

PREEVA®
PREEVA®dH™



Intertek



Operation / Maintenance / Service

Applies to: High Efficiency Models RHH & SHH;
Indoor PreevA® Models PDH, PEH, PXH, SDH;
and Outdoor PreevA® Models RDH, REH, RXH

High Efficiency, Condensing Models



Outdoor Model RHH

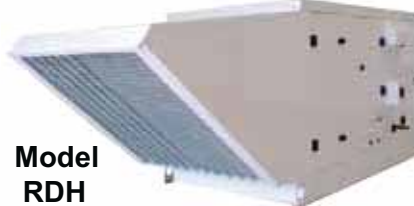


Indoor Model SHH

Outdoor PreevA® Models



Model RXH



Model RDH
(with outside air hood)



Model REH

Indoor PreevA® Models



Model PXH



Model SDH



Model PDH



Model PEH

⚠ WARNING:

FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury, death, or property damage.

Be sure to read and understand the installation, operation, and service instructions in this manual.

Improper installation, adjustment, alteration, service, or maintenance can cause serious injury, death, or property damage.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **WHAT TO DO IF YOU SMELL GAS**
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Leave the building immediately.
 - Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

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1.0 General

1.1 Hazard Labels and Notices

This booklet includes operation, maintenance, and service information. Before beginning any procedure, carefully review the information, paying particular attention to the warnings. Handling of refrigerant should only be performed by a certified HVAC technician and in compliance with all codes and requirements of authorities having jurisdiction.

Definitions of Hazard Intensity Levels used in this Manual

There are warning labels on the unit and throughout this manual. For your safety, comply with all warnings during installation, operation, and service of this system. See definitions of Hazard Intensity Levels of warnings below.

HAZARD INTENSITY LEVELS

- 1. DANGER:** Failure to comply will result in severe personal injury or death and/or property damage.
- 2. WARNING:** Failure to comply could result in severe personal injury or death and/or property damage.
- 3. CAUTION:** Failure to comply could result in minor personal injury and/or property damage.

1.2 DANGER Warnings and Requirements

DANGER

Turn off the power before performing all maintenance procedures (except to check refrigerant pressure and temperature). Lock disconnect switch in OFF position. When you turn off the power supply, turn off the gas (gas-fired units). See Hazard Intensity Levels, page 2.

IMPORTANT: Do not release refrigerant to the atmosphere! If required service procedures include the adding or removing of refrigerant, the service technician must comply with all federal, state and local laws. The procedures discussed in this manual should only be performed by a qualified HVAC technician.

DANGER

If equipped with a DX cooling coil module, this unit will contain refrigerant and may contain R410A high pressure refrigerant.

- If equipped with a reheat pump, the reheat circuit is charged with R410A refrigerant.
- If attached to a MASA condenser unit, the cooling circuit is charged with R410A refrigerant.
- If attached to a field-supplied condenser unit, consult the condenser unit information to identify the type of refrigerant.

All procedures involving any type of refrigerant should only be performed by a qualified HVAC technician.

In addition, hazards exist with R410A that could result in personal injury or death. Installation, maintenance, and service should only be performed by an HVAC technician qualified in R410A refrigerant and using proper tools and equipment. Due to much higher pressure of R410A refrigerant, **DO NOT USE** service equipment or tools designed for R22 refrigerant.

2.0 Maintenance and Service Information

This unit will operate with a minimum of maintenance. To ensure long life and satisfactory performance, a heating or heating/cooling system that is operated under normal conditions should be inspected and cleaned according to the Maintenance Schedule. If in an area where an unusual amount of dust or soot or other impurities are present in the air, more frequent maintenance is recommended.

When any service is completed, be careful to reassemble correctly to ensure that no unsafe conditions are created. When re-lighting, always follow the lighting instructions on the heater.

2.0 Maintenance and Service Information (cont'd)

**NOTE: If replacement parts are required, use only factory-authorized parts.
Use of unauthorