporates, the suction pressure increases until low pressure switch LP1 closes (line 815) as a binary input to CCB1-BI6. When CCB1 senses that LP1 has closed, CCB1-BO1 and BO5 energize contactors M1 and M11 (lines 817 and 832) to start compressor #1 and condenser fan #11. (The above description applies to units without the low ambient start option, For a description of low ambient start, see the “Unit Options” section of this manual,) Additional condenser fan stages are added as the outdoor air temperature rises above setpoints input through the keypad. CCB1-BO6 controls contactor M12 (line 833), which cycles condenser fan 12. CCB1-BO7 controls contactor M13 (line 834), which cycles condenser fan 13. This is stage 1.

If more cooling is required, CCB2-BO4 energizes and opens liquid line solenoid valve SV2 (line 864), allowing refrigerant to flow into the evaporator coil. As the refrigerant evaporates, the suction pressure increases until low pressure switch LP2 closes (line 848) as a binary input to CCB2-BI6. When CCB2 senses that LP2 has closed, CCB2-BO1 and BO5 energize contactors M2 and M21 (lines 850 and 865) to start compressor #2 and condenser fan #21. Additional condenser fan stages are added as the outdoor air temperature rises above setpoints input through the keypad. CCB2-BO6 controls contactor M22 (line 866), which cycles condenser fan 22. CCB2-BO7 controls contactor M23 (line 867), which cycles condenser fan #23. This is stage 2.

If more cooling is required, CCB1-BO2 energizes contactor M3 (line 822) to start compressor #3. This is stage 3.

If more cooling is required, CCB2-BO2 energizes contactor M4 (line 855) to start compressor #4. This is stage 4.

When the cooling demand is satisfied, MCB works through CCB1 and 2 to stage down the compressors. The compressor with the most hours on the lag circuit stages off first, and so on. When both circuits are running with only one compressor each (stage 2) and less cooling is required and if circuit #2 is lag, CCB2-BO4 de-energizes to close liquid line solenoid valve SV2 (line 864). As a result, compressor #2 pumps down refrigeration circuit #2 until the suction pressure drops low enough to open low pressure control LP2 (line 848). When LP2 opens, CCB2-BO1, BO5, (BO6 and BO7) de-energize to shut down compressor #2 and its associated condenser fan(s).

When mechanical cooling is no longer necessary, CCB1-BO4 de-energizes to close liquid line solenoid valve SV1 (line 831). As a result, compressor #1 pumps down refrigeration circuit #1 until the suction pressure drops low enough to open low pressure control LP1 (line 815). When LP1 opens, CCB1-BO1, BO5, (BO6 and BO7) de-energize to shut down compressor #1 and its associated condenser fan(s).

Lead Circuit Loading

The loading and unloading process is similar except that both compressors in the lead cooling circuit energize before energizing any compressors in lag circuit.

Compressor Protective Devices (see page 118)

If a compressor motor protector trips, it immediately disables its associated compressor contactor M1, 2, 3 or 4 (lines 817, 850, 822 and 855).

If high pressure switch HP3 trips (line 823), compressors #1 and #3 are disabled and relay R1 (836) signals CCB1-BI7 of the event (line 807). CCB1 then de-energizes CCB1-BO1 and BO2 (lines 817, 822) to keep compressors #1 and #3 locked out. If high pressure switch HP4 trips (line 856), compressors #2 and #4 are disabled and relay R2 (line 869) signals CCB2-BI7 of the event (line 840). CCB2 then de-energizes CCB2-BO1 and BO2 (lines 850 and 855) to keep compressors #2 and #4 locked out.

Note: The following frost control protection option is not included in the wiring diagram (Figure 84 on page 84).

If frost protect switch FP1 trips (line 811), CCB1-BO4 de-energizes (lines 831) to close SV1 and pump down circuit #1. If frost protect switch FP2 trips (line 844), CCB2-BO4 de-energizes (lines 864) to close SV2 and pump down circuit #2. For both of these alarms, the circuit remains off for at least one cooling stage timer interval. If cooling is still needed, the cooling tries to restart. The cooling resets up to three times in a 24-hour period (between 2:00 a.m. and 2:00 a.m.). After the third trip, the alarm remains until manually cleared at the keypad or over the network.

Heating

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

Refer to "Standard Mod, furnace control (1000 MBH)" on page 81 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 and 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 81), 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.

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
C1–8	Power factor capacitors, compressors	Condenser section
C10	Power factor capacitors, supply fan	Supply Fan section
C11	Capacitors, Speedtrol, circuit #1	Condenser bulkhead
C20	Power factor capacitors, return fan	Return section
C21	Capacitors, Speedtrol, circuit #2	Condenser bulkhead
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
CS1, 2	Control switches, refrig. circuits	Main/cond. 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
DS4	Disconnect, condenser (RCS Only)	RCS control box

ID	Description	Standard location
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
F4	Fuse, ctrl. circuit transformer (T4), primary	Main control box
FB11, 12	Fuseblock, Speedtrol	Main/cond. control box
FB31–40	Fuseblock, electric heat (top bank)	Electric heat box
FB41–50	Fuseblock, electric heat (bot. bank)	Electric heat box
FB65	Fuseblock, evap. cond. sump heater	Main/cond. control 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
GFR4	Ground fault relay, condenser	Condenser control box
GFS4	Ground fault sensor, condenser	Condenser 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
HP1–4	Hi-pressure controls, refrig	On compressors
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

ID	Description	Standard location
HTR1–6	Crankcase heaters	On compressers
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
LP1, 2	Low-pressure controls, refrigeration	On compressors
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
M1–8	Contactor, compressor	Main/cond. control box
M10	Contactor, supply fan	Main control box
M11–18	Contactor, condenser fans, circuit #1	Main/cond. control box
M20	Contactor, return fan	Main control box
M21–28	Contactor, Condenser fans, circuit #2	Main/cond. 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
M64	Contactor, sump pump	Main/cond. control box
M65	Contactor, sump heater	Main/cond. 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
MMP64	Manual motor protector, sump pump	Main/RCE 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
OP1–4	Oil pressure controls, compr.#1-4	Condenser section
PB1, 2	Power block, power distribution	Main control box

ID	Description	Standard location
PB3	Power block, power distribution, electric heat	Electric heat box
PB4	Power block, power distribution, condenser	Condenser control 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
PC12, 22	Pressure control, Fantrol	Condenser section
PM1	Phone modem	Main control box
PS1, 2	Pumpdown switches, refrig circuits	Main/cond. control box
PS3	Pumpdown switch, RFS only	Main control box
PVM1, 2	Phase voltage monitor	Main control box
PVM4	Phase voltage monitor, condenser	Condenser control box
R1, 2	Relay, hi pressure reset	Main/cond. control box
R3, 4	Relay, hi pressure delay	Main/cond. control box
R5–8	Relay, safety, cool fail	Main/cond. control box
R9, 10	Relay, compressor lockout	Main/cond. control box
R11, 12	Relay, Speedtrol fan cycling	Main/cond. 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
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
R56	Relay, heater, water pipe	Main/RCE 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
R64	Relay, sump pump	Main/RCE 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

ID	Description	Standard location
RAE	Return air enthalpy sensor	Return section
RAT	Return air temperature sensor	Return section
REC1	Receptacle, main box	Main control box
REC2	Receptacle, condenser box	Condenser control box
REC3	Receptacle, field power, 115V	Discharge bulkhead
REC10–23	Receptacle, cabinet sections	Cabinet sections
S1	Switch, system on/off	Main control box
S2	Switch, system on/off, condenser unit	Condenser 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
SC11	Speed control, circuit #1	Condenser bulkhead
SC21	Speed control, circuit #2	Condenser bulkhead
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
SV1, 2	Solenoid valves, liquid	Condenser section
SV5, 6	Solenoid valves, hot gas	Condenser section
SV61, 62	Solenoid valves, sump, fill	Main/RCE control box
SV63	Solenoid valves, sump, drain	Main/RCE control box
SWT	Sump water temperature sensor	Evap. condenser section
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, electirc heat	Electric heat box
T6	Transformer, dew point controlller (115/24VAC)	Main control box
T9	Transformer, refrig. circuit 24V	Main control box
T11	Transformer, speedtrol (line/ 240VAC)	Condenser section
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
TB5	Terminal block, RCS, field	Condenser control box
TB6	Terminal block, RCS, factory	Condenser control box
TB7	Terminal block, 115V convenience outlet, field	Main control box
TB8	Terminal block, 115V conv. outlet, RCS, field	Condenser control box
TB11	Terminal block, heat	Heat control box
TB23	Terminal block, oil pressure box, RPE/RCE only	Evap. condenser vestibule
TB25, 26, 27, 28	Terminal block, split unit junction box	Junction box, split unit
TC12, 13, 14	Temperature controls, Fantrol	Condenser section
TC56	Temperature control, water pipe heater	Evap. condenser vestibule
TC66	Temperature control, vestibule exhaust fan	Evap. condenser vestibule
TD1, 2	Time delay, compressor lockout	Main/cond. control box
TD3, 4	Time delay, hi-pressure	Main/cond. control box
TD5–8	Time delay, part winding, compr #1 - 4	Main control box
TD10	Time delay, hi turn down burner	Gas heat box
TD11, 12	Time delay, low ambient	Main/cond. control box
TR1, 2	Transducer, pressure	Main control box
U1, 2	Unloaders, compressors	On compressers
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
WL63	Water level, sump, fill	Evap. condenser section
WL64	Water level, sump, low water	Evap. condenser section
ZNT1	Zone temp. sensor, setback	Field installed

General Notes

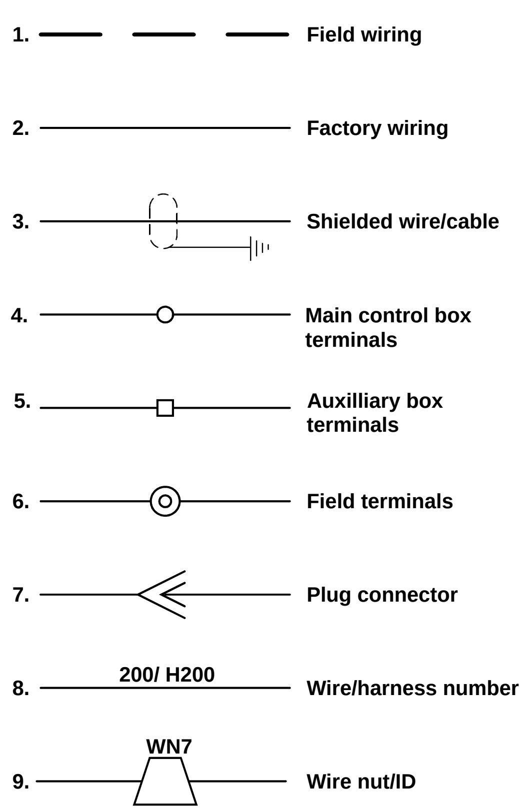
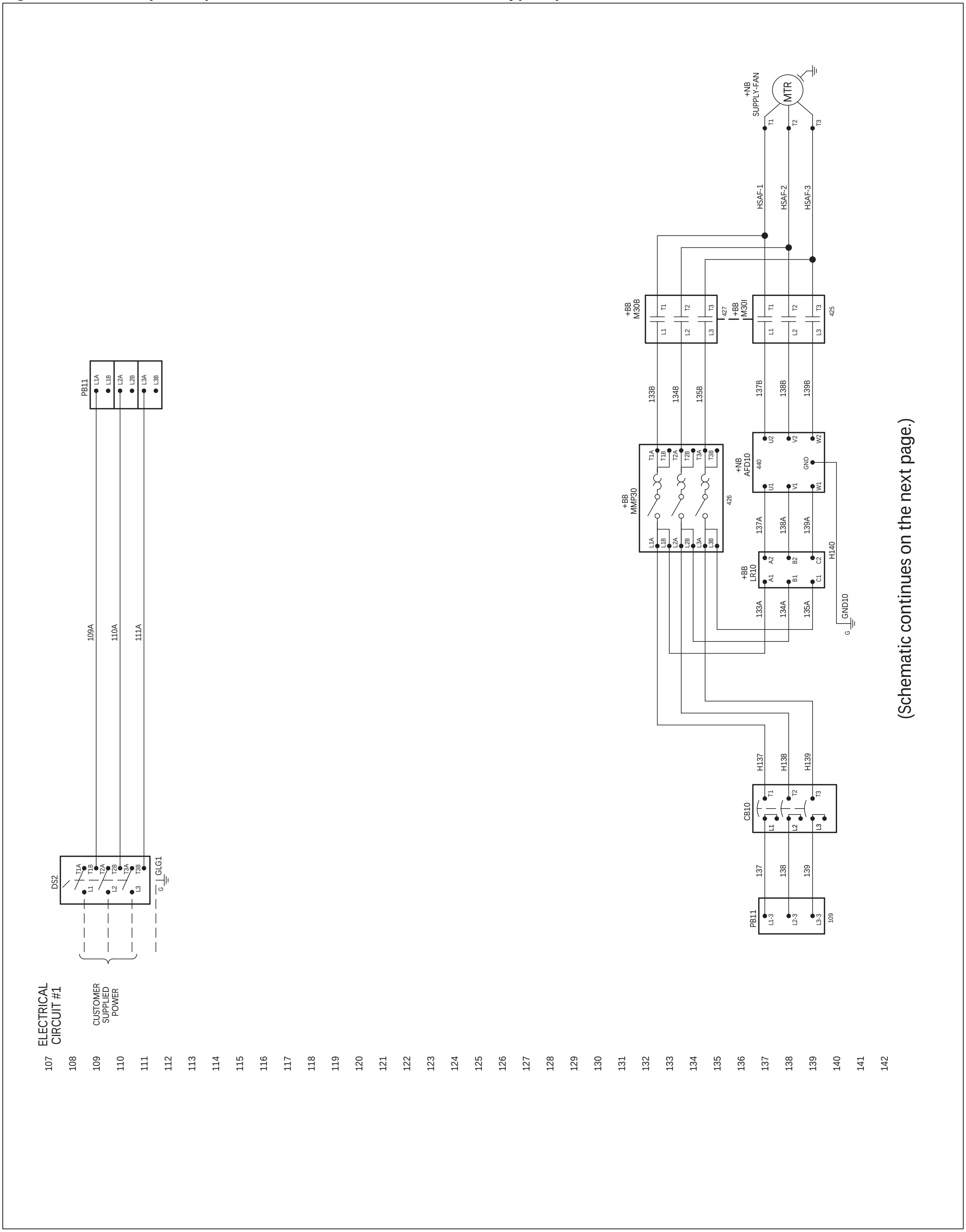


Figure 75. VAV fan power (with SAF and RAF VFDs and manual bypass)



(Schematic continues on the next page.)

Figure 75. VAV fan power (with SAF and RAF VFDs and manual bypass), continued

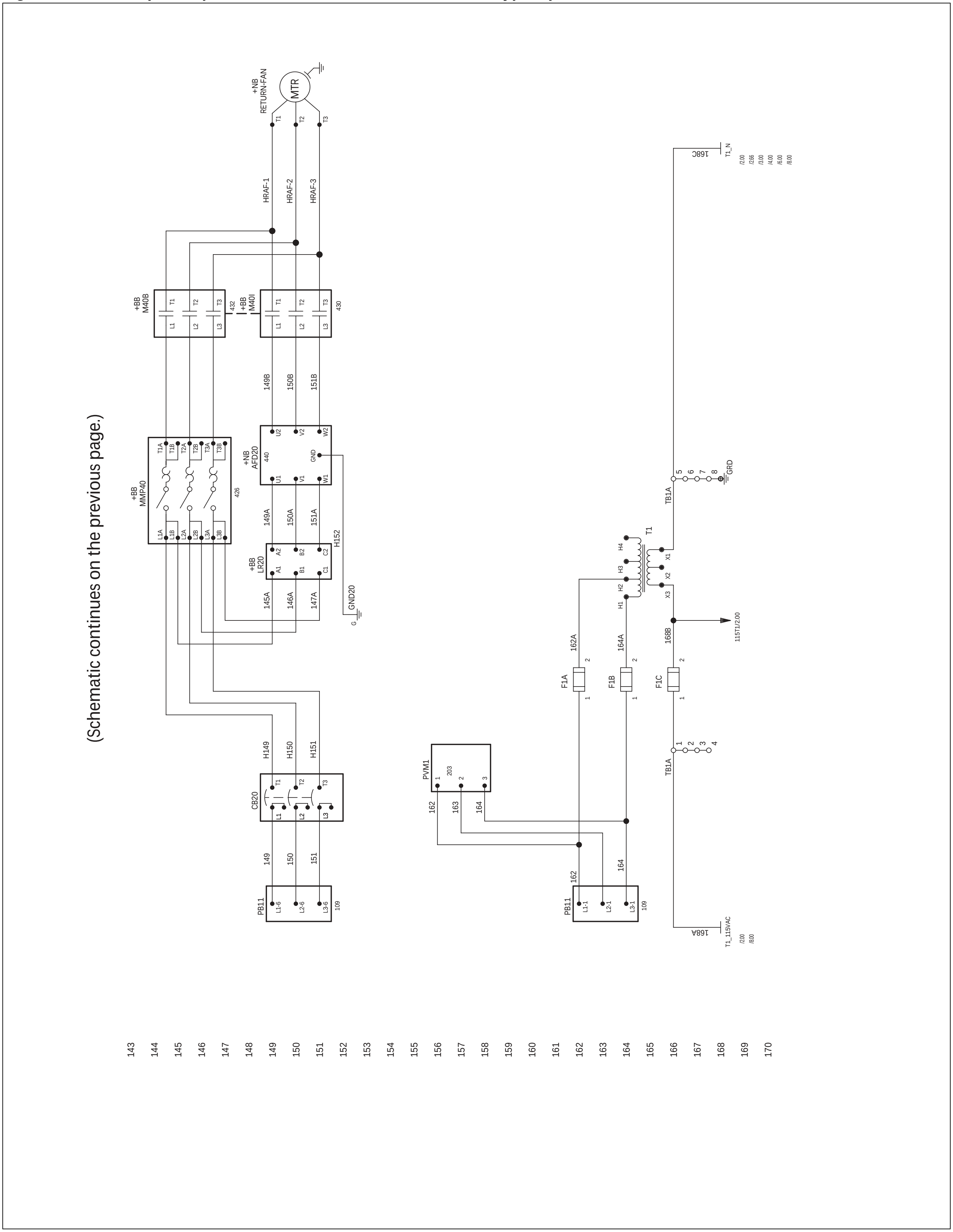


Figure 76. Constant volume fan power (SAF and RAF)

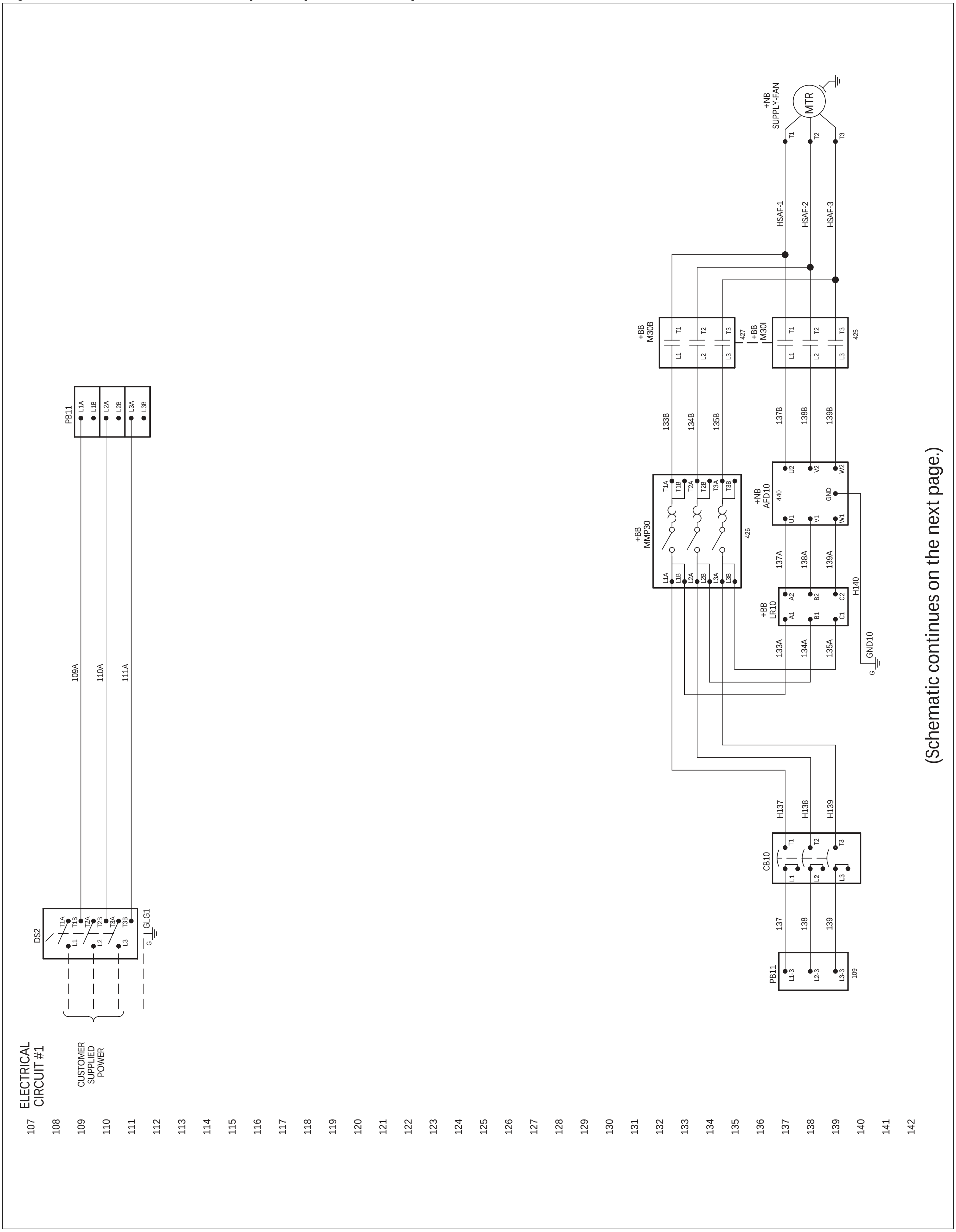


Figure 76. Constant volume fan power (SAF and RAF), continued

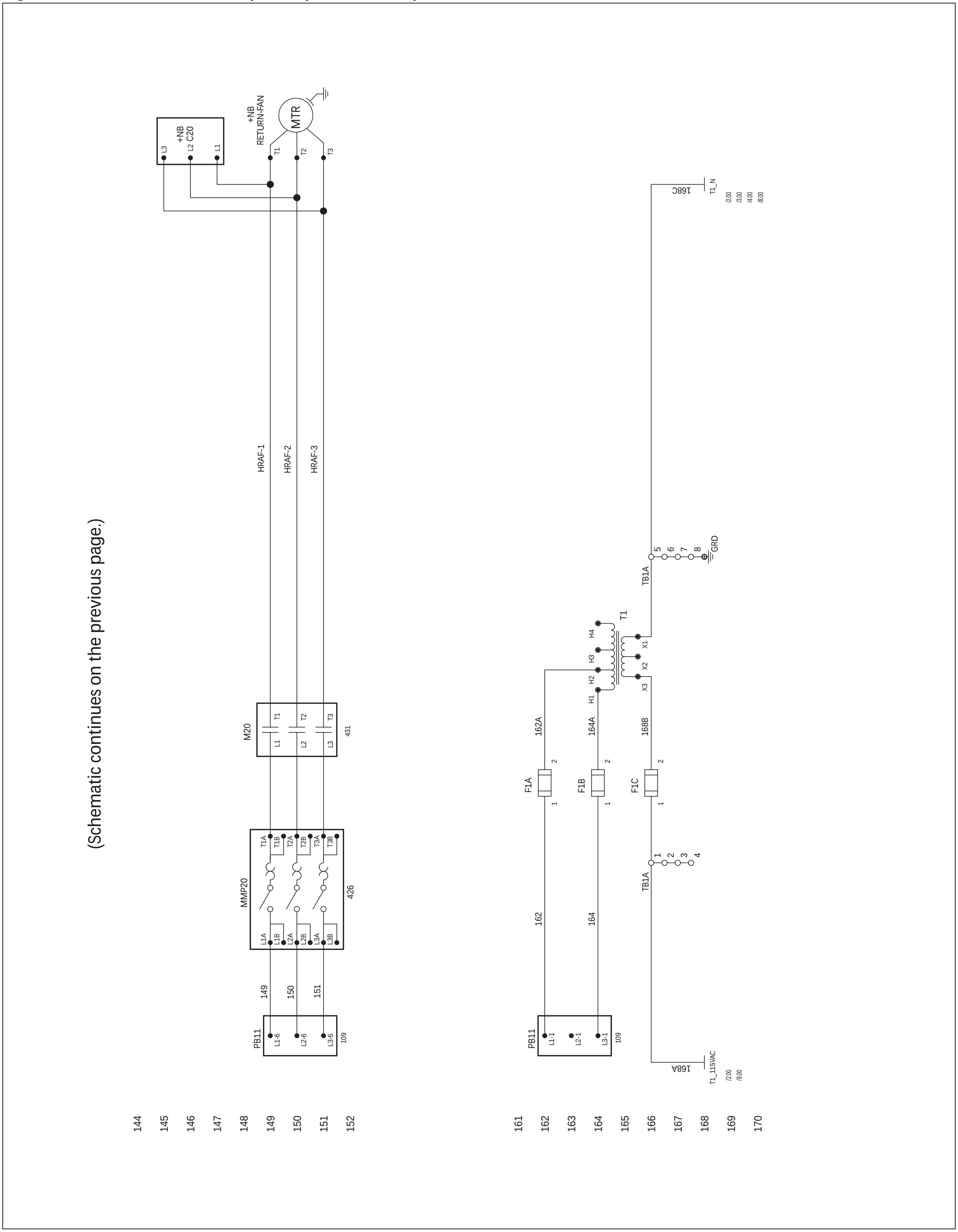
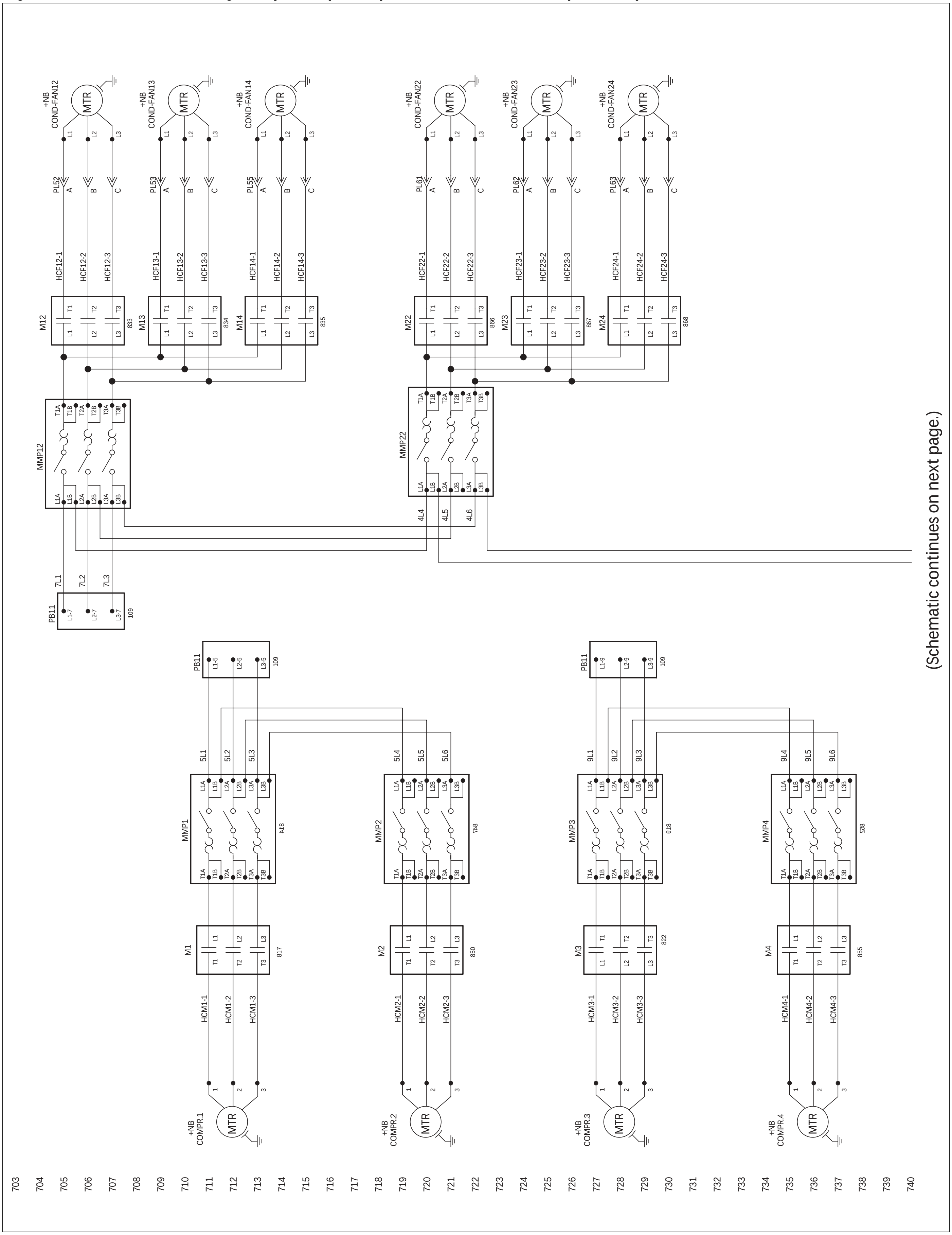


Figure 77. RPS 75 condensing unit power (with SpeedTrol and scroll compressors)



(Schematic continues on next page.)

Figure 77. RPS 75 condensing unit power (with SpeedTrol and scroll compressors, continued

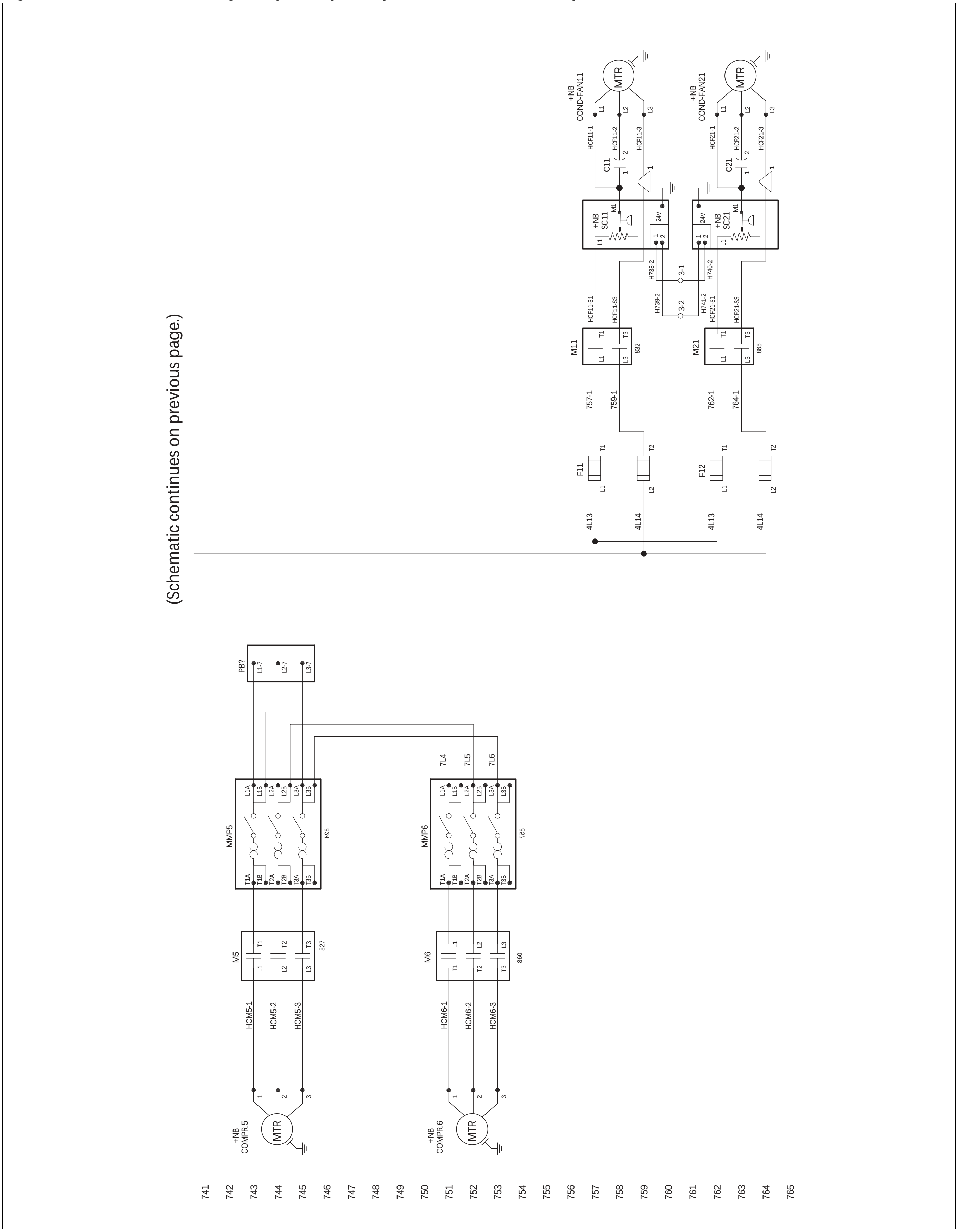


Figure 78. VAV control inputs

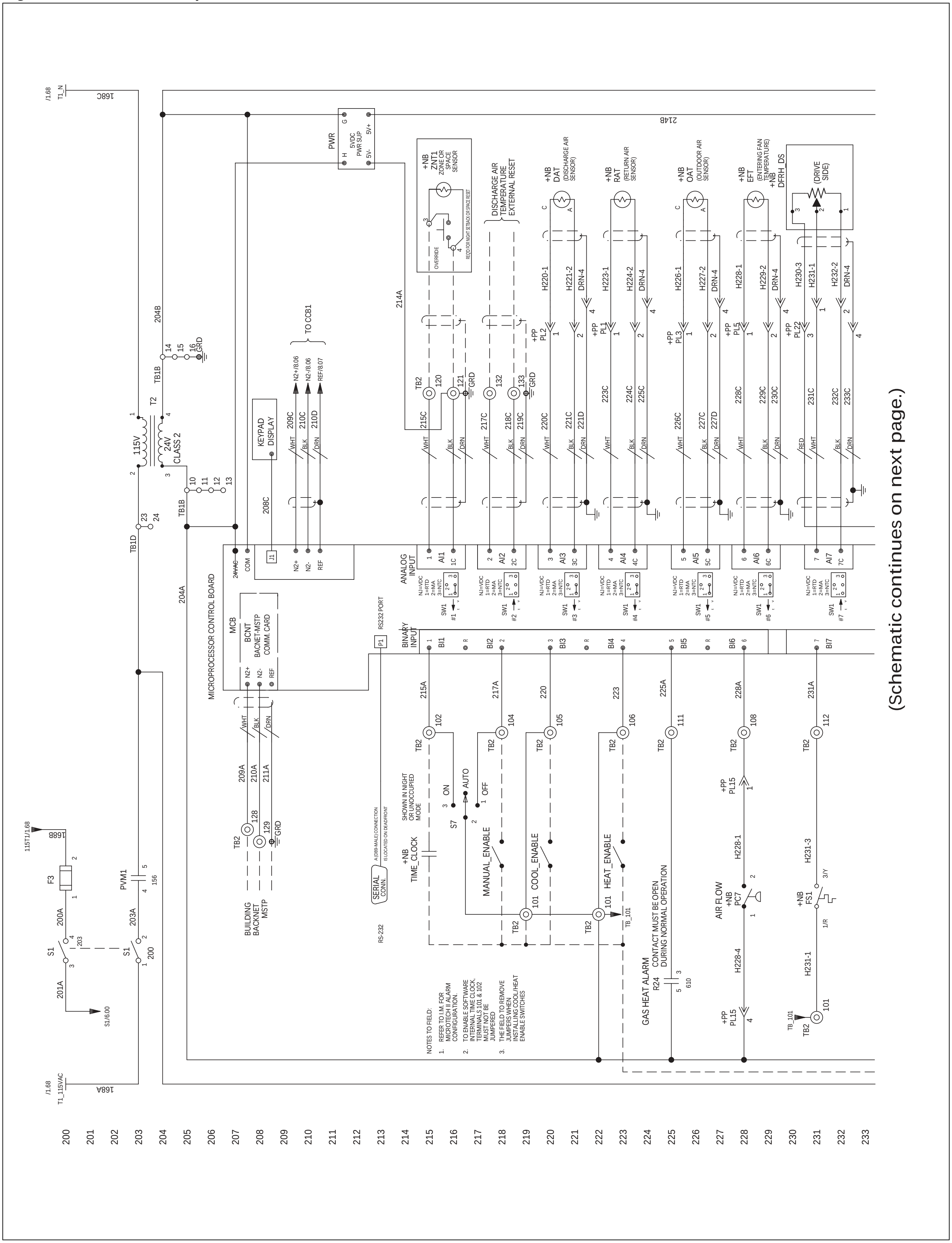


Figure 78. VAV Control Inputs, continued

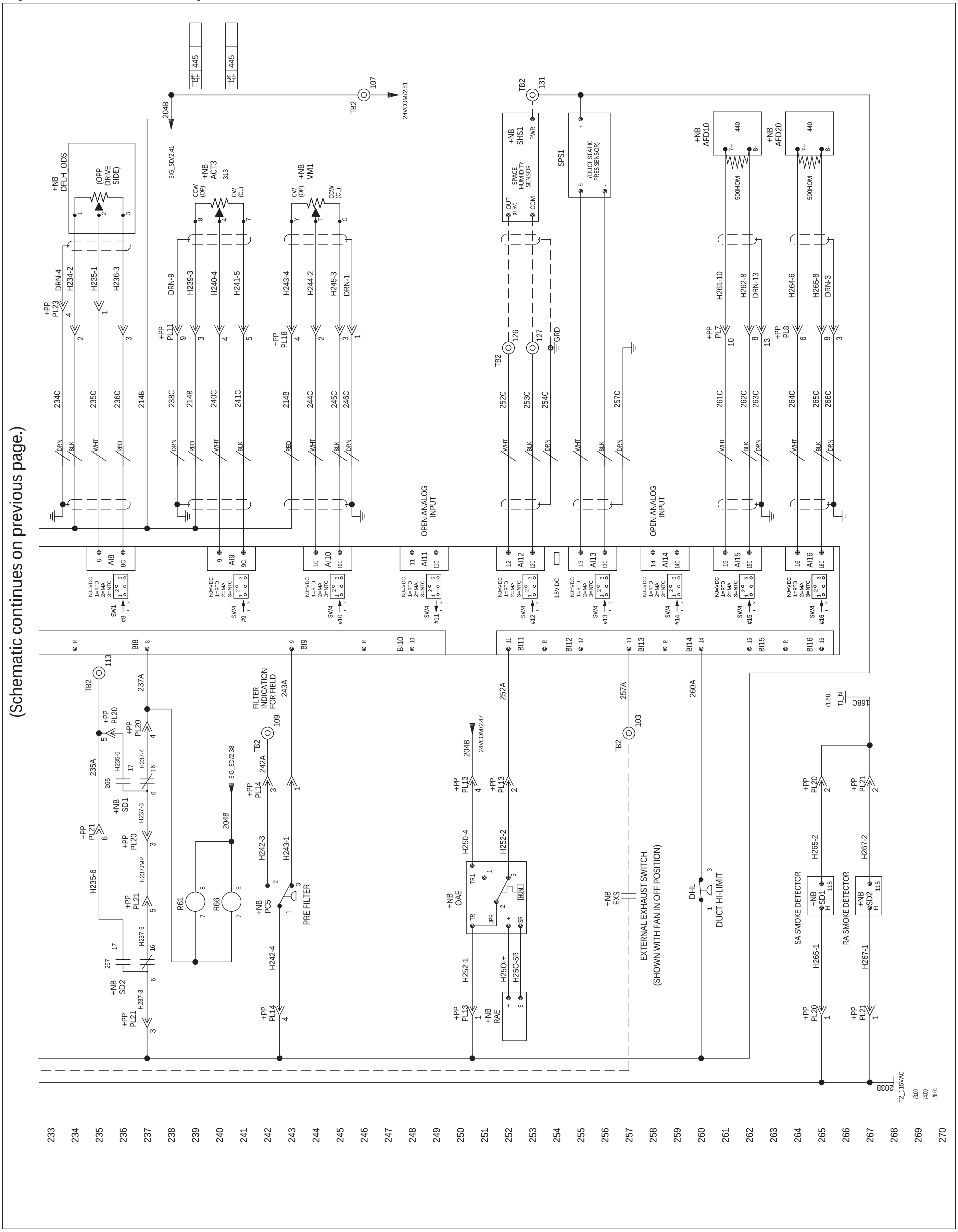


Figure 79. CV control inputs

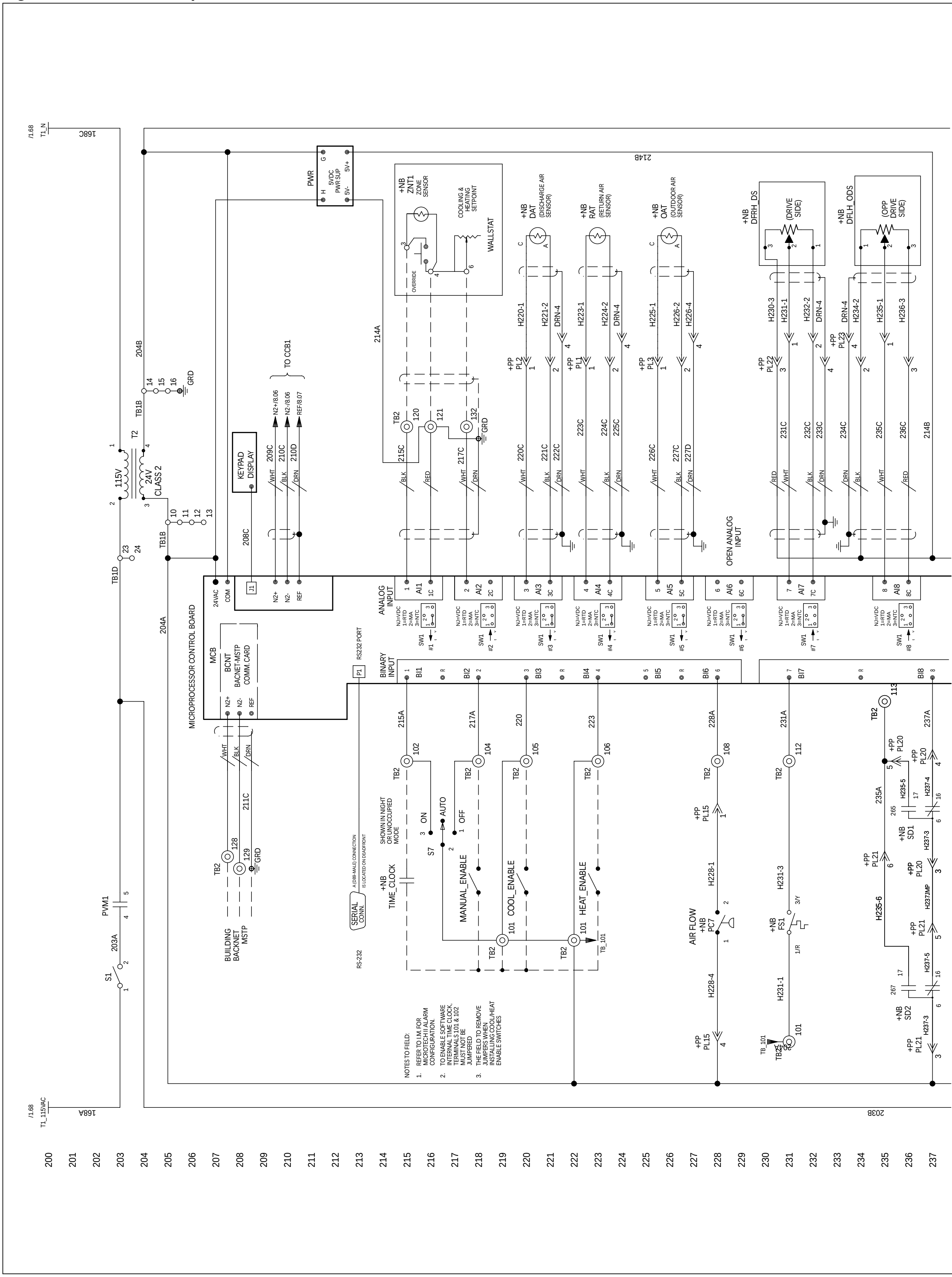


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Figure 79. CV control inputs, continued

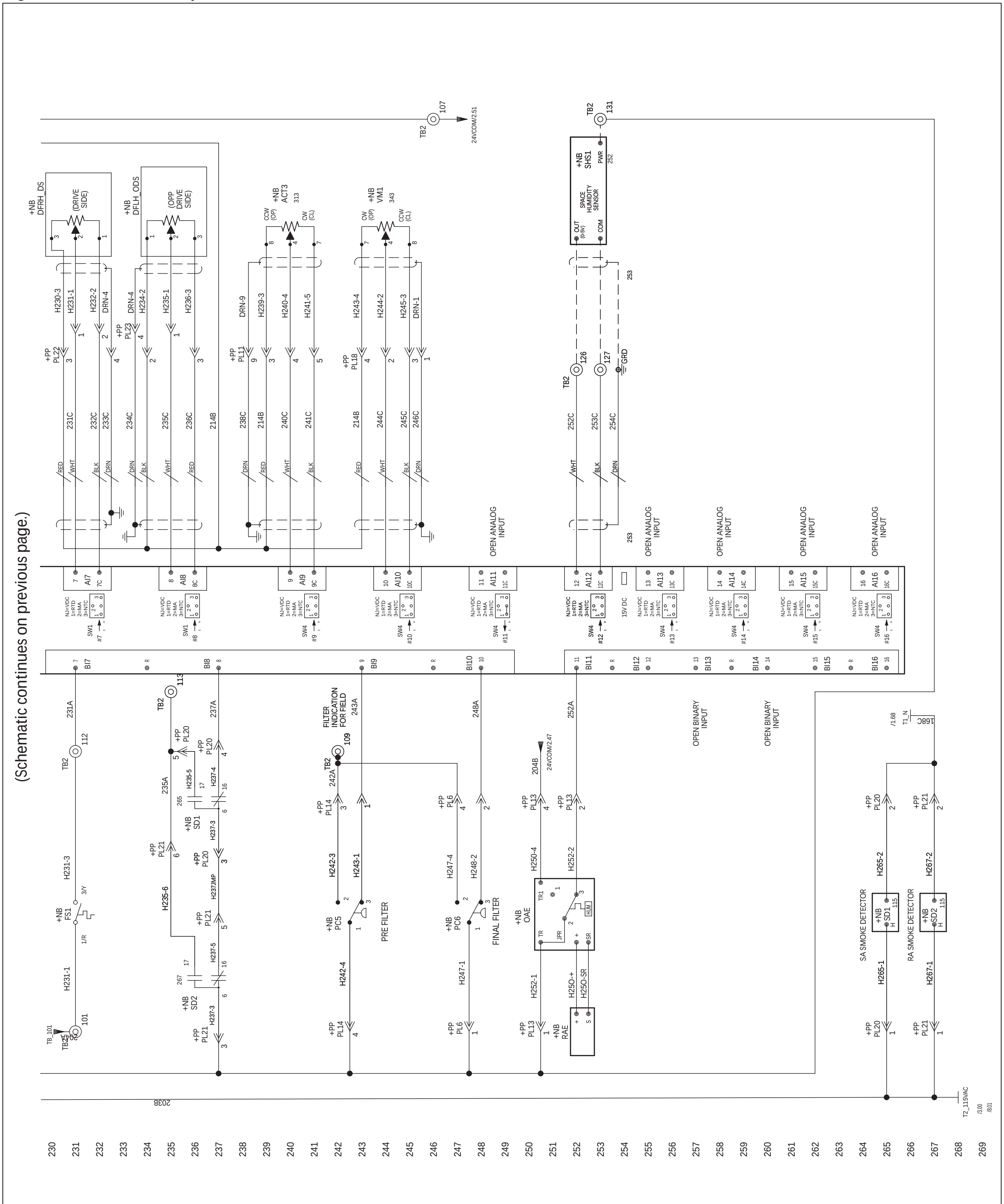


Figure 80. Control actuator outputs (CV, stream, or hot water, plus economizer)

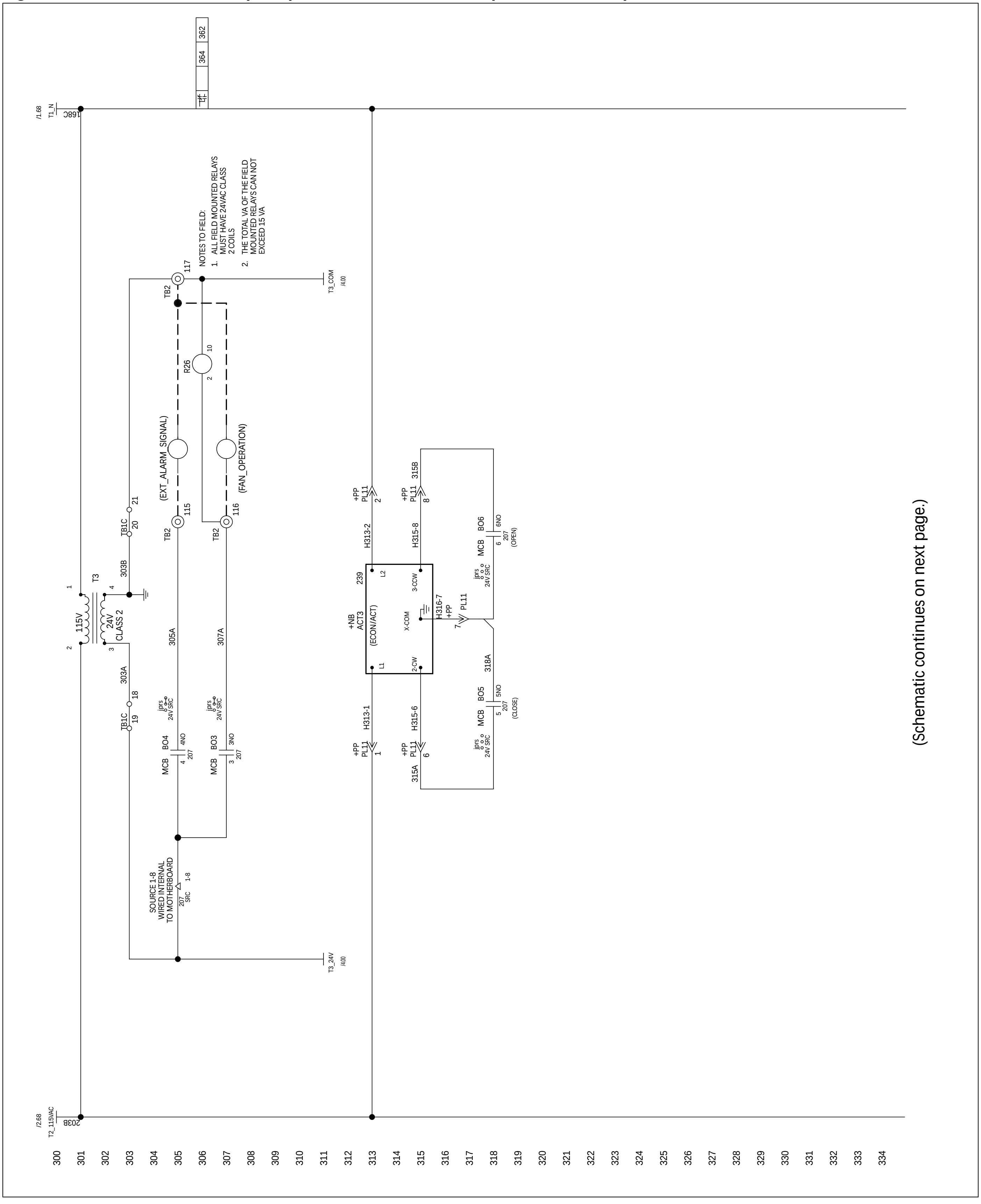


Figure 80. Control actuator outputs (CV, stream, or hot water, plus economizer), continued

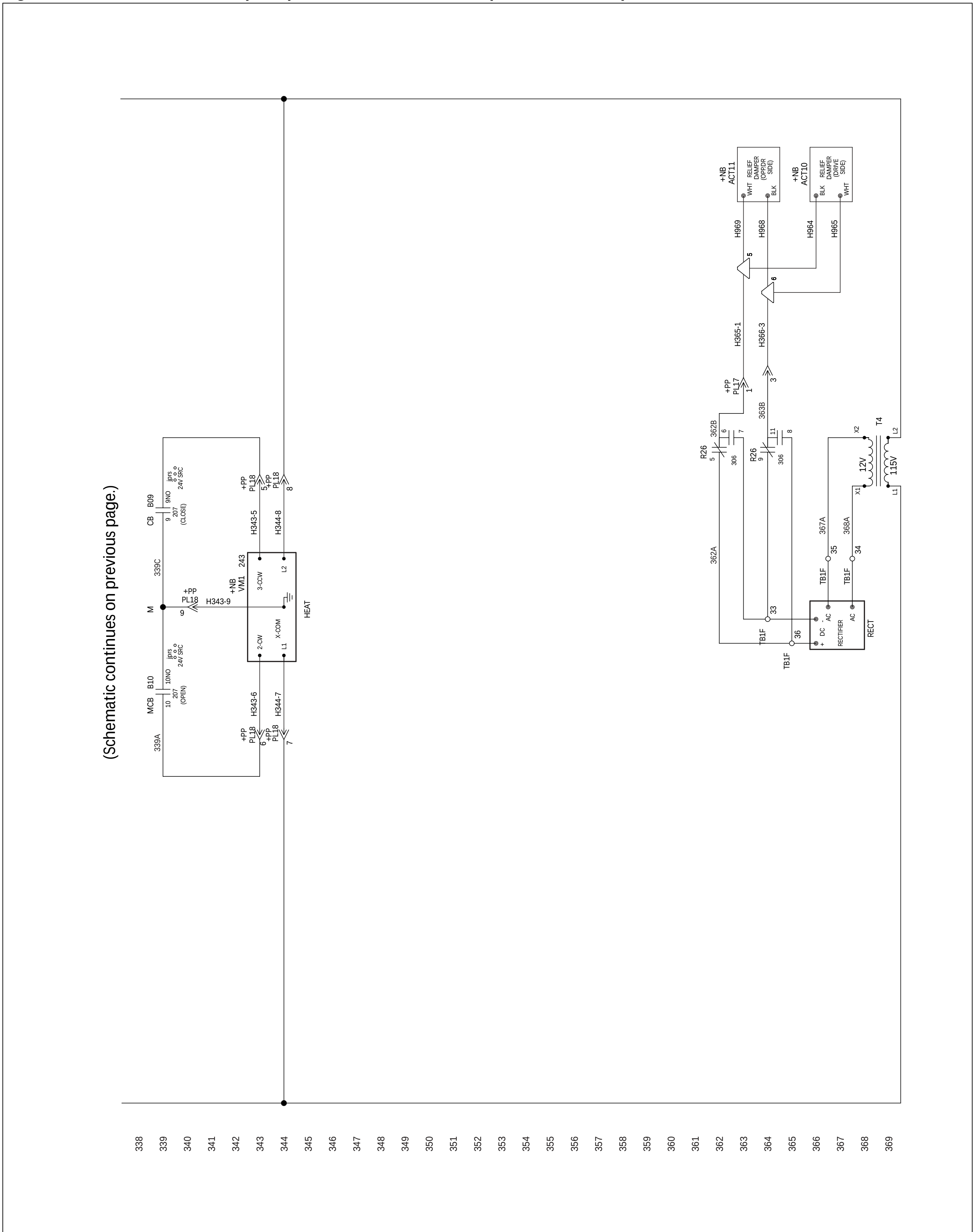


Figure 81. VFD control (SAF and RAF)

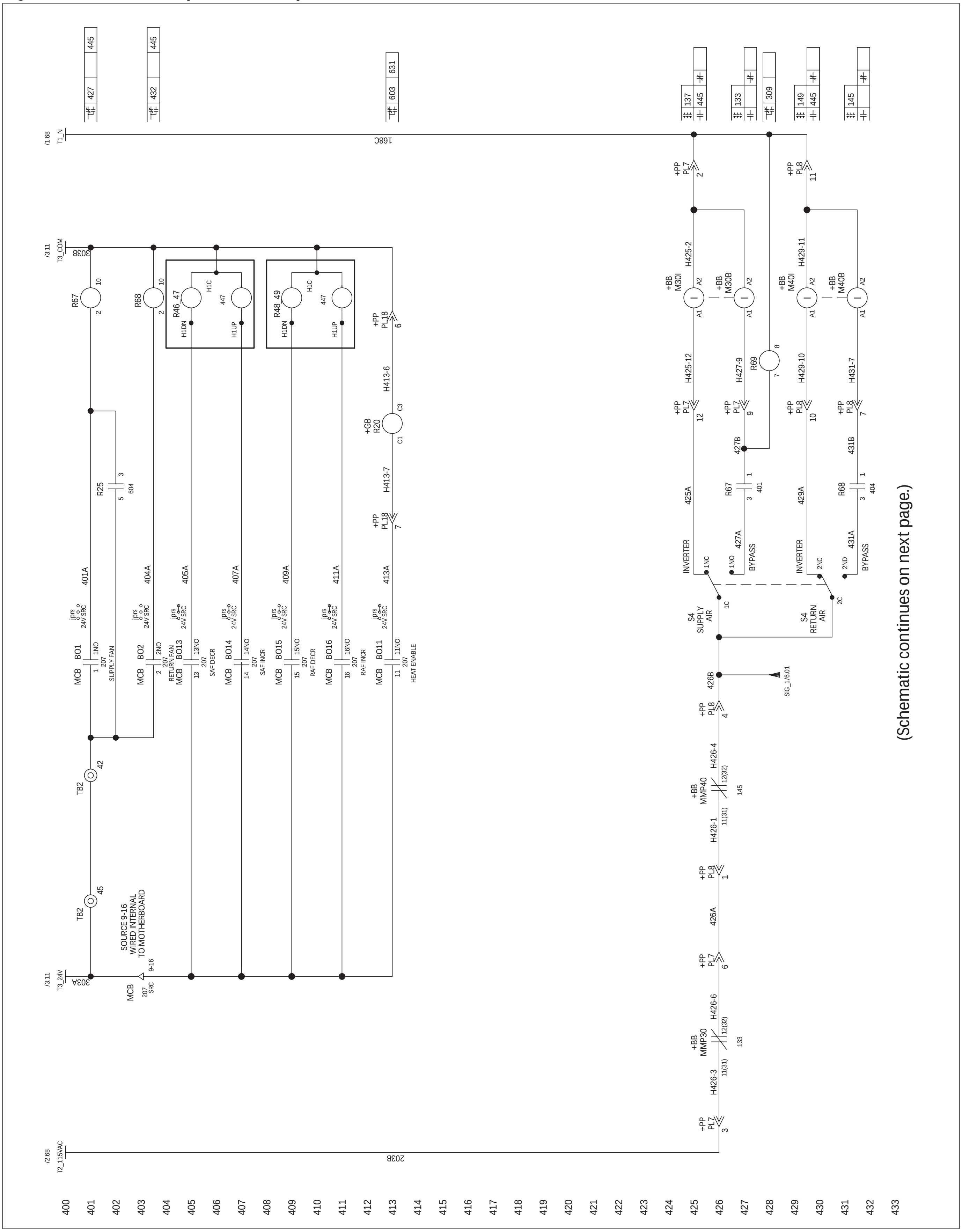


Figure 81. VFD control (SAF and RAF), continued

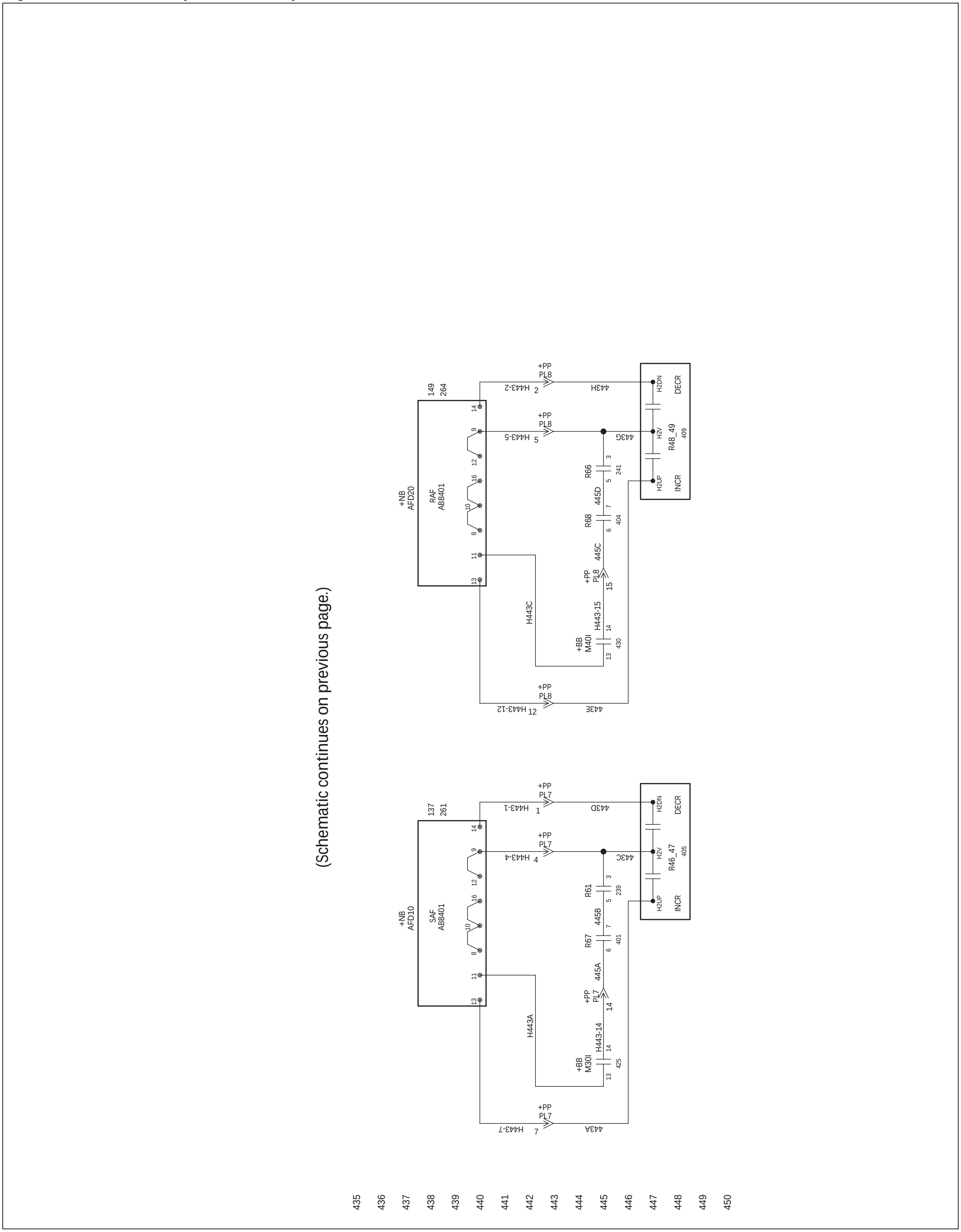


Figure 82. Super Mod gas furnace control (1000 MBH)

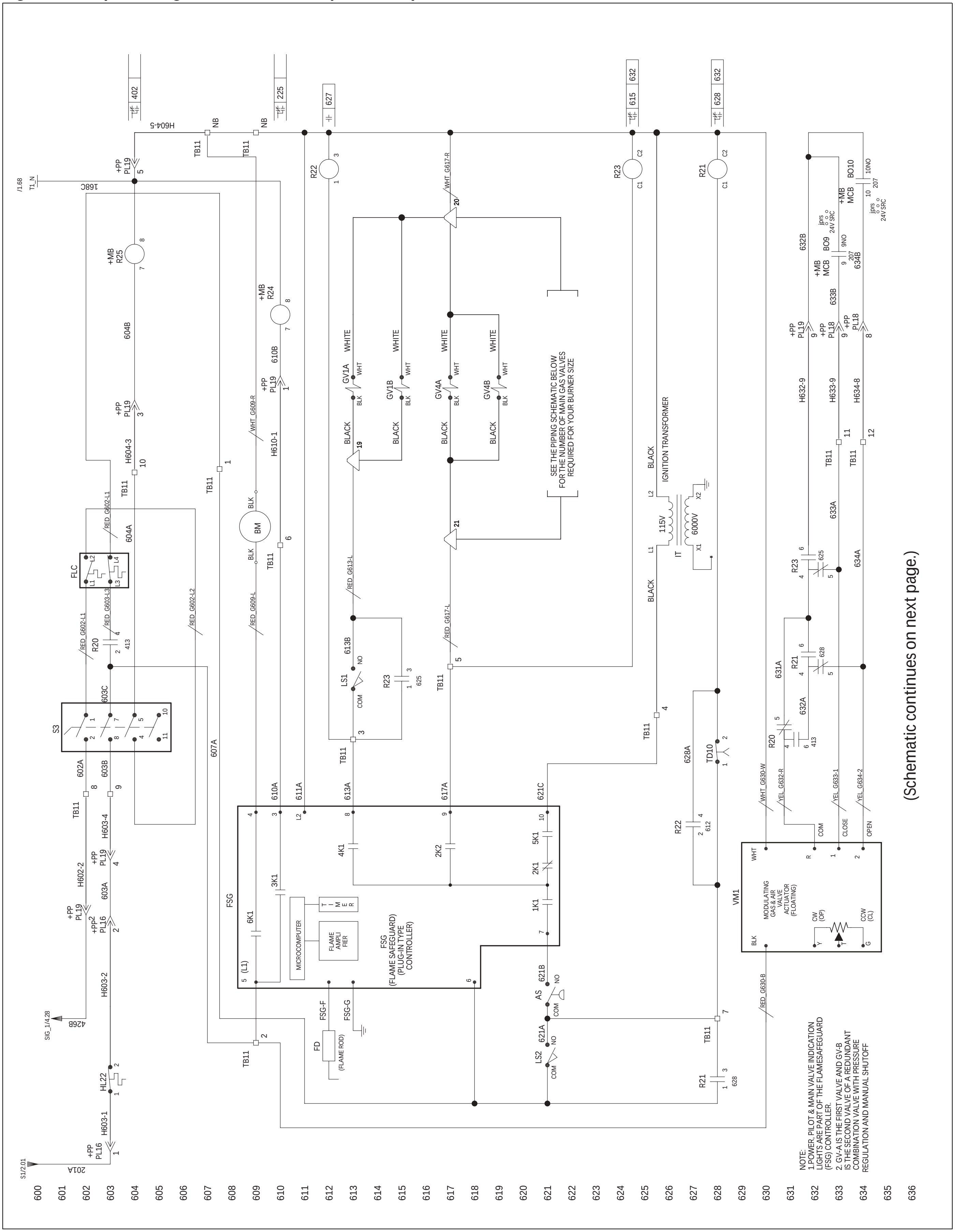


Figure 82. Super Mod gas furnace control (1000 MBH), continued

(Schematic continues on previous page.)

SEQUENCE OF OPERATION

WHEN THE ROOFTOP UNIT IS ENERGIZED 120 VOLT POWER IS SUPPLIED TO THE SYSTEM ON-OFF SWITCH (S1), TO BURNER ON-OFF SWITCH (S3) AND 24 VOLTS TO THE (BO#11) CONTACTS ON THE MAIN CTRL BRD (MCB). BURNER ON-OFF SWITCH (S3) WILL POWER THE MODULATING GAS VALVE ACTUATOR (VM1) AND TERMINAL #5(L1) ON THE FLAME SAFEGUARD (FSG). UPON A CALL FOR HEAT, THE CONTROL SYSTEM WILL CLOSE (BO#11) ON THE MAIN CTRL BRD (MCB), THUS ENERGIZING RELAY (R20). WHEN 120 VOLT POWER IS FURNISHED THROUGH THE SYSTEM ON-OFF SWITCH (S1), THROUGH THE BURNER ON-OFF SWITCH (S3), THROUGH RELAY (R20 CONTACTS, THROUGH THE HIGH LIMIT CONTROL (FLC) AND TERMINAL #6 ON THE FLAME SAFEQUARD (FSG) IS POWERED. THE FLAME SAFEGUARD THEN ENERGIZES ITS TERMINAL #4, WHICH POWERS THE BURNER COMBUSTION AIR BLOWER MOTOR (BM). WHENEVER POWER IS RESTORED TO THE FLAME SAFEGUARD, THE FLAME SAFEGUARD WILL GO THROUGH A 10 SECOND INITIATION PERIOD BEFORE THE PREPURGE PERIOD WILL BEGIN.

THE BURNER AIR CONTROL VALVE WILL BE AT THE MINIMUM POSITION DURING OFF CYCLES. UPON A CALL FOR HEAT OR ANY OTHER TIME THAT A PREPURGE CYCLE OCCURS THE AIR CONTROL VALVE WILL BE RE-POSITIONED TO THE MAXIMUM POSITION FOR THE PREPURGE AND THEN RETURNED TO THE MINIMUM POSITION FOR LOW FIRE START.

(VM1), THROUGH THE N/C CONTACTS OF (R20) AND (R23), POSITIONS THE BURNER AIR AND GAS CONTROL VALVES TO MINIMUM AFTER A RUN CYCLE. WHEN (R20) IS ENERGIZED FOR A NEW CALL FOR HEAT, (VM1) THROUGH THE N/O CONTACTS OF (R20) AND THE N/C CONTACTS OF (R21), WILL RE-POSITION THE BURNER AIR VALVE TO ITS MAXIMUM OPEN POSITION FOR PREPURGE. WHEN THE AIR CONTROL VALVE REACHES THE FULL OPEN POSITION SWITCH (LS2) IS 'MADE', POWERING (FSG) TERMINAL #7 THROUGH THE BURNER AIR SWITCH (AS). THIS INITIATES THE 60 SECOND PREPURGE CYCLE. CONCURRENTLY, (LS2) POWERS TIMER (TD10) WHICH WILL ENERGIZE RELAY (R21) AFTER 20 SECONDS. WHEN (R21) IS ENERGIZED (VM1) WILL START THE AIR CONTROL VALVE ON ITS WAY TOWARD THE MINIMUM AIR VALVE POSITION THROUGH THE N/O CONTACT OF (R21) AND THE N/C CONTACT OF (R23). AT THE COMPLETION OF THE 60 SECOND PREPURGE CYCLE THE VALVE WILL BE AT THE MINIMUM OPEN POSITION AND THE MINIMUM POSITION SWITCH (LS1) WILL BE 'MADE'. IF (LS1) IS NOT 'MADE' THE COMBINATION GAS CONTROL START VALVES (GV1) WILL NOT OPEN AND THE BURNER WILL GO OUT ON SAFETY LOCKOUT.

AFTER COMPLETION OF THE 60 SECOND PREPURGE PERIOD THERE WILL BE A 10 SECOND TRIAL FOR IGINITION DURING WHICH TERMINAL #8 (COMBINATION GAS VALVE--GV1) AND TERMINAL #10 (IGNTION TRANSFORMER--IT) WILL BE ENERGIZED. IF FLAME IS BEING DETECTED THROUGHT THE FLAME ROD (FD) AT THE COMPLETION OF THE 10 SECOND TRIAL FOR IGNITION PERIOD TERMINAL #10 (IGNITION TRANSFORMER--IT) WILL BE DE-ENERGIZED AND TERMINAL #9 (RELAY R23 COIL AND MAIN GAS VALVES--GV4 & GV5) WILL BE ENERGIZED AND THE CONTROL SYSTEM WILL BE ALLOWED TO CONTROL THE FIRING RATE. THE FLAME SAFEGUARD CONTAINS "LEDS"(LOWER LEFT CORNER) THAT WILL GLOW TO INDICATED OPERATION.

AFTER THE FLAME HAS LIT AND BEEN PROVEN, RELAY (R23) IS ENERGIZED ALLOWING (VM1), AS CONTROLLED BY (BO#9) & (BO#10) ON THE MAIN CTRL BRD (MCB), TO POSITION THE BURNER AIR AND GAS VALVES FOR THE REQUIRED FIRING RATE. WHEN THE MAIN CONTROL SYSTEM CLOSES (BO#10) ON THE MAIN CTRL BRD (MCB), THE GAS VALVE ACTUATOR WILL RE-POSITION TOWARD A HIGHER FIRING RATE UNTIL (BO#10) OPENS OR THE ACTUATOR REACHES ITS MAXIMUM POSITION. WHEN THE MAIN CONTROL SYSTEM CLOSES (BO#9), THE ACTUATOR WILL RE-POSITION TOWARD A LOWER FIRING RATE. IF NEITHER (BO#9) OR (BO#10) ON THE MAIN CONTROL BOARD (MCB) ARE CLOSED, THE ACTUATOR WILL REMAIN AT ITS PRESENT POSITION. THE HEATING CAPACITY IS MONITORED BY THE MAIN CTRL BRD (MCB) THROUGH (AI#10) VIA A POSITION FEEDBACK POTENTIOMETER ON THE ACTUATOR.

IN THE EVENT THE FLAME FAILS TO IGNITE OR THE FLAME SAFEGUARD FAILS TO DETECT ITS FLAME WITHIN 10 SECONDS, TERMINALS #4, 8, 9, AND 10 WILL BE DE-ENERGIZED, THUS DE-ENERGIZING THE BURNER AND TERMINAL #3 WILL BECOME ENERGIZED. THE FLAME SAFEGUARD WOULD THEN BE ON SAFETY LOCKOUT AND WOULD REQUIRE MANUAL RESETTING. TERMINAL #3 WILL ENERGIZE THE HEAT ALARM RELAY (R24), WHICH WOULD THEN ENERGIZE THE REMOTE 'HEAT FAIL' INDICATOR LIGHT AND SEND A FAIL SIGNAL TO BINARY INPUT #5 ON THE MICROTECH II MAIN CONTROL BOARD (MCB).

IF AN ATTEMPT IS MADE TO RESTART THE BURNER BY RESETTING THE FLAME SAFEGUARD, OR IF AN AUTOMATIC RESTART IS INITIATED AFTER FLAME FAILURE, THE EARLIER DESCRIBED PREPURGE CYCLE WITH THE WIDE OPEN AIR VALVE WILL BE REPEATED.

IF THE UNIT OVERHEATS, THE HIGH LIMIT CONTROL (FLC) WILL CYCLE THE BURNER, LIMITING FURNACE TEMPERATURE TO THE LIMIT CONTROL SET POINT.

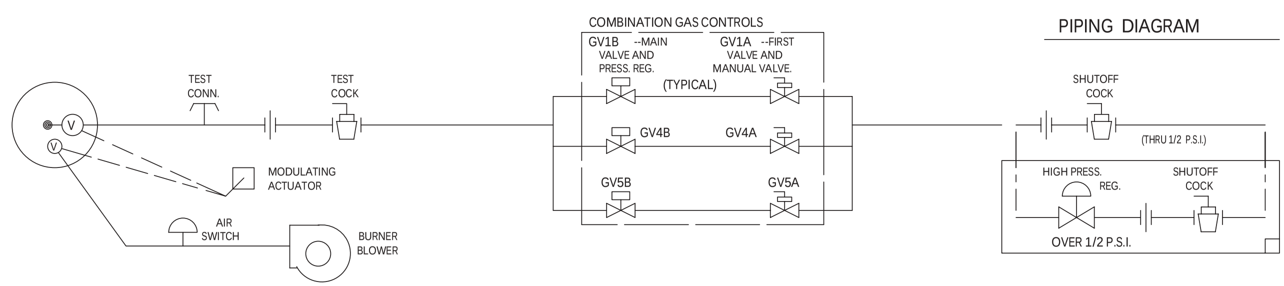
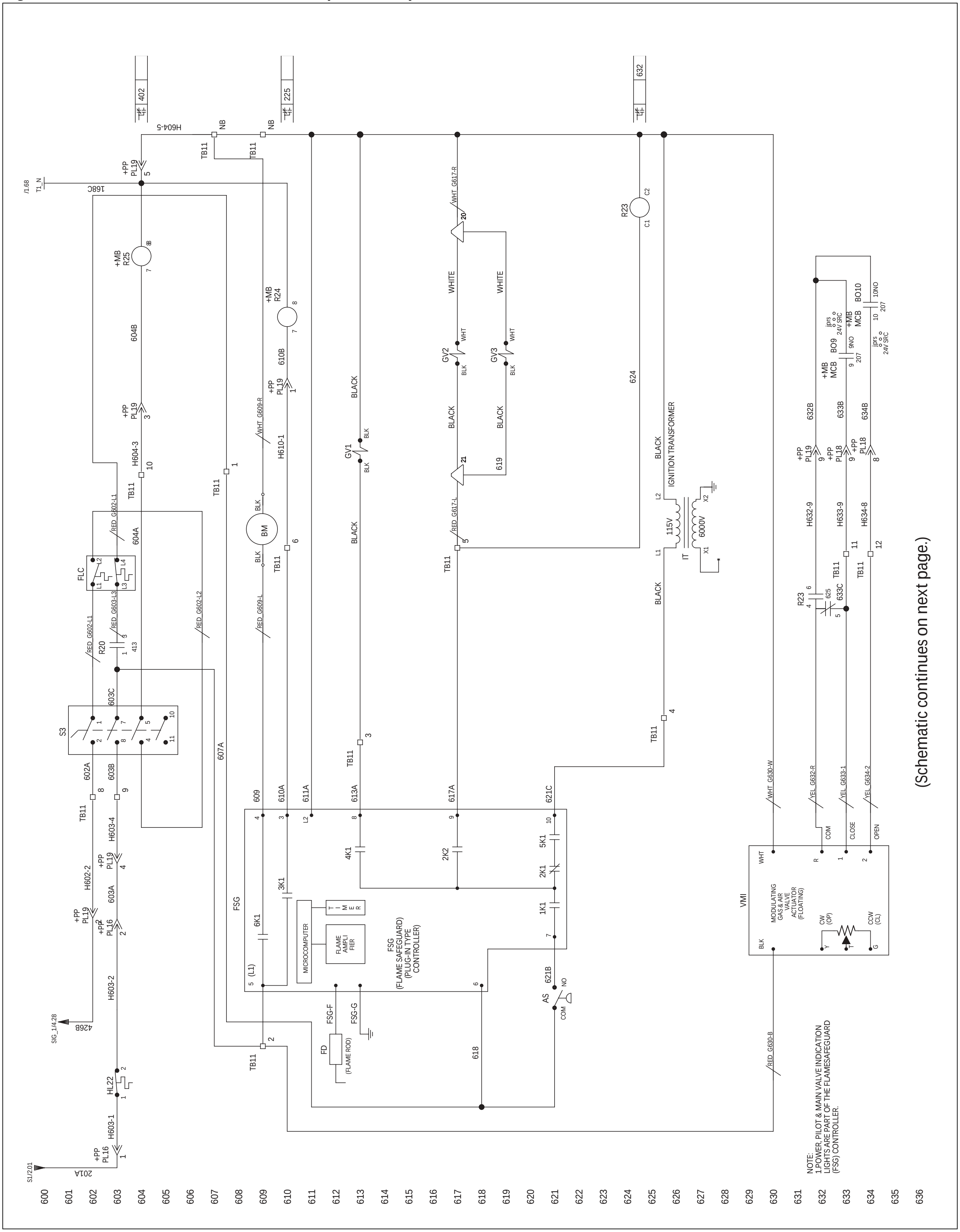


Figure 83. Standard Mod, furnace control (1000 MBH)



(Schematic continues on next page.)

Figure 83. Standard Mod, furnace control (1000 MBH), continued

(Schematic continues on the previous page.)

SEQUENCE OF OPERATION

WHEN THE ROOFTOP UNIT IS ENERGIZED 120 VOLT POWER IS SUPPLIED TO THE SYSTEM ON-OFF SWITCH (S1), TO BURNER ON-OFF SWITCH (S3) AND 24 VOLTS TO THE (BO#11) CONTACTS ON THE MAIN CTRL BRD (MCB). BURNER ON-OFF SWITCH (S3) WILL POWER THE MODULATING GAS VALVE ACTUATOR (VM1) AND TERMINAL #5(L1) ON THE FLAME SAFEGUARD (FSG). UPON A CALL FOR HEAT, THE CONTROL SYSTEM WILL CLOSE (BO#11) ON THE MAIN CTRL BRD (MCB), THUS ENERGIZING RELAY (R20). WHEN 120 VOLT POWER IS FURNISHED THROUGH THE SYSTEM ON-OFF SWITCH (S1), THROUGH THE BURNER ON-OFF SWITCH (S3), THROUGH RELAY (R20) CONTACTS, THROUGH THE HIGH LIMIT CONTROL (FLC) AND TERMINAL #6 ON THE FLAME SAFEQUARD (FSG) IS POWERED. THE FLAME SAFEGUARD THEN ENERGIZES ITS TERMINAL #4, WHICH POWERS THE BURNER COMBUSTION AIR BLOWER MOTOR (BM). WHENEVER POWER IS RESTORED TO THE FLAME SAFEGUARD, THE FLAME SAFEGUARD WILL GO THROUGH A 10 SECOND INITIATION PERIOD BEFORE THE PREPURGE PERIOD WILL BEGIN.

BLOWER OPERATION IS SENSED BY THE AIR SWITCH (AS), WHICH MAKES TERMINAL #6 TO #7. AFTER A 90 SECOND PREPURGE PERIOD, TERMINAL #8 (FIRST GAS VALVE (PILOT)--GV1) AND TERMINAL #10 (IGNITION TRANSFORMER--IT) WILL BE ENERGIZED. THE PILOT FLAME WILL IGNITE AND BE DETECTED BY THE FLAME SAFEGUARD THROUGH THE FLAME ROD (FD). UPON DETECTION OF PILOT FLAME, TERMINAL #10 (IGNITION TRANSFORMER--IT) WILL BE DE-ENERGIZED AND TERMINAL #9 (MAIN GAS VALVES--GV2 & GV3) WILL BE ENERGIZED AND THE MAIN FLAME WILL COME ON. ALSO, THE FLAME SAFEGUARD CONTAINS "LED'S" (LOWER LEFT CORNER) THAT WILL GLOW TO INDICATE OPERATION.

LOW FIRE START IS PROVIDED BY RELAY (R23). THE RELAY DRIVES THE GAS VALVE ACTUATOR (VM1) TO THE MINIMUM FIRING RATE POSITION WHENEVER THE FLAME IS NOT ON, AND HOLDS IT THERE UNTIL THE FLAME HAS LIT AND BEEN PROVEN.

WHENEVER THE BURNER IS IN OPERATION ITS FIRING RATE WILL BE DETERMINED BY THE "FLOATING" GAS VALVE ACTUATOR (VM1). THIS ACTUATOR POSITIONS THE BUTTERFLY GAS VALVE AND COMBUSTION AIR DAMPER AND CAN SET THE FIRING RATE BETWEEN 33% AND 100% OF NORMAL RATE. WHEN THE MAIN CONTROL SYSTEM CLOSES (BO#10) ON THE MAIN CTRL BRD.(MCB), THE GAS VALVE ACTUATOR WILL REPOSITION TOWARD A HIGHER FIRING RATE UNTIL EITHER (BO#10) OPENS OR THE ACTUATOR REACHES ITS MAXIMUM POSITION. WHEN THE MAIN CONTROL SYSTEM CLOSES (BO#9) ON THE MAIN CTRL BRD.(MCB), THE ACTUATOR WILL REPOSITION TOWARD A LOWER FIRING RATE. IF NEITHER (BO#9) OR (BO#10) ON THE MAIN CONTROL BOARD (MCB) ARE CLOSED THE ACTUATOR WILL REMAIN AT ITS PRESENT POSITION. THE HEATING CAPACITY IS MONITORED BY THE MAIN CONTROL BOARD (MCB) THROUGH (AI#10) VIA A POSITION FEEDBACK POTENTIOMETER ON THE ACTUATOR (VM1).

IN THE EVENT THE PILOT FAILS TO IGNITE OR THE FLAME SAFEGUARD FAILS TO DETECT ITS FLAME WITHIN 10 SECONDS, TERMINALS #4, 8, 9, AND 10 WILL BE DE-ENERGIZED, THUS DE-ENERGIZING THE BURNER. THE FLAME SAFEGUARD WOULD THEN BE ON SAFETY LOCKOUT AND WOULD REQUIRE MANUAL RESETTING. THE HEAT ALARM RELAY (R24) WOULD THEN BE ENERGIZED AND WOULD THEN ENERGIZE THE REMOTE "HEAT FAIL" INDICATOR LIGHT AND SEND A FAIL SIGNAL TO BINARY INPUT #5 ON THE MICROTECH II MAIN CONTROL BOARD (MCB).

IF THE UNIT OVERHEATS, THE HIGH LIMIT CONTROL (FLC) WILL CYCLE THE BURNER, LIMITING FURNACE TEMPERATURE TO THE LIMIT CONTROL SET POINT.

PIPING DIAGRAM

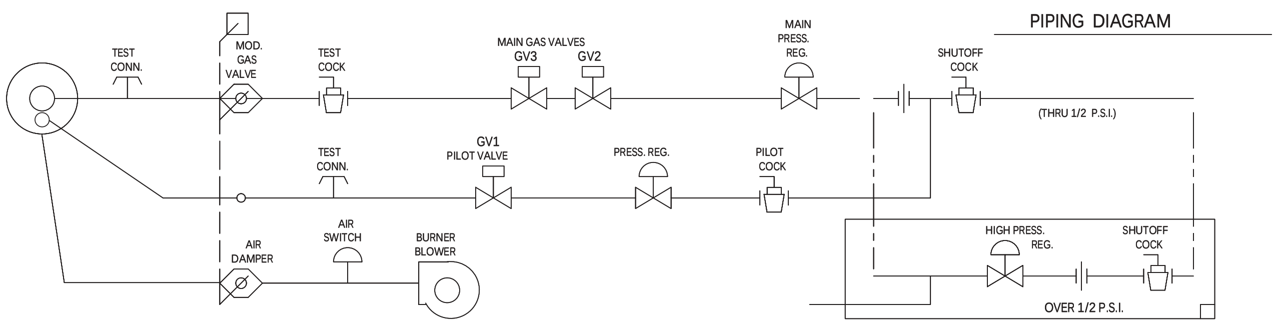


Figure 84. RPS 60 condensing unit control (with scroll compressors)

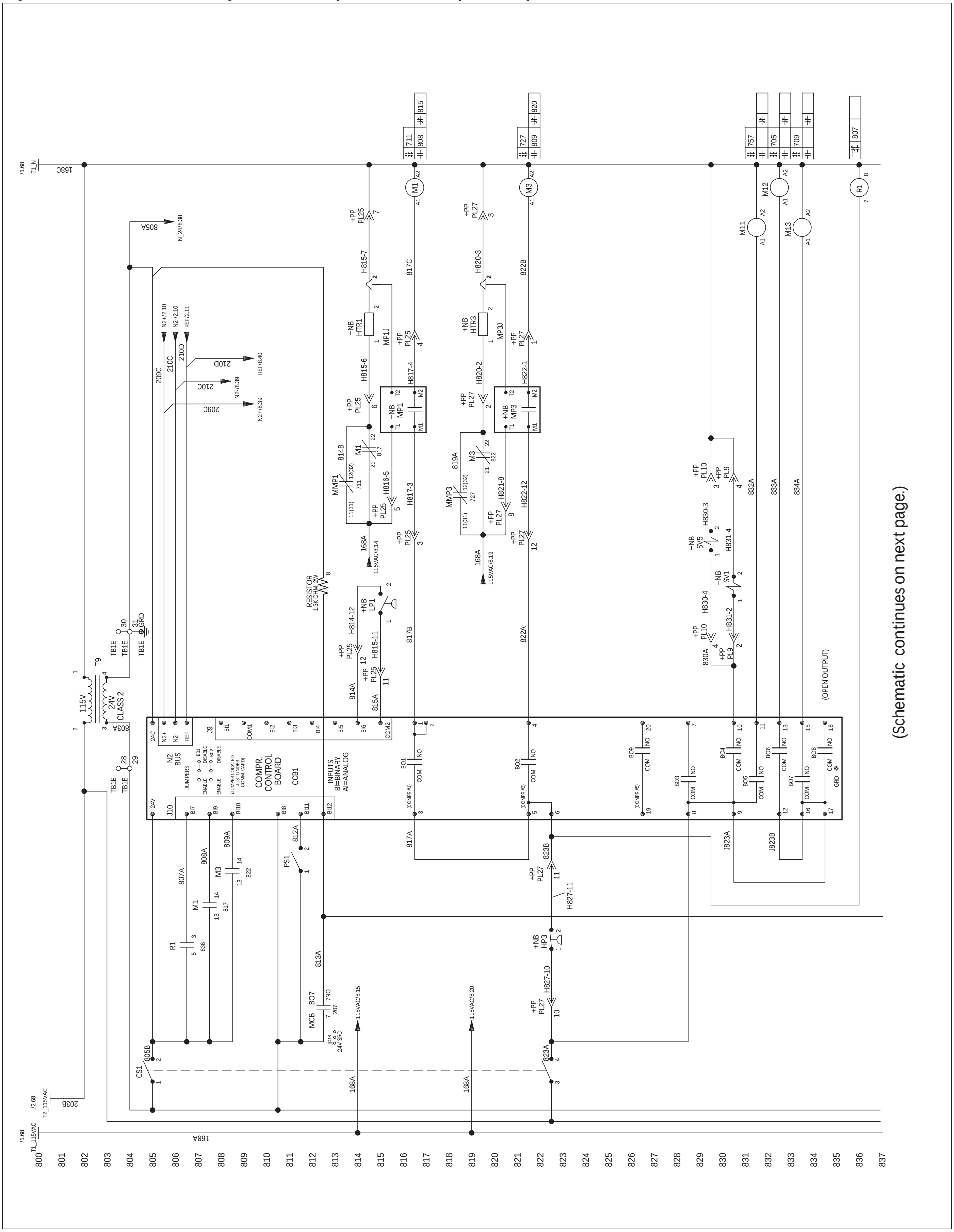


Figure 84. RPS 60 condensing unit control (with scroll compressors), continued

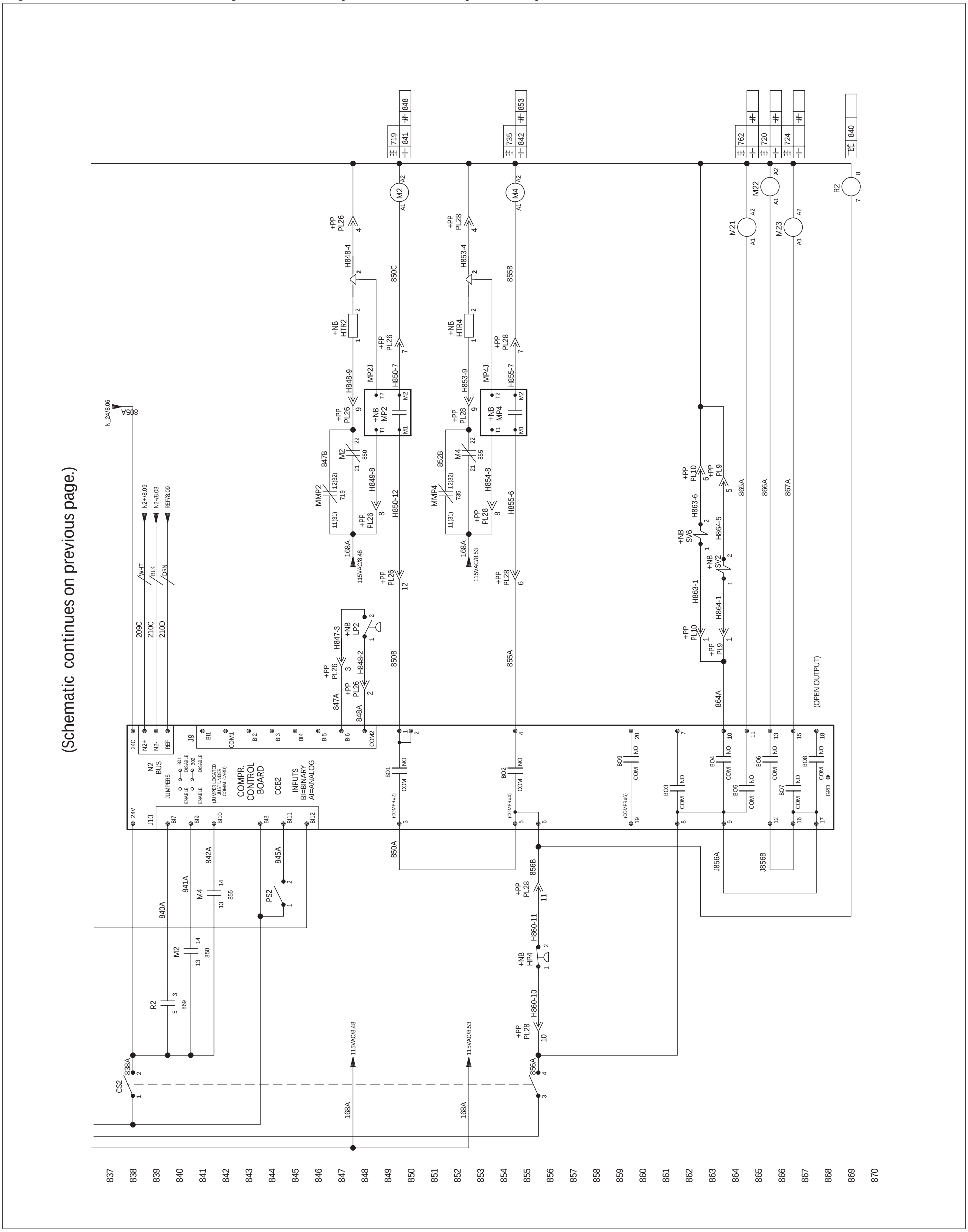


Figure 85. RPS 135 condensing unit control (with reciprocating compressors)

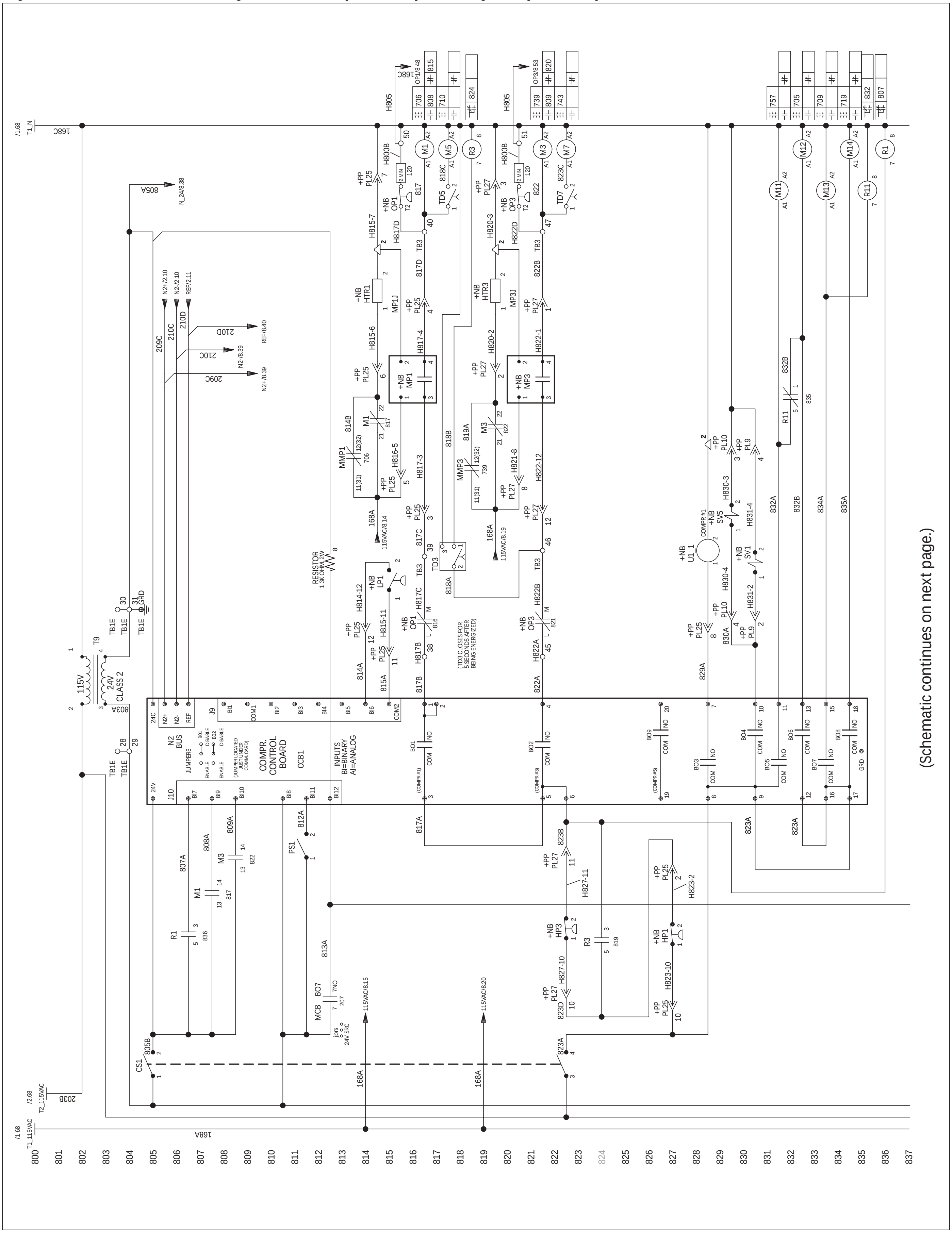


Figure 85. RPS 135 condensing unit control (with reciprocating compressors), continued

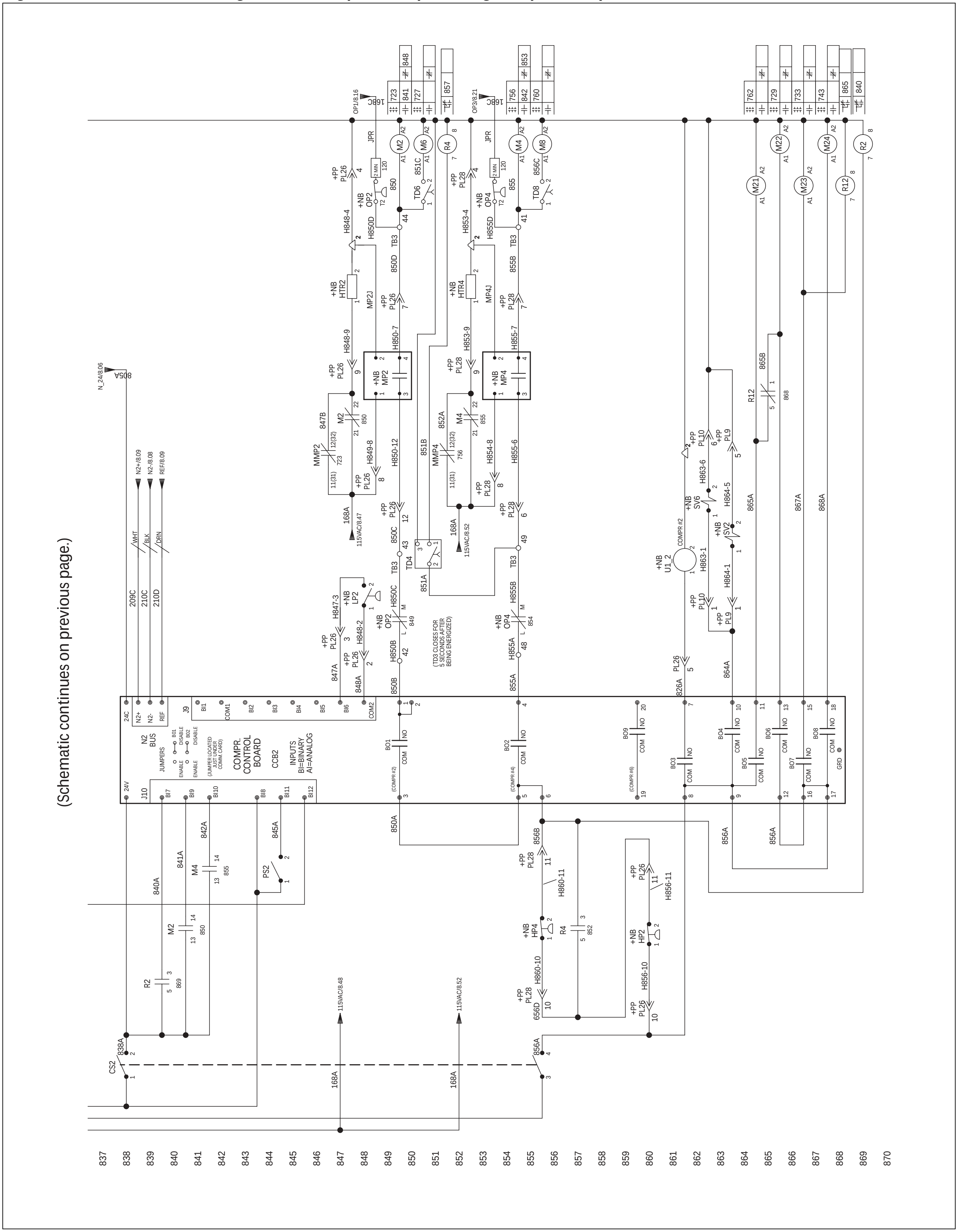


Figure 86. CV fan control (SAF and RAF)

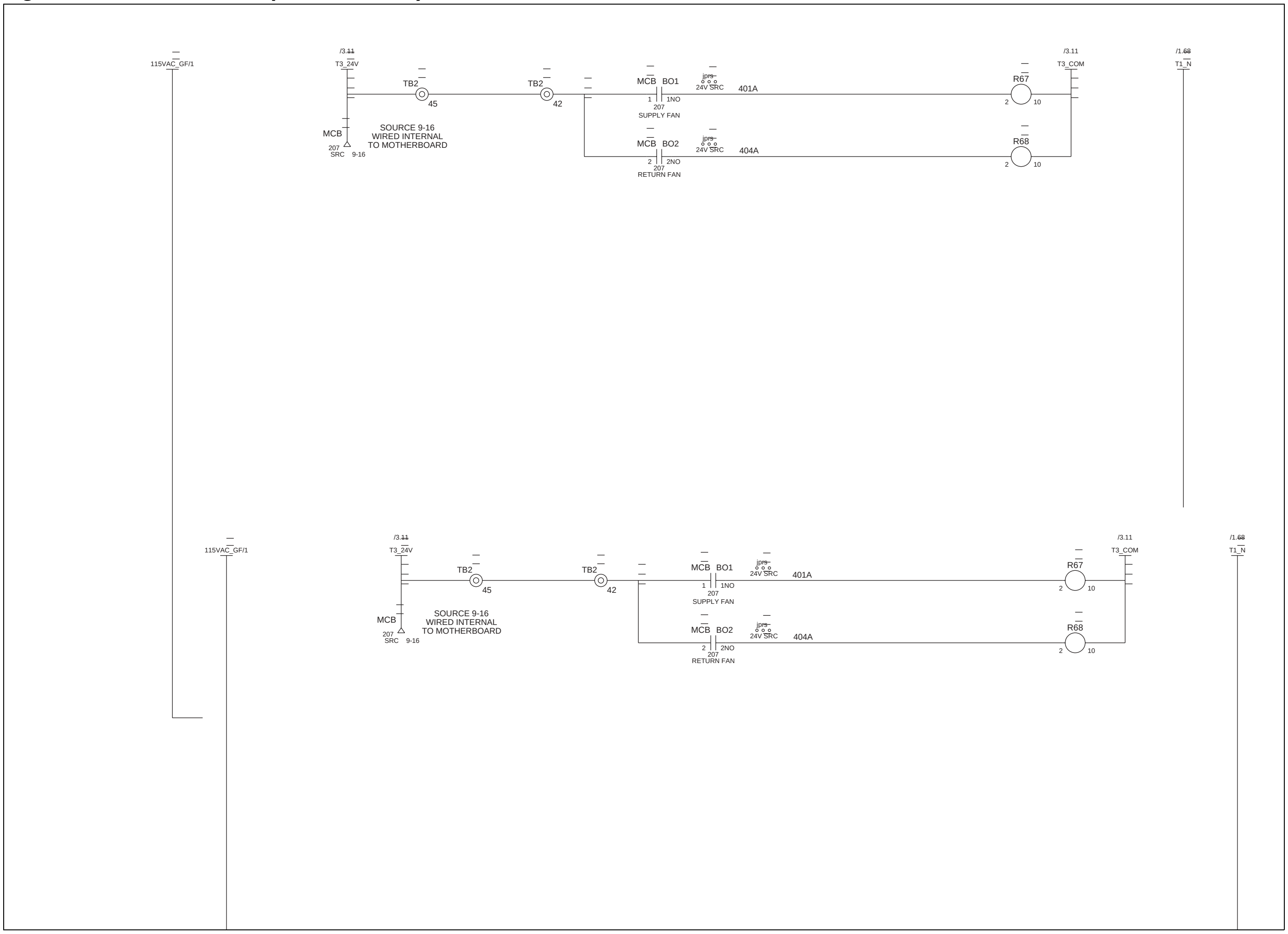
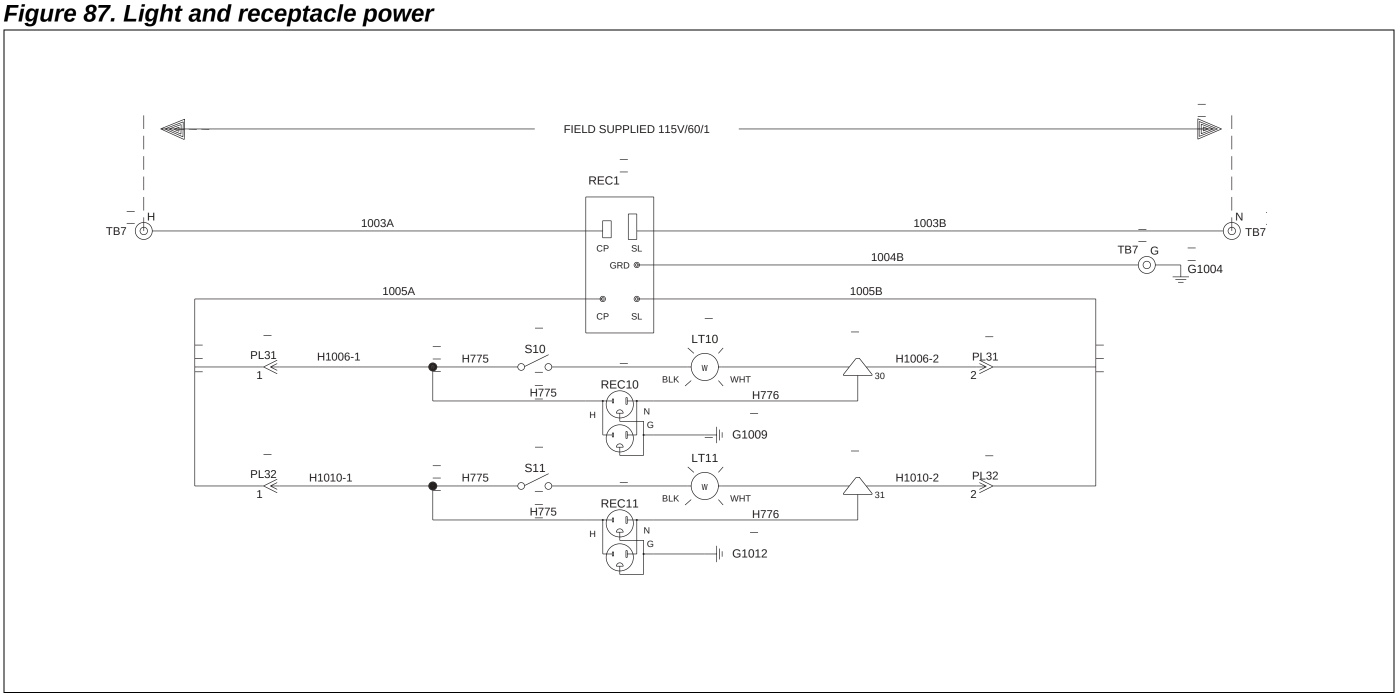


Figure 87. Light and receptacle power



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 23 shows the control points at 50% RH for settings A through D. Figure 88 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 23: 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)

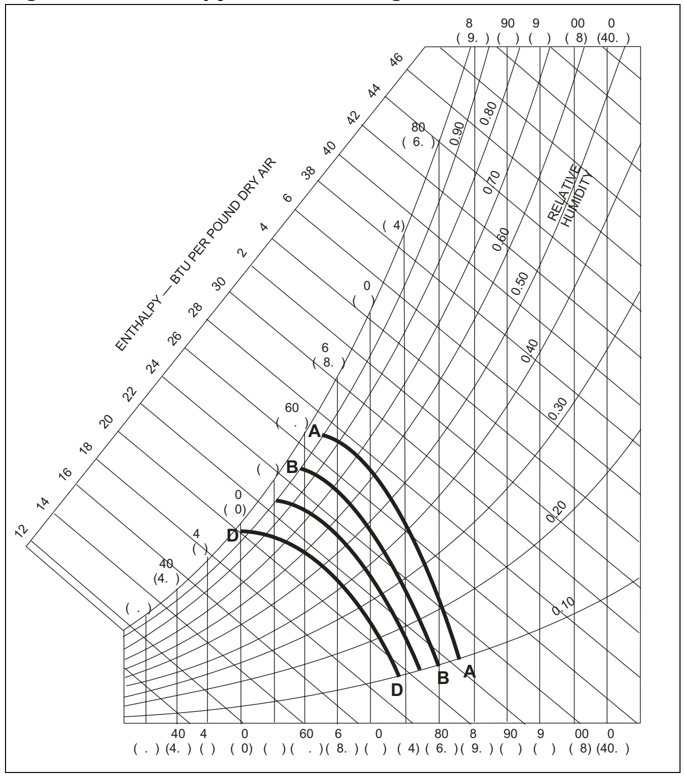
Differential Enthalpy Control (OAE/RAE)

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 88. Enthalpy control settings



Phase Voltage Monitor (see page 120)

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.

Hot Gas Bypass

Hot gas bypass is a system for maintaining evaporator pressure at or above a minimum value. The purpose for regulating the hot gas into the distributor is to keep the velocity of the refrigerant as it passes through the evaporator high enough for proper oil return to the compressor when cooling load conditions are light.

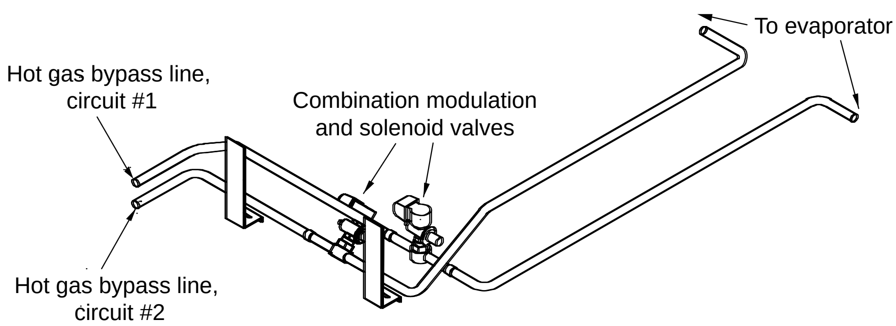
The system consists of a combination of solenoid valves and a pressure regulating valve as shown in Figure 89. The solenoid valves are factory wired to open whenever the controller calls for the first stage of cooling. The pressure regulating valve starts to modulate open at 57 psig (393 kPa).

The regulating valve opening point can be determined by slowly reducing the system load or reducing the required discharge air temperature setting while observing the suction pressure. When the bypass valve starts to open, the refrigerant line on the evaporator side of the valve will begin to feel warm to the touch.

⚠ CAUTION

Do not touch gas liner during valve checkout. The hot gas line can become hot enough in a short time to cause personal injury.

Figure 89. Hot gas bypass system



SpeedTrol™ (N/A Unit Sizes 015C to 030C)

McQuay's SpeedTrol system of head pressure control operates in conjunction with FanTrol by modulating the motor speed of the last condenser fan of each refrigeration circuit in response to condenser pressure. By varying the speed of the last condenser fan of each refrigeration circuit, the SpeedTrol option allows mechanical cooling operation in ambient temperatures down to 0°F (–18°C). SpeedTrol controllers SC11 and SC21 sense refrigerant head pressure and vary the fan speed accordingly. When the pressure rises, SpeedTrol increases the fan speed; when the pressure falls, SpeedTrol decreases the fan speed. The SpeedTrol controller's throttling range is 140 to 200 psig (1212 to 1318 kPa) fixed.

The SpeedTrol fan motor is a single phase, 208/240 volt, thermally protected motor specially designed for variable speed application. Units with 460 volt power have a transformer mounted inside the condenser fan compartment to step the voltage down to 230 volts for the SpeedTrol motor. A portion of a typical SpeedTrol power circuit schematic is shown in Figure 90.

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."

Smoke and Fire Protection

Daikin 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

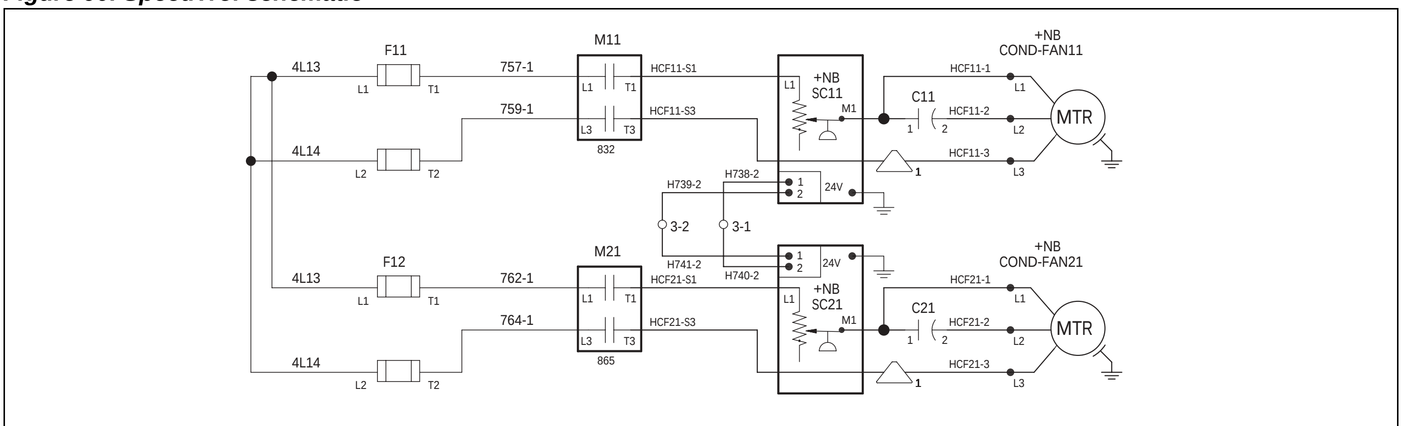
Optional smoke detectors can be located at the supply and return openings. The wiring for these smoke detectors is shown on any of the "Typical Main Control Circuit" wiring schematics within the "Wiring Diagrams" section on pages 65–85.

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 (OM 138 or OM 137).

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

Figure 90. SpeedTrol schematic



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 (OM 138 or OM 137).

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 (OM 138 or OM 137).

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 (OM 138 or OM 137).

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 91.

Cable and Wiring Recommendations

Remote wiring to connect the unit to the remote UI is not included. See Figure 92 on page 92 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 91. Factory-assembled remote user interface

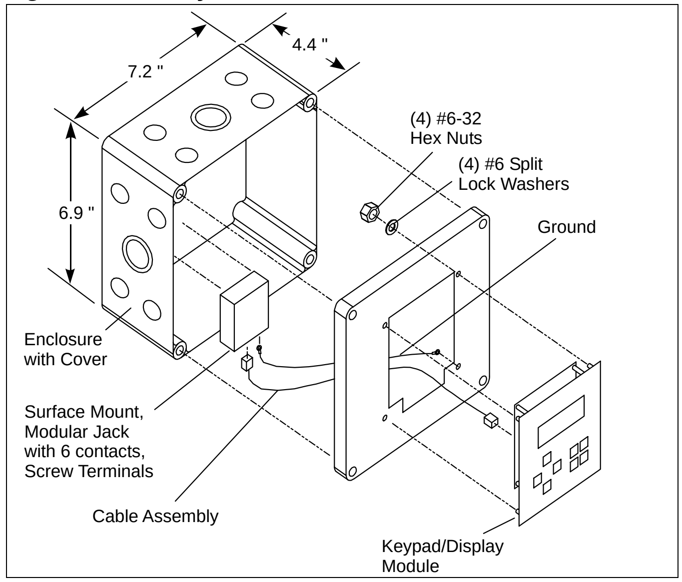
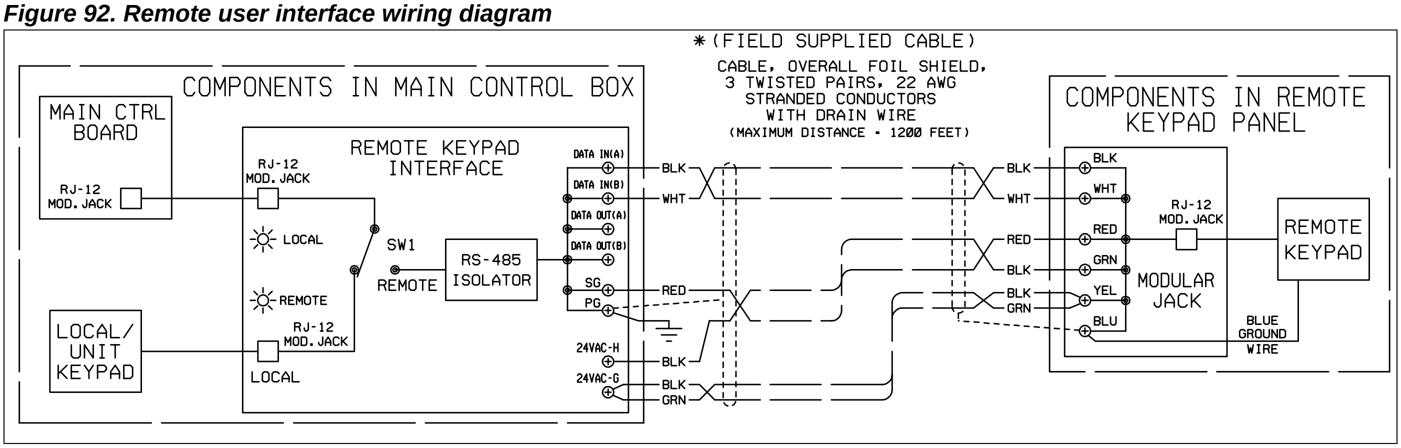


Figure 92. Remote user interface wiring diagram



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 (Figure 93). 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.

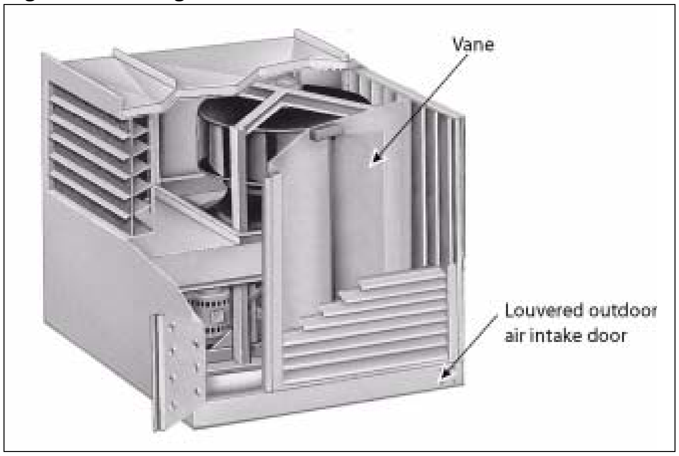
Accurately leveling a station involves applying a precise mechanical force against the vane. This force should cause the vane to move to a specific position if the DesignFlow unit is correctly leveled.

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 93).

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 93).
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 93. 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.

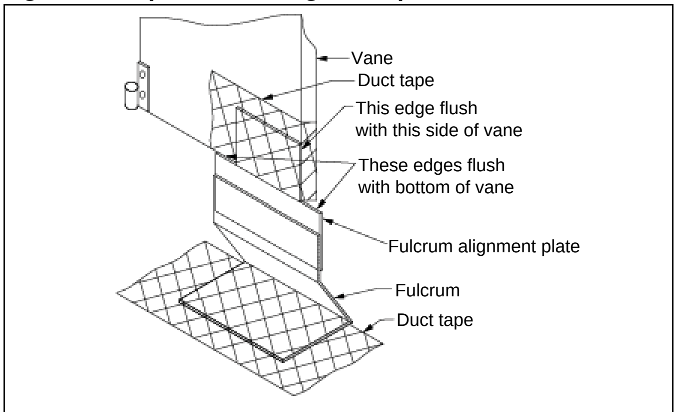
   Do this by viewing the *LH Lvl Pos=* or *RH Lvl Pos=* parameter in the DesignFlow setup menu. The *LH Lvl Pos=* parameter indicates the current position of the vane for the left-hand DesignFlow station (side opposite the control panel). The *RH Lvl Pos=* parameter indicates the current position of the 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 94) 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.

Figure 94. Tape fulcrum alignment plate to vane



9 Locate and install the fulcrum used in the leveling procedure as follows (see Figure 94):

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 97*)*.

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.

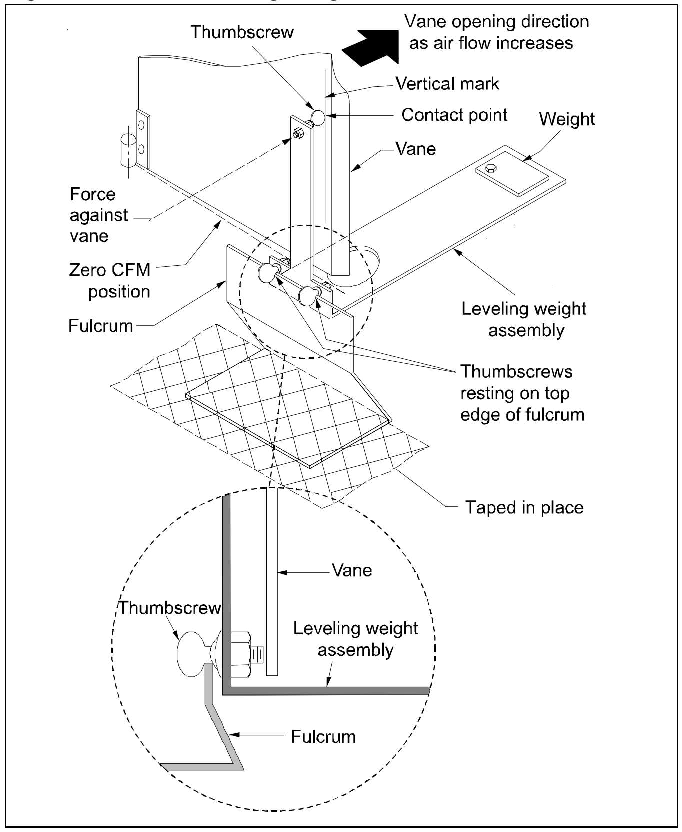
13 Rest the leveling weight assembly on the fulcrum, as shown in Figure 95, so that:

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 95. 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 **22.56% to 23.02% (22.79% is ideal)**, 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.

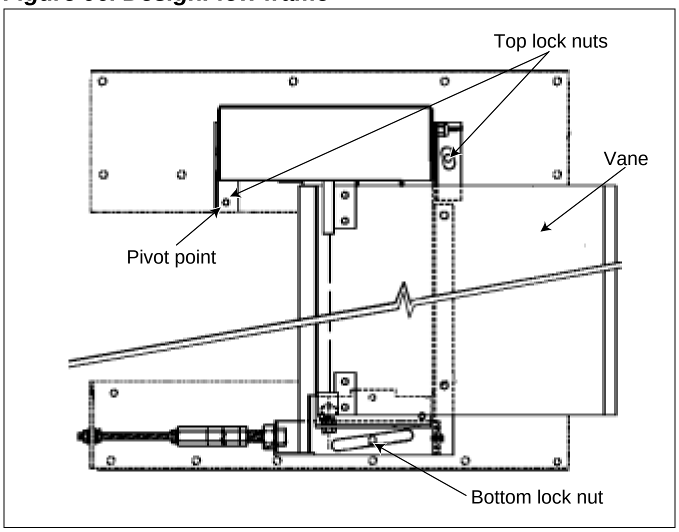
Making Level Adjustments

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 96). 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 96.)

Figure 96. 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 97).
5. Loosen the .25-20 NC lock nut in the slotted hole at the bottom of the DesignFlow frame. (See Figure 98.)
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 98.

   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 98.

   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 98).

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 98.)

Note: Make sure the leveling weight's top thumbscrew is still against the vertical alignment mark on the vane.

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.

Note: If large adjustments are required to correctly level the vane assembly, before rechecking the level, relocate the fulcrum as described in Step 9 in "DesignFlow Station Startup" on page 93.

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 96.)
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, remove the fulcrum and replace the access opening cover in the louvered door.

Figure 97. Remove covers from access opening

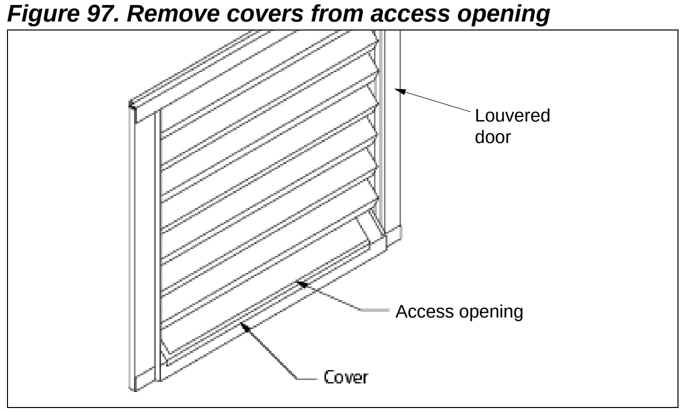
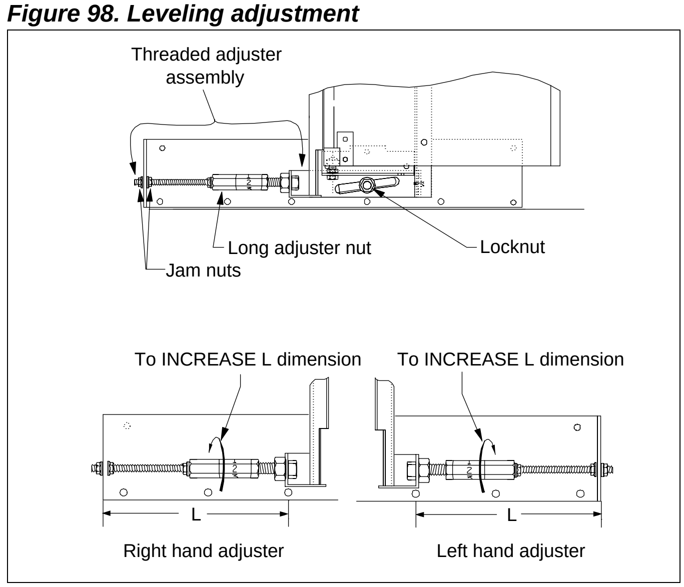


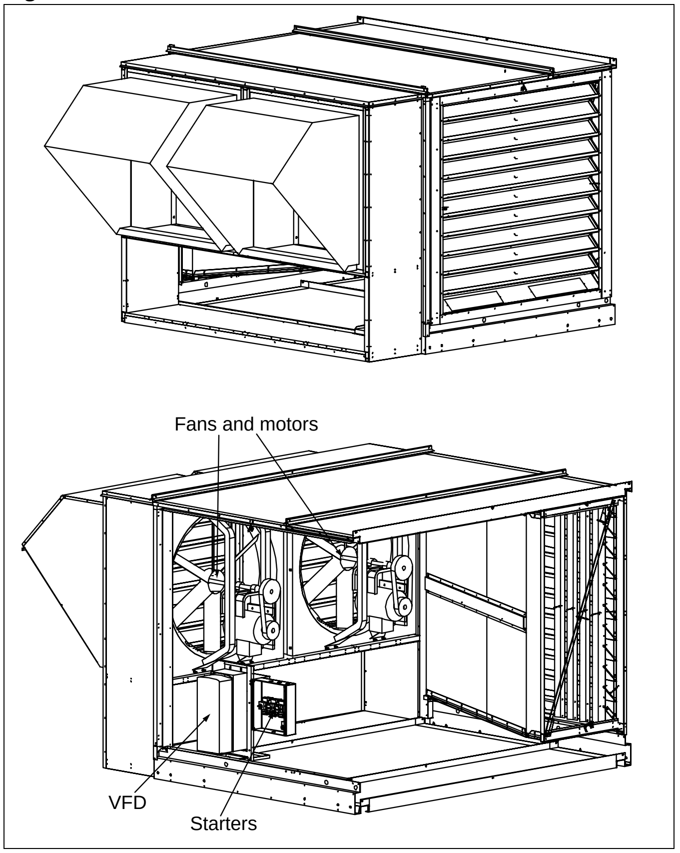
Figure 98. Leveling adjustment



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 99. Two fans with back return shown



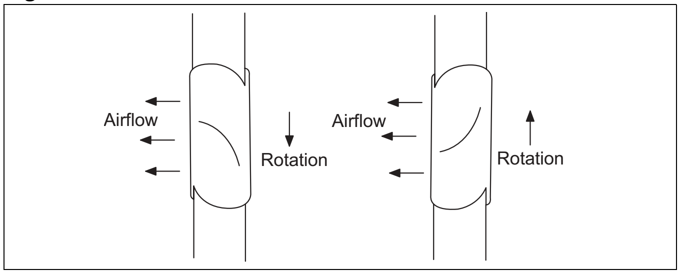
Prestarting Checks

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 100 on page 96. 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 100. 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 101.

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 102.

⚠ WARNING

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

Figure 101. Belt adjustment

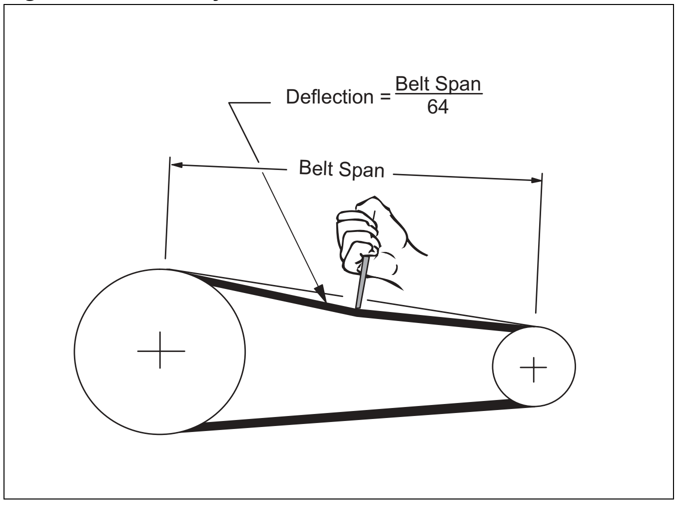


Figure 102. Drive pulley alignment

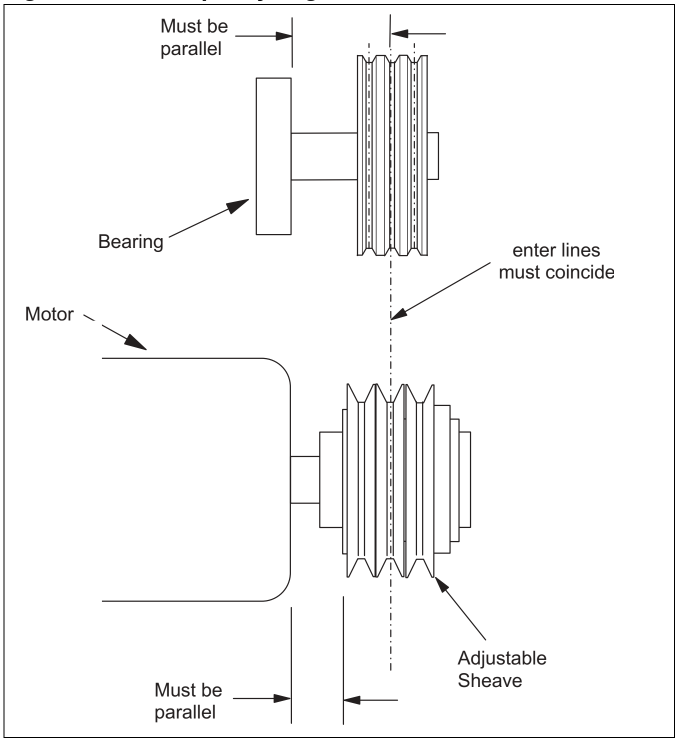
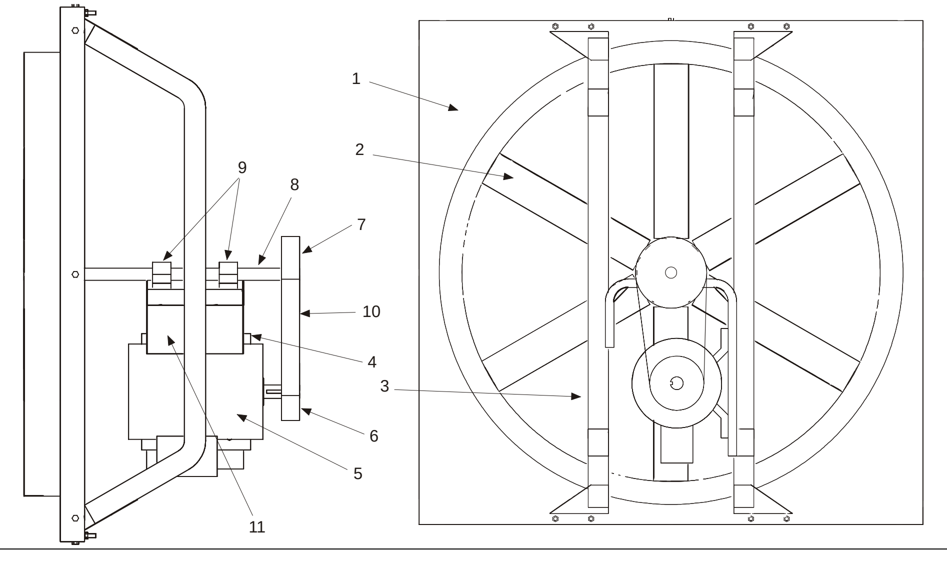


Table 24: Propeller exhaust fan troubleshooting

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 96
	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 103. Propeller exhaust fan replacement parts list



1. Fan panel
2. Propeller
3. Drive frame channel (2)
4. Motor plate
5. Motor
6. Motor pulley
7. Shaft pulley
8. Fan shaft
9. Bearings
10. Belt
11. Bearing plate

Bearings

Bearings are the most critical moving part of the fan; inspect them at periodic intervals. Check locking collars, set screws, and fasteners that attach bearings to the bearing plate for tightness. In a clean environment and temperatures above 32°F/below 200° F, lubricate fan shaft bearings with grease fittings 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. Pay particular attention to setscrews attaching the propeller to the shaft and the shaft to the bearings. Loose bearing set screws 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. Oil motors equipped with oil holes 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. Grease motors supplied with grease fittings according to directions printed on the motor.

Removing 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, see the operation manual supplied with the unit (OM 138 or OM 137).

Exhaust Fan Troubleshooting

Table 24 provides guidelines for troubleshooting problems with the propeller exhaust fan options. A list of parts is provided in Table 103.

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.

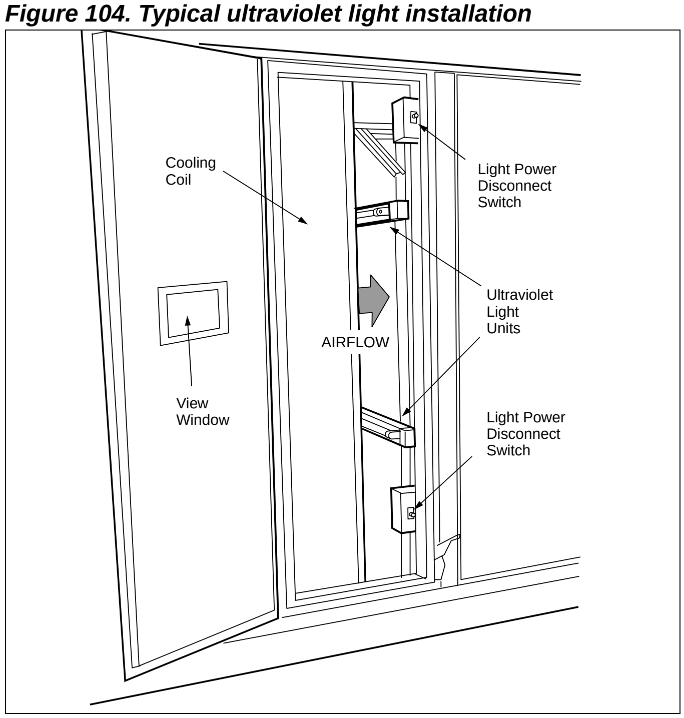
UV Light Power Disconnect switches (two per door) are factory installed on every door that allows a direct line of sight to the UV lamps when opened. These switches are designed to prevent UV exposure when cabinet doors are opened and must not be disabled.

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 104. Typical ultraviolet light installation

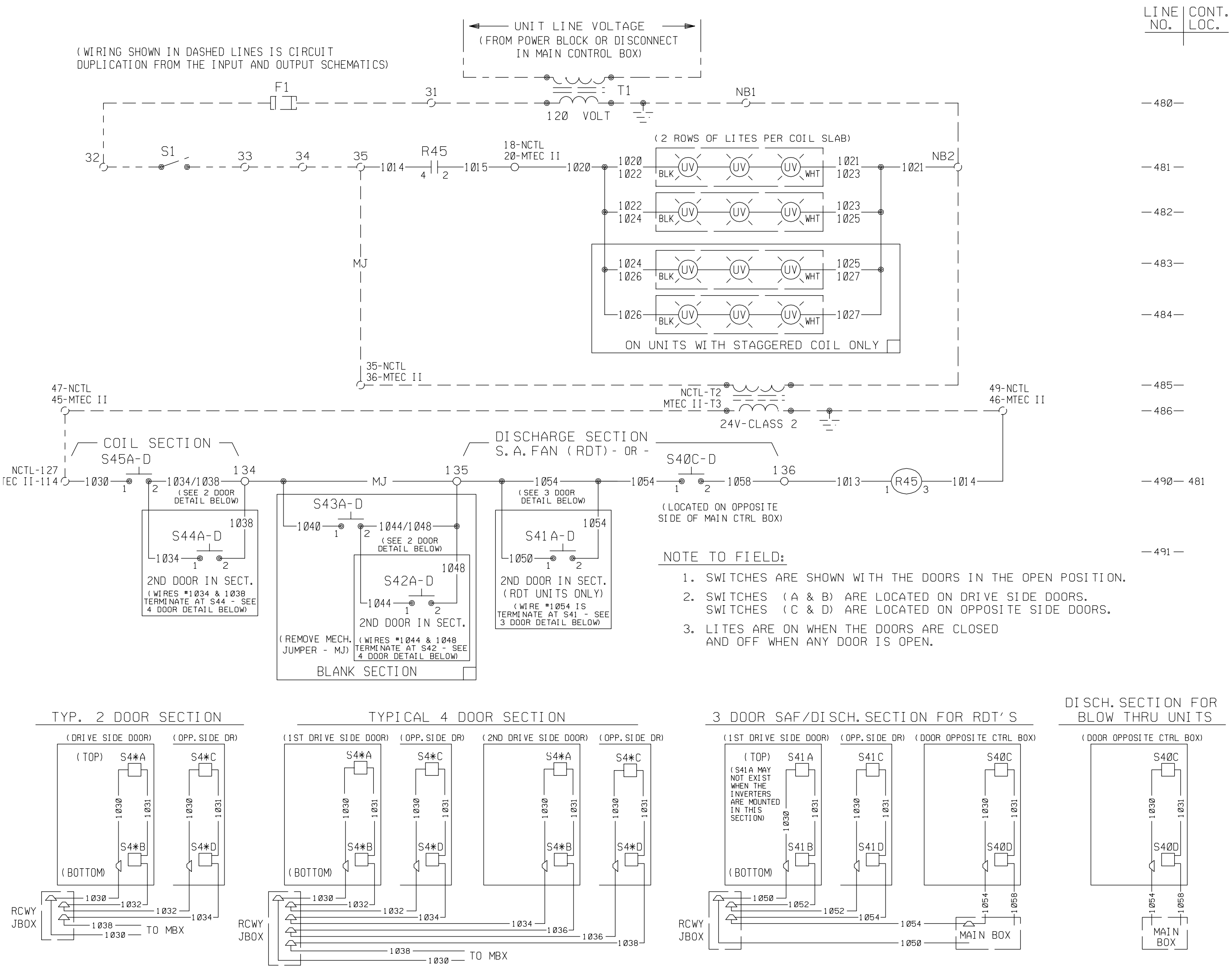


Ultraviolet Light Operation

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 105. Typical ultraviolet light wiring schematic



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 Daikin Applied.

⚠ 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 119 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. May 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.

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 evaporator condensate drain is trapped and that the drain pan is level.
13. If unit is curb mounted, verify that the curb is properly flashed to prevent water leakage.
14. 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.
        - – Turn compressor control circuit switches CS1, CS2 to OFF.
        - – Turn liquid line solenoid valve switches PS1 and PS2 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 to change the keypad entry under *Setup/Service \ Unit Configuration \ Space Sensor=* from YES to NO.

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 "RDT spring mount hold down fasteners" on page 56.
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 104.

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 88 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.

Compressor Startup

With the supply and return fans operational, prepare for compressor operation.

⚠ CAUTION

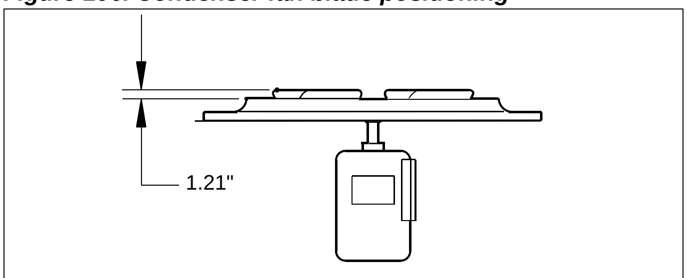
Low ambient temperature hazard. Can cause compressor damage.
Do not attempt to start up and check out the refrigeration system when the outdoor air temperature is below 50°F unless the unit is specially equipped for low ambient operation.

The unit is shipped with refrigeration service valves closed. Backseat (open) the discharge (suction on sizes 115 to 135), and liquid line valves. Connect service gauges and crack the valves off the backseat position (one turn forward). Verify that the unit has not lost its refrigerant charge.

Verify that the crankcase heaters are operating. These should operate for at least 24 hours before starting the compressors.

Verify that the condenser fan blades are positioned properly and that the screws are tight (see Figure 106). The fan blade must be correctly positioned within its orifice for proper airflow across the condenser coils.

Figure 106. Condenser fan blade positioning



Scroll Compressor Rotational Direction (sizes 15 to 105)

Scroll compressors only compress in one rotational direction. Three-phase compressors rotate in either direction depending upon phasing of the power to L1, L2, and L3. Since there is a 50/50 chance of connecting power to cause rotation in the reverse direction, verify that the compressor rotates in the proper direction after the system is installed. If the compressor is rotating properly, suction pressure drops and discharge pressure rises when the compressor is energized. If the compressor is rotating in reverse, the sound level is louder and current draw is reduced substantially. After several minutes of operation, the compressor's internal protector trips.

All three-phase compressors are wired the same internally. Therefore, once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the same terminals should maintain proper rotation direction.

Perform the following procedure on all units:

1. At the keypad, set the cooling setpoint low enough so that the controller will call for cooling. The value in *Temperature \ Zone Cooling \ Occ Clg Spt=* will need to be adjusted below the temperature shown in *Temperature \ Zone Cooling \ Control Temp=*. In addition, on DAC units, the value in *Temperature \ Discharge Cooling \ DAT Clg Spt=* will need to be adjusted below the temperature shown in *Temperature \ Discharge Cooling \ Disch Air=*.
2. Place the unit into cooling mode through the keypad menu *System Summary \ System \ Ctrl Mode= Cool Only.*
3. Verify that the low ambient compressor lockout temperature setpoint, *Temperature \ OA Damper \ OATComp Lock=* is set below the current outside air temperature (shown in *System Summary \ Temperatures \ OA Temp=*).

Note: Do not attempt to operate the compressors if the outdoor air is too cool. See the warning statement under "Compressor Startup" on page 102.

4. Turn the compressor control circuit switch CS1 and the pump-down switch PS1 to ON. Now refrigeration circuit #1 is enabled and circuit #2 is disabled. After CS1 is closed, the MT II board starts its 5-minute timing cycle. Note that if the unit has an economizer and the outdoor air enthalpy is low, the economizer must fully open before the controller will energize mechanical cooling.
5. When the outdoor air damper has fully opened and the time delay has expired, liquid line solenoid valve SV1 should open. If the solenoid valve does not open, do the following:
   - **a** Verify that there is a call for cooling by checking the keypad menu *System Summary \ System \ UnitStatus=*. This should be in *Cooling*.
   - **b** Check the keypad menu *System Summary \ System \ Clg Status=*. The compressors will only run if this reads either *All Clg* or *Mech Clg*.
   - **c** For sizes 115 to 135 units only; manually reset oil pressure safeties if they have tripped.
   - **d** Trace the control circuits.

NOTICE

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

6. Verify that compressor #1 starts. On units without optional low ambient start, the compressor should start shortly after the solenoid valve opens. On units with low ambient start, the compressor should start when the solenoid valve opens. If the compressor motor hums but does not run, verify that it is getting three-phase power.
7. The compressor should operate continuously while there is a call for cooling. If a reciprocating compressor (size 115 to 135C only) trips on oil pressure, see "Oil Pressure (sizes

115 to 135C only)” on page 103. If the compressor cycles on its low pressure switch, do the following:

- **a** Verify that the circuit is not short of refrigerant.
- **b** Check for low airflow.
- **c** Check for clogged filters.
- **d** Check for restricted ductwork.
- **e** Check for very low temperature return air entering the unit.
- **f** Verify that the liquid line components, expansion valve, and distributor tubes are feeding the evaporator coil.
- **g** Verify that all air handling section panels are closed.
- **h** Verify that the suction service valve (size 115 to 135 only) and the liquid line service valves are completely open.

8 Verify that the compressors stage properly. As the circuit loads up the second compressor (if available) will be energized. Any unloaders (reciprocating compressors only) are energized when unloaded. For more information on staging sequences, see the *Binary Outputs-Auxiliary Control Boards* section of bulletin IM 696, “MicroTech II Applied Rooftop Unit Controller.”

9 Verify that the condenser fans are cycling and rotating properly (blowing air upward). When the compressor starts, at least one condenser fan should also start. The CCB1 should control the remaining condenser fans based on outdoor air conditions. Look at keypad *menu Setup/ Service \ Compressor Setup \ Cond Fan1*= (also look at *Cond Fan2*=, *Cond Fan3*=, *Cond Fan4*=). Tables 4 and 5 on page 20 shows recommended setpoints based on the unit size. Cond Fan1 controls BO5, Cond Fan2 controls BO6, Cond Fan3 controls BO7, Cond Fan4 controls BO8. Refer to the unit wiring diagrams and “Condenser Fan Arrangement” on page 4.

10 Check the oil level in the compressor sightglass. If low oil is observed, it is possible that liquid refrigerant is returning to the compressor. Check the suction superheat, see “Expansion Valve Superheat Adjustment” on page 103. It should be between 10°F (5.5°C) and 13°F (7.2°C). See “Expansion Valve Superheat Adjustment” below.

11 Close solenoid valve SV1 by turning switch PS1 to OFF The circuit should pump down and then the compressor(s) should stop. Place the unit into the “Fan Only” mode through the keypad menu *System Summary \ System \ Ctrl Mode= Fan Only.*

12 Check refrigerant circuit #2 by repeating steps 2 through 9, substituting circuit #2 nomenclature for circuit #1 nomenclature (CS2, PS2, TD2, SV2, CCB2, and compressor #2 (and #4).

Note: The unit is wired for one time pumpdown. The compressor will not restart on the off cycle even if the low pressure switch closes due to small leaks in the solenoid valve or compressor check valve.

13 Verify that the condenser refrigerant subcooling at full capacity is between 13 and 20°F.

Expansion Valve Superheat Adjustment

It is very important that the expansion valve superheat setting be adjusted to be between 10° F (–12° C) and 13° F (–11° C). Insufficient superheat will cause liquid floodback to the compressor which may result in slugging. Excessive superheat will reduce system capacity and shorten compressor life.

Turn the adjustment stem clockwise to increase superheat. Not exceeding one turn, adjust the stem and then observe the superheat. Allow up to 30 minutes for the system to rebalance at the final superheat setting.

On refrigeration circuits with multiple expansion valves, the superheat adjustment should be approximately the same for all valves in the circuit.

R-407C Superheat

Due to refrigerant glide, when measuring and/or adjusting TEV superheat, it is important to use SATURATED VAPOR (Dew Point) TABLES. Example: The Pressure/Temperature (P/T) chart shows that the saturated vapor temperature, at the dew point, of R-407C for 79 psig is approximately 51°F. If the actual refrigerant temperature is 60°F, the superheat is 9°F.

Checking Superheat

Following are recommendations for checking superheat:

1. Close the unit section doors. Running the unit with its doors open will affect expansion valve and system operation considerably.
2. For units with one expansion valve per circuit, check the pressure and temperature at the compressor suction valve.
3. For units with multiple expansion valves per circuit, check the pressure at the compressor, and check the temperature at the suction header that is fed by the valve.

Oil Pressure (sizes 115 to 135C only)

When the compressor has operated long enough to stabilize conditions, proper oil pressure should be maintained. The actual oil pressure value varies from compressor to compressor and depends upon the temperature, oil viscosity, compressor size, and the amount of clearance in the compressor bearings. Oil pressure values from 20 psi to 60 psi (138kPa to 414 kPa) (over suction pressure) are not uncommon.

The oil level in the compressor sightglass can vary widely and depends upon the same factors listed above. In fact, it is not unusual for two compressors that serve the same circuit to have very different oil levels. Therefore, it is recommended that oil pressure, not sightglass level, be used to judge whether there is enough oil in a refrigerant circuit. If the oil pressure is low, add additional. Refer to page 43 to find acceptable refrigerant oils.

Note: If low oil level is accompanied by heavy foaming visible in the oil sightglass, it is possible that excess liquid refrigerant is returning to the compressor depending on the rotation of the crank shaft. Check the suction superheat and adjust the expansion valve for 10°F (–12°C) to 13°F (–11°C) of superheat. If proper superheat is obtained, sightglass foaming is not a concern.

For RCS/RFS applications in which the condensing section is remote from the air handling section, consideration should have been given to proper piping between the sections, as this can affect the compressor oil level. Refer to the “ASHRAE Handbooks” for more information on proper refrigeration piping design and installation.

Heating System Startup

General

1. At the keypad, set the heating setpoints high enough so that the controller calls for heating.Adjust the value in *Temperature \ Zone Heating \ Occ Htg Spt*= above the temperature shown in *Temperature \ Zone Heating \ Control Temp*=. In addition, on DAC units, adjust the value in *Temperature \ Discharge Heating \ DAT Htg Spt*= 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 IM 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 106. 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.

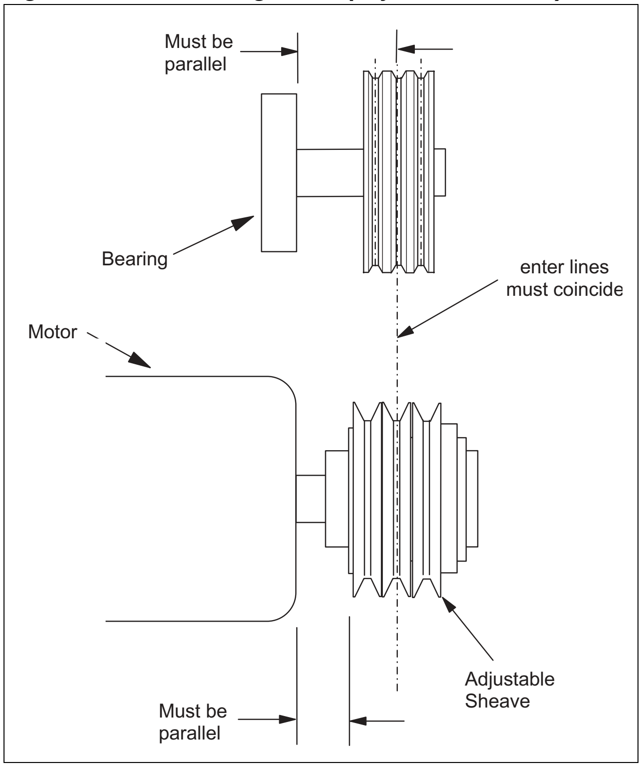
> ⚠ **WARNING**
>
> **Rotating parts can cause severe personal injury or death.**
> Replace all belt/fan guards that are temporarily removed for service.

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 107.
2. Verify that all setscrews are torqued to the values shown in Table 28 on page 115 before starting drive. Check setscrew torque and belt tension after 24 hours of service.

Figure 107. Sheave alignment (adjustable shown)



Drive Belt Adjustment

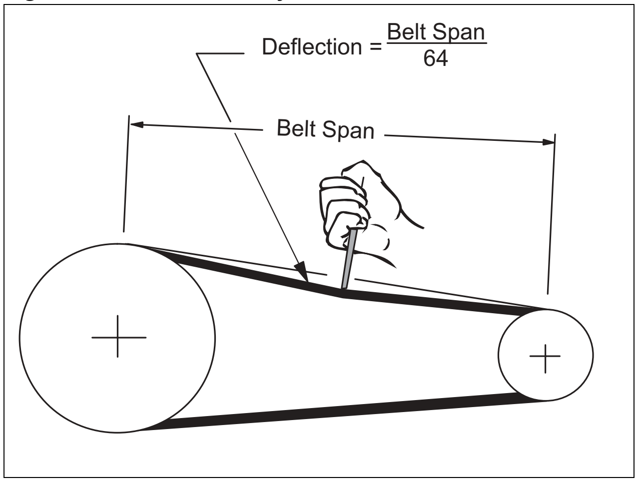
General Rules of Tensioning

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–
3. 48 hours of operation.
4. Over tensioning shortens belt and bearing life.
5. Keep belts free from foreign material which may cause slippage.
6. 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

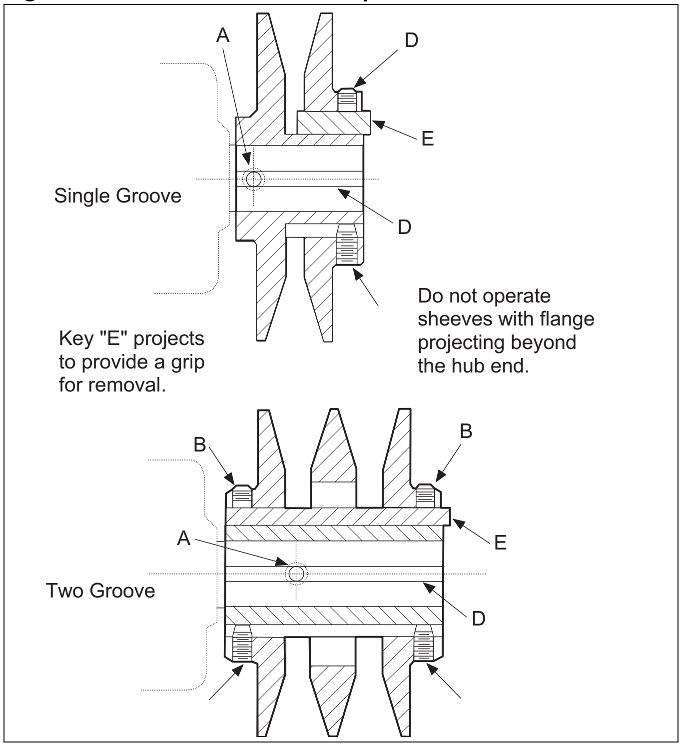
1. Measure the belt span. See Figure 108.
2. Place belt tension checker squarely on one belt at the center of the belt span. Apply force to the checker, perpendicular to the belt span, until the belt deflection equals belt span distance divided by 64. Determine force applied while in this position.
3. Compare this force to the values on the drive kit label found on the fan housing.

Figure 108. Drive belt adjustment



Mounting and Adjusting Motor Sheaves

Figure 109. 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 109 on page 106).
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 109*)*. 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 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 110 on page 107). 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 110 on page 107).
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. **To ensure the same pitch diameter for satisfactory operation, move both movable flanges the same number of turns. 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
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 retension 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 110. LVP variable pitch sleeves

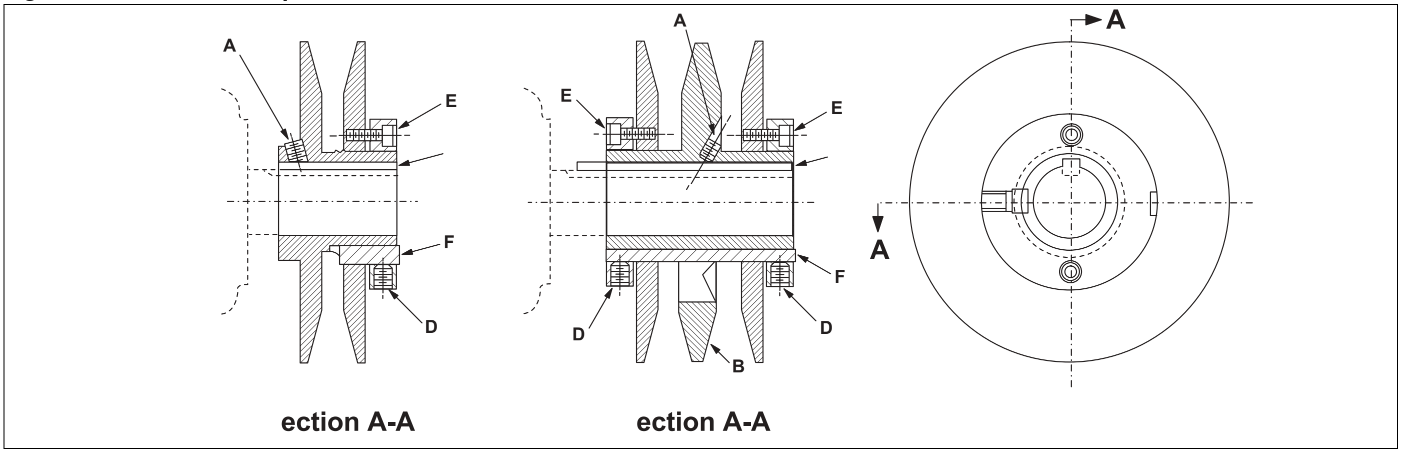


Figure 111. MVP variable pitch sheaves (type A-B)

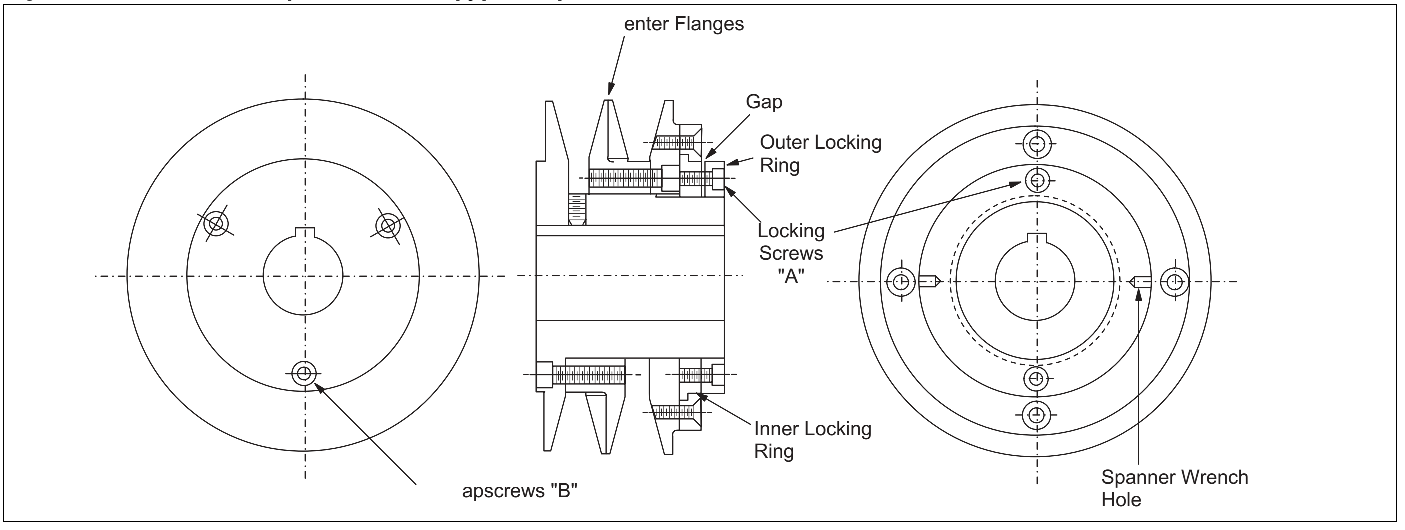
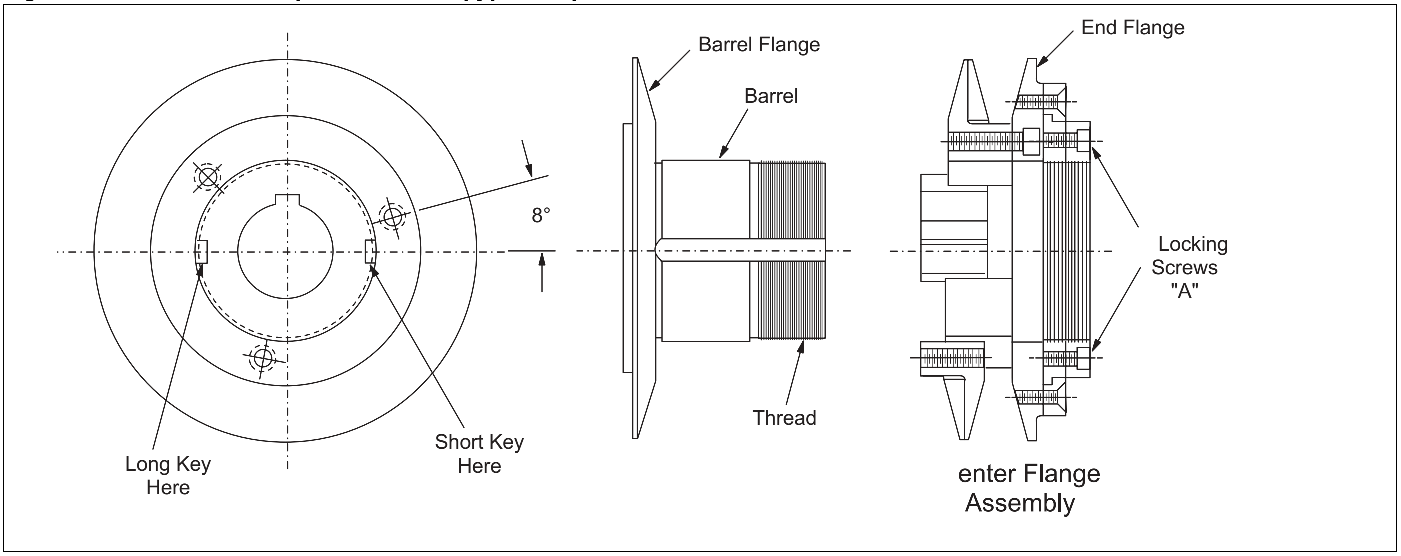


Figure 112. MVP variable pitch sheaves (type A–B)



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. Turn compressor control switches CS1 and CS2 to ON.
4. Turn liquid line solenoid switches PS1 and PS2 to ON.
5. 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.
6. 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 *
7. 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.
8. Set the high ambient heat lockout temperature setpoint, *Temperature \ Zone Heating \ OAT Htg Lock=* as required.
9. Set the alarm limits as required in *Setup/Service \ Alarm Limits *.
10. Set the compressor lead/lag function as desired using keypad menu *Setup/Service \ Compressor Setup \ Lead Circuit=* and *Setup/Service \ Compressor Setup \ Comp Ctrl=*. Refer to "*Compressor Staging*" in Bulletins OM137 and OM138.

Note: If the unit has hot gas bypass on circuit #1 only, lead circuit must always be *#1*.

11. Set the duct static pressure control parameters as required in keypad menu *Airflow \ Duct Pressure *.
12. Set the building static pressure control parameters as required in keypad menu *Airflow \ Bldg Pressure *.
13. Set the fan tracking parameters as required in keypad menus *Setup/Service \ Fan Tracking Setup * and *Setup/ Service \ Fan Balance *.
14. Set the economizer control parameters as required in keypad menu *Temperature \ OA Damper *.
15. Set the control timers as required in keypad menu *Setup/Service \ Timer Settings *.
16. Set the date and time in keypad menu *Setup/Service \ Time/Date *.
17. 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 *
18. 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*.
19. 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

Daikin 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 113 on page 110 are conditional. A conditional menu or menu item includes a reference in Figure 113 to the position in the Software Configuration Code upon which its applicability depends. For example, the Duct Pressure menu in Figure 113 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 113 include the factory-set value for all adjustable items. **Keep a record of any changes made to any of these items.**

Final Control Settings: Keypad accessible menu structure

Figure 113. Keypad accessible menu structure

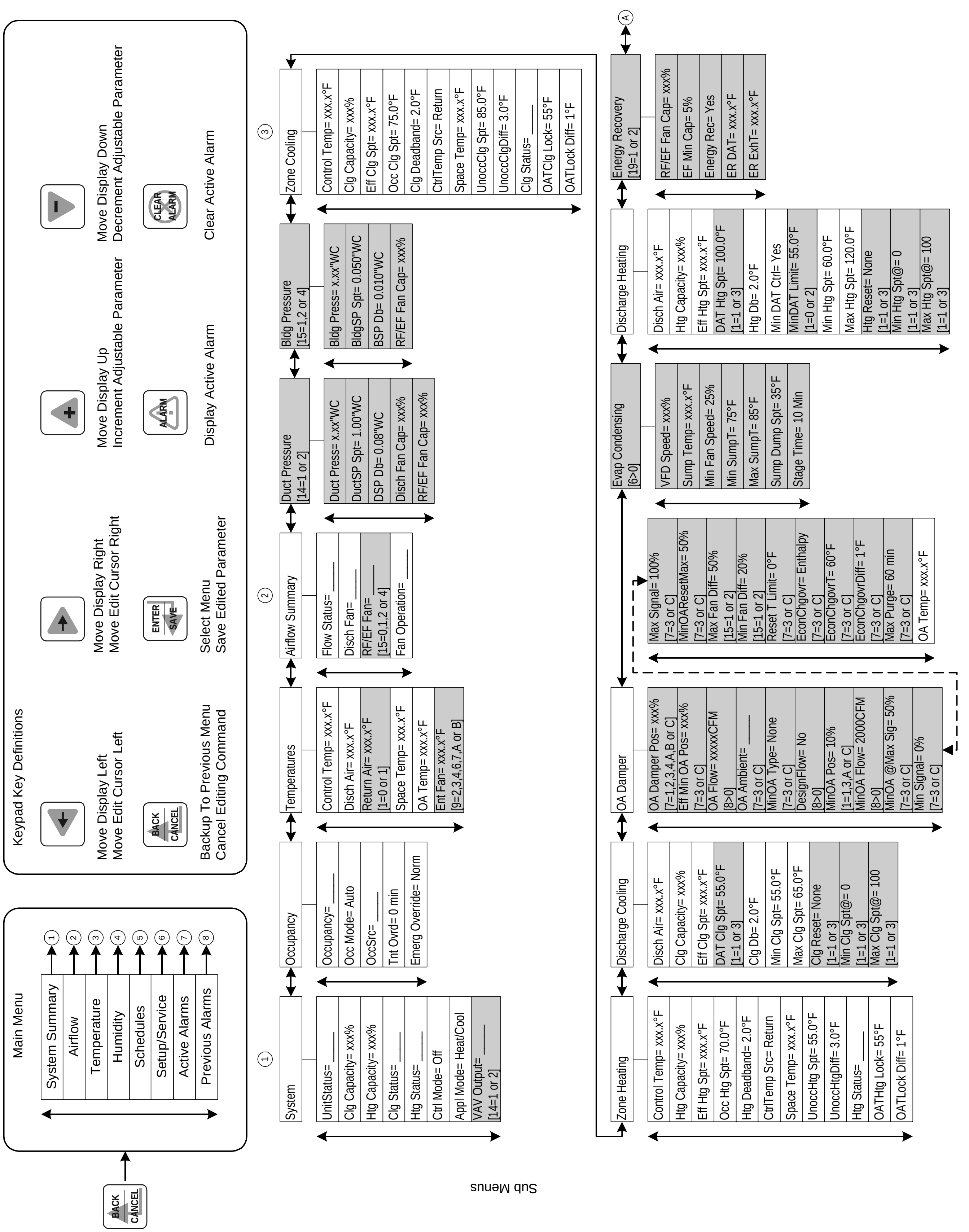


Figure 113. Keypad accessible menu structure (continued)

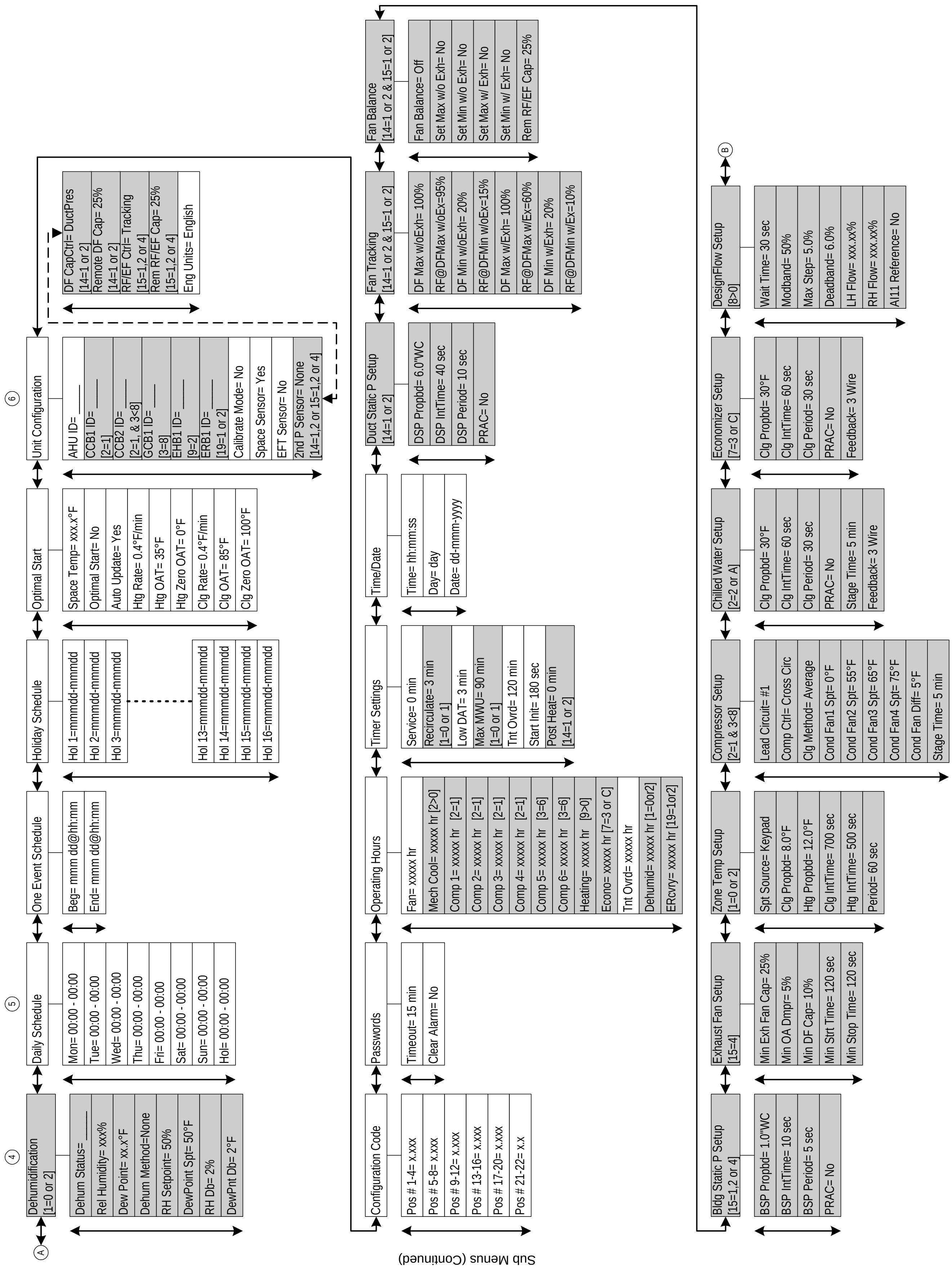
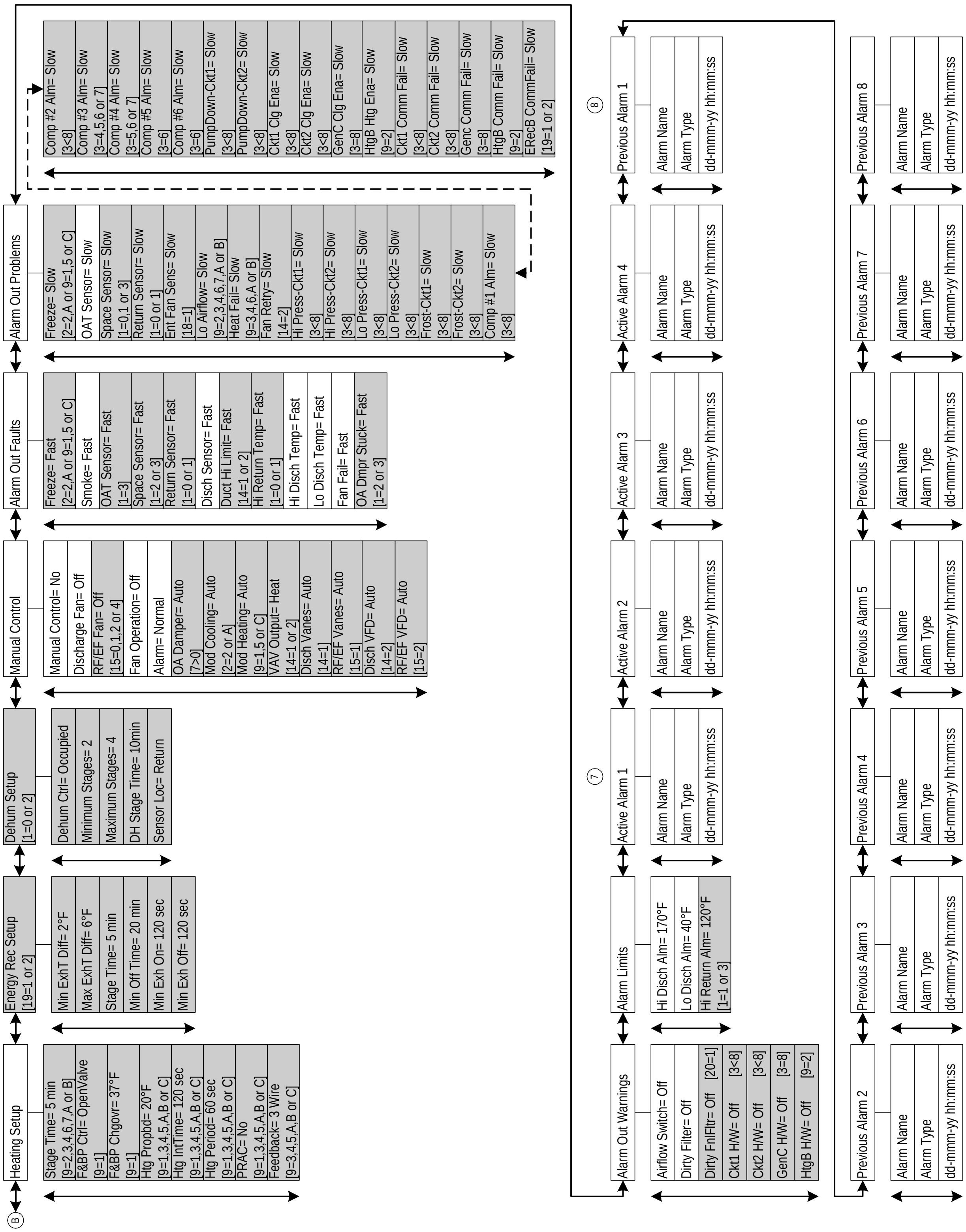


Figure 113. Keypad accessible menu structure (continued)



Sub Menus (Continued)

Maintenance

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

⚠ WARNING

Moving machinery and electrical power hazards. May cause severe personal injury or death.
Disconnect and lock off all power before 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. May cause severe injury or death.
Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

Planned Maintenance

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

- Tighten all belts, wire connections, and setscrews.
- Clean the evaporator and condenser coils mechanically or with cold water, if necessary. Usually any fouling is only matted on the entering air face of the coil and can be removed by brushing.
- 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).
- Check the condenser fans and tighten their setscrews.
- Lubricate the door latch mechanisms.

Unit Storage

Location

The Daikin Rooftop Packaged System 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. The condenser fins are particularly vulnerable to damage by even light contact with ground based objects.
- 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 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. Daikin Applied recommends that the electronic control equipment in the unit be stored in a 5% to 95% RH (non-condensing) environment.
2. It may be necessary to put a heat source (light bulb) in the main control panel to prevent the accumulation of atmospheric condensate within the panel.
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 25 on page 115 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 25 on page 115. 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.

Condenser fan—Condenser fan motors are permanently lubricated and require no periodic lubrication.

Fan Shaft Bearings

Relubricate fan shaft bearings periodically. Relubricate according to the schedule shown in Table 26. 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 25.

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 25: 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 26: 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

Propeller Exhaust

For more information, see page 96.

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 27.

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 27: 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 28, 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 28: Setscrew minimum torque specifications

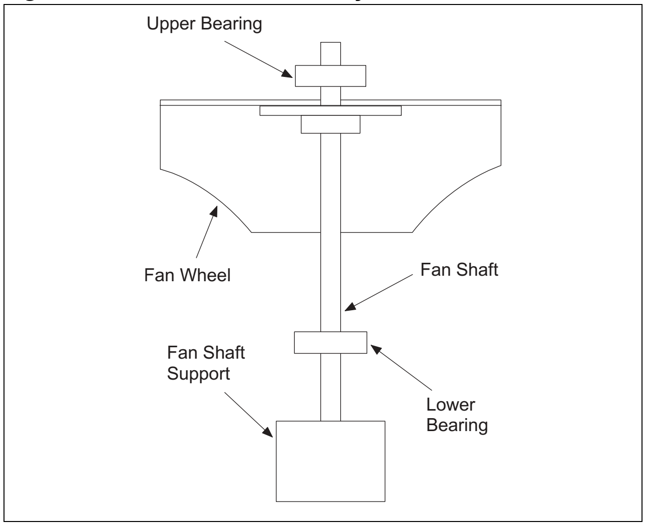
Setscrew diameter (in.)	Minimum torque (ft.lb)
1/4	5.5
5/16	10.5
3/8	19.0
7/16	29.0
1/2	42.0
5/8	92.0

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 114). **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 28. Remove the fan shaft support and retension the belts.

Figure 114. 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 115, Figure 116, Figure 118 and Figure 119 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 29, Table 30, and Table 31.
3. Retighten the setscrews to the torque specification given in Table 28 on page 115. 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 115. 20" DWDI airfoil wheel-to-funnel (015C to 030C)

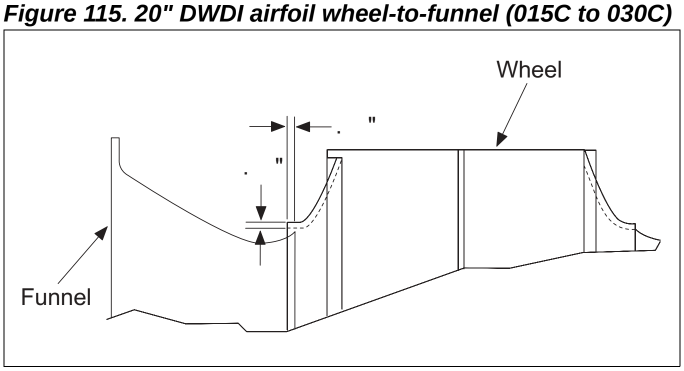


Figure 116. 24" DWDI backward curved wheel-to-funnel (036C, 040C)

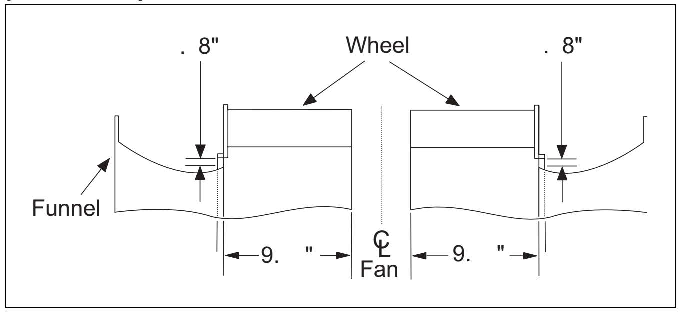


Figure 117. 27 to 40" DWDI airfoil wheel-to-funnel alignment

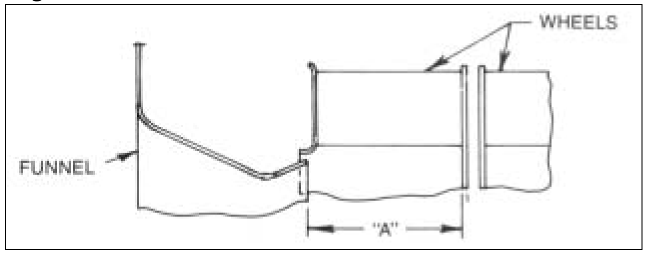


Table 29: 27 to 40" DWDI airfoil wheel-to-funnel relationship

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 118. 40" SWSI airfoil wheel-to-funnel alignment (RDT 045 to 075)

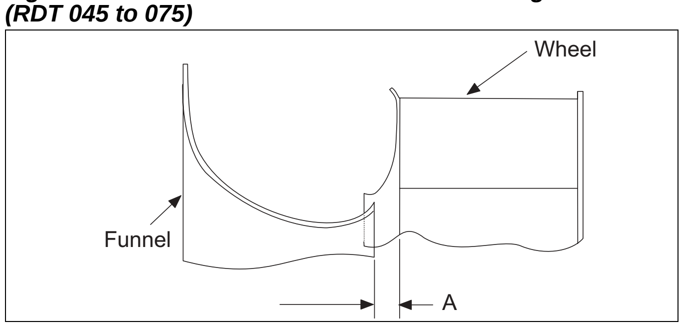


Table 30: SWSI airfoil wheel-to-funnel relationship

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

Figure 119. 44" and 49" SWSI airfoil wheel-to-funnel alignment

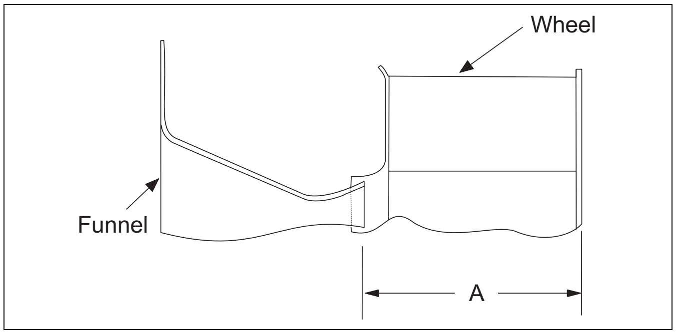


Table 31: 44" and 49" SWSI airfoil wheel-to-funnel Relationship

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

Refrigerant Leaks

R-407C is a zeotropic blend of three HFC refrigerants (R-32, R-125, and R-134a). Zeotropic blends do not behave as one substance. Therefore, a change of phase does not occur at a fixed temperature. R-407C has a "glide" of 8°F because it boils and evaporates over an 8°F change in temperature.

If an R-407C unit leaks refrigerant, there is no way to determine how much of each of the three component refrigerants leaked. However, experience in the field has shown that **R-407C systems can be "topped off" after a leak and will operate normally**. There is no need, except in the case of critically charged systems, to replace the entire charge after a leak.

Add charge per instructions on page 42.

Refrigerant Charge

The unit nameplate references proper charge for each RPS/RDT refrigerant circuit in case a full charge must be added to the unit. Verify these values using pages 39–41. Refer to pages 39–41 for RFS/RCS units.

⚠ WARNING

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

Servicing Refrigerant Sensors or Switches

The Daikin Rooftop unit includes the following refrigerant sensors or switches.

1. Low refrigerant pressure sensing, operating switch, automatic reset
   - **a** Disables their associated compressors on a drop in suction pressure to approximately 35 psig.
   - **b** Enables their associated compressors on a rise in suction pressure to approximately 60 psig.
2. SpeedTrol™ high refrigerant pressure sensor (not available on sizes 15 to 30). See page 90 for more information.
3. High refrigerant pressure, protective switch, manual reset, reset by breaking control power to the S1 control switch.
   - **a** All R-22 high pressure switches disable their associated compressors on a rise in discharge pressure to 400 psig.
   - **b** R-407C high pressure switches disable their associated compressors on a rise to the following discharge pressure:
     - Scroll compressor units (sizes 015 to 105C) = 425 psig
     - Reciprocating compressor units (sizes 15 to 135C) = 400 psig
   - **a** The switches have a differential of 100 psig.
4. High pressure relief, protective valve on sizes 115 to 135C only and located on the condenser headers.

The low pressure and SpeedTrol sensors/ switches sense refrigerant pressure through shrader fittings that contain cores. The cores are stop valves that do not allow refrigerant to flow through the shrader unless the device is in place. Therefore the low pressure and SpeedTrol sensors/switches can be replaced without reclaiming the refrigerant.

The Shrader that serves the high pressure switch does not contain a core in order to maximize the functionality of the safety. Therefore it cannot be replaced unless the refrigerant has already been reclaimed.

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 120.

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 120**,** ②.

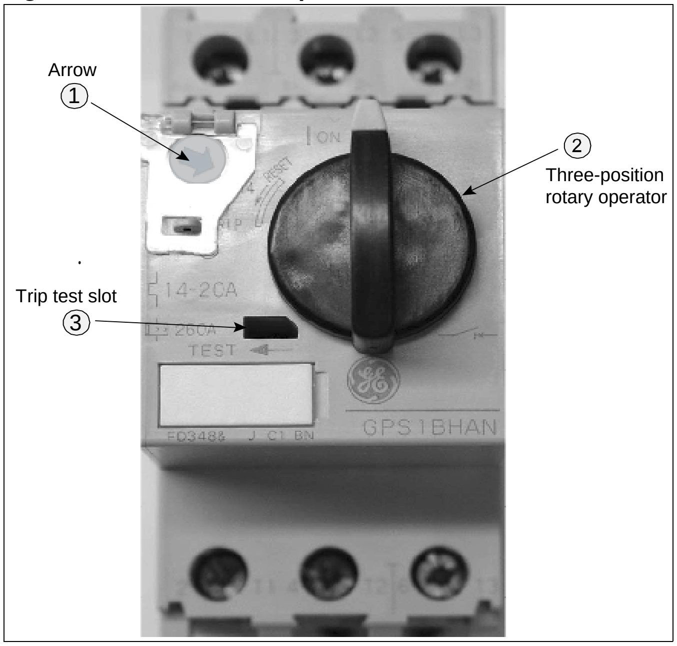
⚠ WARNING

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 120.
- 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 120**.**

Figure 120. Manual motor protector



Circuit Breaker

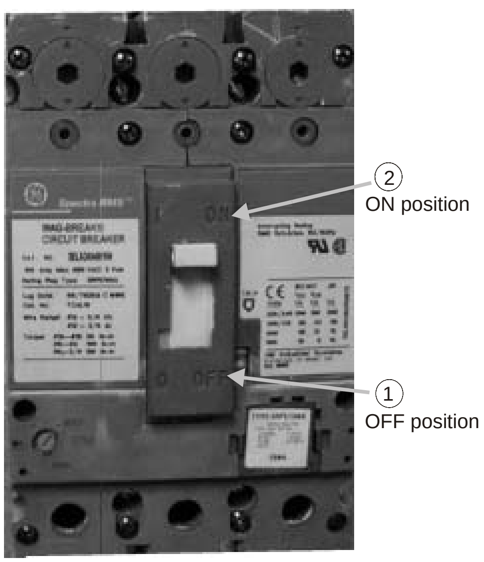
Circuit breakers are installed upstream of all VFDs to provide short circuit protection.

To reset a tripped circuit breaker: Clear the trip by rotating the lever down to the OFF position. See ① in Figure 121. Then rotate lever up to the ON position. See ② in Figure 121.

⚠ 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 121. Circuit breaker



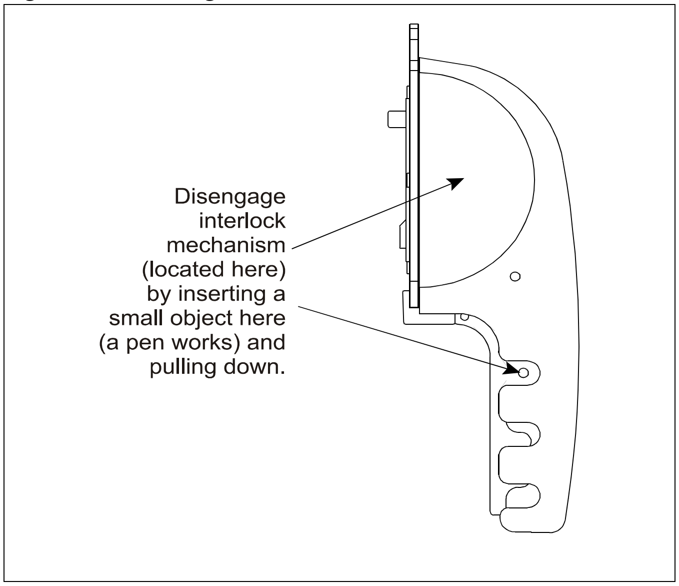
Disconnect

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 122. Through-the-door handle disconnect

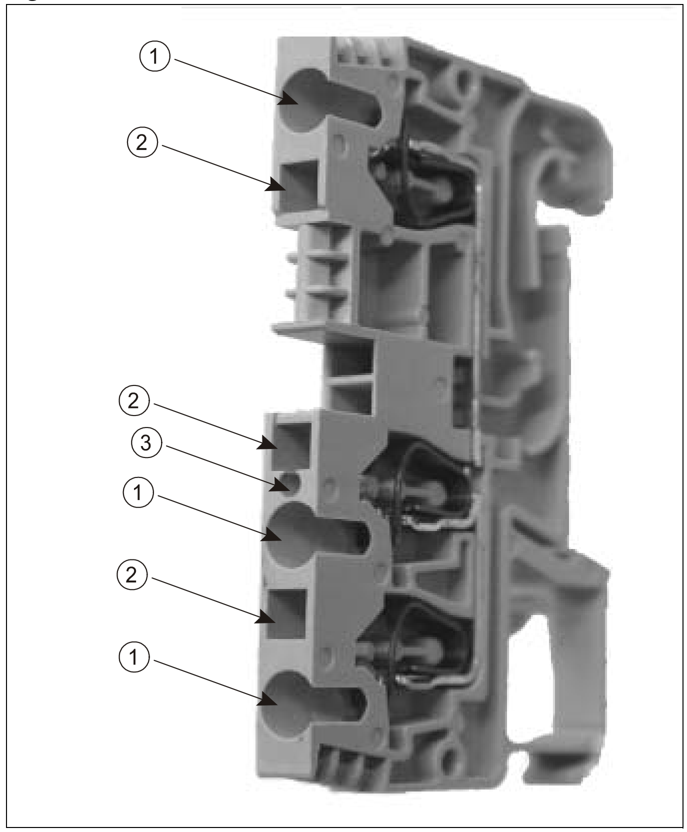


Terminals

The terminals are spring clamp type. They only require inserting (see ① in Figure 123) 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 123.

- 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 123.

Figure 123. Terminal connectors



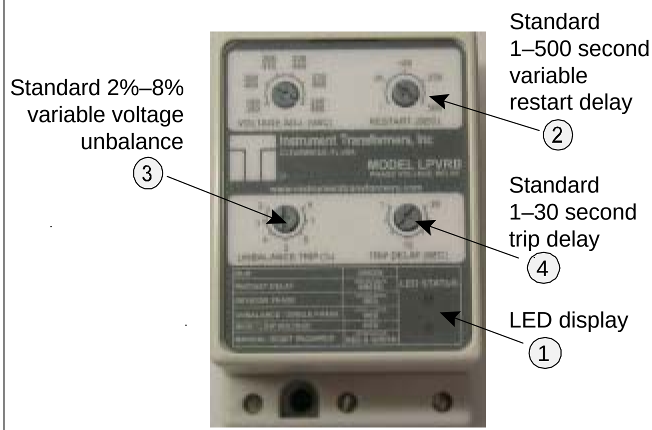
Phase Voltage Monitor (PVM) (see page 88)

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 124)
  - 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 124)
- Standard 2% to 8% variable voltage unbalance (see 3 in Figure 124)
- Standard 1 to 30 second trip delay (see 4 in Figure 124)

Figure 124. Phase voltage monitor



Replacement Parts List

Component designation	Description	Daikin 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

Service and Warranty Procedure

Replacement Parts

When writing to Daikin for service or replacement parts, provide the model number, serial number, and unit part number of the unit as stamped on the serial plate attached to the unit. For questions regarding wiring diagrams, 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.

Scroll Compressor (sizes 15 to 105C)

Daikin Rooftops use the following Copeland Scroll Compressors.

1. Single compressors, one per refrigerant circuit
2. Tandem compressors, basically two compressors specifically manufactured by Copeland into a single assembly.
3. Trio compressors, basically three single compressors factory piped in parallel with equalization lines.

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

Scroll service replacement compressors for Daikin Rooftop Units can be obtained from the following two sources:

- Daikin Service Parts maintains a stock of replacement compressors.
- Copeland Refrigeration has stocking wholesalers throughout the U.S. who maintain a limited stock of replacement scroll compressors. The stock of single compressors is much better than the stock of tandems “tandem/trio ready”, single compressors. Trios are almost never in wholesaler stock and are not recommended for use on Daikin Rooftops due to piping interference. Copeland does offer quick ship options though their wholesalers.

Both sources can be used, at the customer’s discretion, within the first year warranty and with the following limitations.

1. RPS 018 to 020C (with single compressors. No limitations).
2. RPS 025 to 030C (with single and tandem compressors).
   a. If any part of the tandem fails then the entire tandem must be replaced. Both sources are acceptable.
   b. Single compressor. No limitations.
3. RPS 036C (with tandem compressors).
   a. Circuit #1 tandem - If any part of the tandem fails then the entire tandem must be replaced. Both sources are acceptable.
   b. Circuit #2 tandem–Each of the tandem’s compressors have a rotalock and only the failed portion of the tandem may need replacement.
3. RPS 040 to 060C—Each of the tandem’s compressors have a rotalock and only the failed portion of the tandem may need replacement.
4. RPS 070 to 105C—Each of the trio compressors have a rotalock and only the failed portion of the trio may need replacement.
5. Only a “tandem or trio ready” compressor, with oil equalizer lines, can be used to replace a portion of the tandem or trio.

Reciprocating Compressors (sizes 115 to 135C)

Daikin Rooftops use Copeland Discus™ compressors mounted in “tandem.”

Tandem compressors are basically two single compressors factory piped in parallel with equalization lines.

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

If the equipment experiences a compressor failure within the first year parts warranty period or is a “dead” on arrival (DOA) compressor at start-up, the failed compressor is covered under the first year parts warranty. To receive a replacement compressor:

1. Notify the local (Copeland) wholesaler of the failure and provide the compressor model and serial number.
2. The customer/contractor picks up the replacement compressor from the wholesaler.
3. After removing the failed compressor from the equipment, return it to the local wholesaler for credit on the replacement compressor.
4. Consideration may be given at this time to a compressor teardown analysis, depending on the history of failures.

All Compressors

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

1. The entire tandem must be replaced if the individual portions do not include rotalocks and rotalocks are not available on the RPS 025 to 030 (tandems and the RPS circuit #1 tandem).
2. In warranty: Warranty only covers replacement of the failed portion of the tandem or trio. Either source may be used.
3. Out of warranty: The customer decides whether to replace the entire tandem/trio or just a portion and either source may be used.

When replacing an "in warranty" compressor through a Copeland Wholesaler, take the failed compressor to the wholesaler for an over-the-counter or an advanced replacement exchange. Credit is issued by Copeland on the returned motor compressor upon receipt and factory inspection of the inoperative motor compressor. In this transaction, be certain that the motor compressor is definitely defective. If a motor compressor is received from the field that tests satisfactorily, a service charge plus a transportation charge will be charged against its original credit value.

If there was a delay in the startup of the equipment and the first-year warranty (Copeland) has expired on the compressor, within the 18-month-from-shipment warranty, order the replacement compressor through the Daikin Parts Department (Minneapolis).

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

On Daikin equipment that includes the extended 2nd -5th year compressor warranty option, the replacement compressor must be ordered through the Daikin Parts Department (Minneapolis).

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

In-Warranty Return Material Procedure

Material other than compressors may not be returned except by permission of authorized factory service personnel of Daikin Applied at Minneapolis, Minnesota.

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

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

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

Limited Product Warranty (North America)

Daikin Applied (“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 Daikin Air Conditioning, AAF Air Conditioning, AAF HermanNelson and Daikin 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 McQuayService 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 McQuayService 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.

Rooftop Equipment Warranty Registration Form

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

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

Job Name: **Daikin G.O. No.:**

Installation address: ______________________________

City: ______________________________ **State:** ______________

Purchasing contractor: ______________________________

City: ______________________________ **State:** ______________

Name of Person doing start-up (print) ______________________________

Company name ______________________________

Address ______________________________

City/State/Zip ______________________________

Unit model number: ______________________ **Unit serial number:** ______________________

Compressor 1 model number: ______________________ **Serial number:** ______________________

Compressor 2 model number: ______________________ **Serial number:** ______________________

Compressor 3 model number: ______________________ **Serial number:** ______________________

Compressor 4 model number: ______________________ **Serial number:** ______________________

Compressor 5 model number: ______________________ **Serial number:** ______________________

Compressor 6 model number: ______________________ **Serial number:** ______________________

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

I. INITIAL CHECK

A. Is any shipping damage visible? . . . . Yes No N/A
B. Are fan drives properly aligned and belts properly adjusted? . . . . Yes No N/A
C. Tightened all setscrews on pulleys, bearings and fans? . . . . Yes No N/A
D. Have the hold-down bolts been backed off on spring mounted fan isolators? . . . . Yes No N/A
E. Do fans turn freely? . . . . Yes No N/A
F. Has the discharge static pressure reference line been properly located within the building? Yes No N/A
G. Electrical service corresponds to unit nameplate? . . . . Yes No N/A
Volts Hertz Phase
H. Is the main disconnect adequately fused and are fuses installed? . . . . Yes No N/A
I. Are crankcase heaters operating, and have they been operating 24 hours prior to start-up? . . . . Yes No N/A
J. Are all electrical power connections tight? (Check compressor electrical box.) . . . . Yes No N/A
K. Is the condensate drain trapped? . . . . Yes No N/A

II. FAN DATA

A. Check rotation of supply fan? . . . . Yes No N/A
B. Voltage at supply fan motor: 1–2_________ V 2–3 _________ V 1–3 _________ V
C. Supply fan motor amp draw per phase: L1 L2 L3
D. Fuse sizes: ______________________________
E. What is the supply fan rpm?
F. Check rotation of return fan? . . . . Yes No N/A
G. Voltage at return fan motor: 1–2_________ V 2–3 _________ V 1–3 _________ V
H. Return fan motor amp draw per phase: L1 L2 L3
I. Fuse sizes: ______________________________
J. What is the return fan rpm?
K. Record supply static pressure at unit:_______________ inches of H_20
L. Record return static pressure at unit (with outside air dampers closed)______________ inches of H_20

III. START-UP COMPRESSOR OPERATION

A. Do compressors have holding charges?
Circuit #1. . . . . Yes No N/A
Circuit #2. . . . . Yes No N/A
B. Backseat discharge, suction (sizes 115 to 135C only), and liquid line valves? . . . . Yes No N/A
C. Are compressors rotating in the right direction? . . . . Yes No N/A
D. Do condenser fans rotate in the right direction? . . . . Yes No N/A

Warranty Registration Form (continued)

E. Ambient temperature ______________________°F

F. Oil safety control time delay (sizes 115 to 135C only): Compressor #1 ________sec. Compressor #3________ sec.
Compressor #2sec. Compressor #4_________sec.

G. Compressor lockout timers function? . . . . Yes No N/A

H. FanTrol functions: TC13 ________ TC14 ________

I. Part winding start time functions (sizes 115 to 135C option only):
Compressor: TD1 __________ TD2 __________ TD3__________ TD4 __________
Supply fan: TD9 __________
Return fan: TD19 _________

J. Does unit start up and perform per sequence of operation?. . . . . Yes No N/A

IV. PERFORMANCE DATA

A. Compressor voltage across each phase: 1–2 _________ V 2–3 _________ V 1–3 ________ V

B. Compressor amperage of fully loaded compressor:

Compressor #1	Phase 1________	Phase 2 ________	Phase 3 _______
Compressor #2	Phase 1________	Phase 2 ________	Phase 3 _______
Compressor #3	Phase 1________	Phase 2 ________	Phase 3 _______
Compressor #4	Phase 1________	Phase 2 ________	Phase 3 _______
Compressor #5	Phase 1________	Phase 2 ________	Phase 3 _______
Compressor #6	Phase 1________	Phase 2 ________	Phase 3 _______

C. Low pressure cut-out: Circuit 1___________ psig Circuit 2 ___________psig
Low pressure cut-in: Circuit 1___________ psig Circuit 2 ___________psig

D. High pressure cut-out: Circuit 1___________ psig Circuit 2 ___________psig

E. Discharge pressure, one compressor: Circuit 1 __________ psig Circuit 2 __________ psig
Discharge pressure, fully loaded, 2–3 compressors: Circuit 1 __________ psig Circuit 2 __________ psig

F. Suction pressure, one compressor: Circuit 1 __________ psig Circuit 2 __________ psig
Suction pressure, fully loaded, 2–3 compressors: Circuit 1 __________ psig Circuit 2 __________ psig
Liquid press, fully loaded, 2–3 compressors
(at liquid line shutoff valve): Circuit 1 __________ psig Circuit 2 __________ psig
Liquid temperature, fully loaded, 2–3 compressors: Circuit 1 __________ psig Circuit 2 __________ psig

G. System oil pressure (oil pressure-suction-net oil pressure):
(on four-compressor units, indicate for each compressor) Circuit 1 ___________psig Circuit 2 __________ psig

H. Suction line temperature: ____________°F ____________°F

I. ____________°F ____________°F

Superheat:

J. Is the liquid in the line sightglass clear and dry?. . . . . Yes No N/A

K. Does the hot gas bypass valve function properly? . . . . Yes No N/A

L. At what suction pressure does the hot gas bypass valve open? __________ psig __________ psig _________ psig

M. Record discharge air temperature at discharge of unit: ___________ °F

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

O. Are all gauges shut off and valve caps and packings tight after start-up? . . . . Yes No N/A

V. ELECTRIC HEAT CHECK, TEST & START

A. Electrical heat service corresponds to unit nameplate? . . . . Yes No N/A
Volts Hertz Phase

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

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

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

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

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

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

G. FLA: L1 ___________ L2____________ L3 ___________

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

Warranty Registration Form (continued)

VI. GAS & OIL BURNER CHECK, TEST, & START

Specifications:

For gas, see *Forced Draft Gas Burner Installation and Maintenance Bulletin*.

For oil, see *Oil Fired Furnace Installation and Maintenance Bulletin*.

A. (Gas/Oil) Furnace model no. ___________________

B. (Gas/Oil) Burner model no.____________________ Serial no. ____________________

C. (Gas) Type firing: Single Stage two Stage modulation

D. (Oil) Type firing start: Full fire start Low fire start

E. (Gas) Rated firing rate: __________________ MBH input

F. (Oil) Rated firing rate: __________________ GPH, #2 fuel oil

G. (Gas/Oil) Altitude: ____________________ ft. above sea level

H. Is there a circulating tank? . . . . Yes No N/A

VII. GAS BURNER CHECK, TEST, & START

A. Input:__________________________________CFH

B. Gas pressure at burner: _________________inches w.c.

C. CO_2: ___________________________%

D. CO_2: ___________________________%

E. Pilot flame only: _______________ microamps (steady at low fire)

F. Pilot Tap-gas pressure:__________________inches w.c.

G. Motor only/burner: FLA___________________ running amps

H. High limit control OK? . . . . Yes No N/A

I. Flame safeguard: _________________ microamps

J. Flame failure shutoff: ________________ seconds

K. Airswitch OK? . . . . Yes No N/A

L. High Gas Pressure Switch OK? . . . . Yes No N/A

M. Low Gas Pressure Switch OK? . . . . Yes No N/A

N. Main Gas Valve Close-off OK? . . . . Yes No N/A

VIII. OIL BURNER CHECK, TEST & START

A. Nozzle(s): Type/manufacturer GPH Angle Pattern manufacturer

B. Nozzle pressure: ________________________ psi

C. CO_2: ___________________________%

D. Smoke spot: number________________

E. Running amps__________________ FLA

F. Flame safeguard: microamps __________________

G. High limit control OK? . . . . Yes No N/A

H. Flame failure shutoff OK? . . . . Yes No N/A

I. Ignition failure check OK? . . . . Yes No N/A

IX. Have all electronic or electrical controls been checked, adjusted, and tested for proper operation per the installation and maintenance bulletins? Yes No N/A

X. MAINTAINING MICROTECH CONTROL PARAMETER RECORDS

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

Signature: ____ Startup date: ____________________________________

RETURN COMPLETED FORM TO:

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

Please list any additional comments that could affect the operation of this unit; e.g., shipping damage, failed components, adverse installation applications, etc., on a separate sheet and attach to this form.

Quality Assurance Survey Report

To Whom it may concern:

Please review the items below upon receiving and installing our product. Mark N/A on any item that does not apply to the product.

Job Name:_______________________________________ Daikin G.O. no. ____________________

Installation Address: ____

City:_______________________________________ State: ___________________________

Purchasing Contractor: ____

City:_______________________________________ State: ___________________________

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

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

   Location on unit ____

2. How would you rate the overall appearance of the product; i.e., paint, fin damage, etc.?

   Excellent Good Fair Poor

3. Did all sections of the unit fit together properly? . . . . Yes No N/A
4. Did the cabinet have any air leakage? . . . . Yes No N/A

   Location on unit ____

5. Were there any refrigerant leaks? . . . . Yes No N/A

   Shipping Workmanship Design

6. Does the refrigerant piping have excessive vibration? . . . . Yes No N/A

   Location on unit ____

7. Did all of the electrical controls function at start-up? . . . . Yes No N/A

   Comments ____

8. Did the labeling and schematics provide adequate information? . . . .
9. How would you rate the serviceability of the product?

   Excellent Good Fair Poor

10. How would you rate the overall quality of the product?

    Excellent Good Fair Poor

11. How does the quality of Daikin products rank in relation to competitive products?

    Excellent Good Fair Poor

Comments:

Please list any additional comments which could affect the operation of this unit; i.e., shipping damage, failed components, adverse installation applications, etc., on a separate sheet and attach to this form.

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DAIKIN

13600 Industrial Park Boulevard, Minneapolis, MN 55441 USA (763) 553-5530

Daikin Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority. For training information on all Daikin HVAC products, please visit us at www.DaikinApplied.com and click on training, or call 540-248-9646 and ask for the Training Department.

This document contains the most current product information as of this printing. For the most up-to-date product information please go to www.DaikinApplied.com.

DAIKIN

13600 Industrial Park Boulevard, Minneapolis, MN 55441 USA (612) 553-5330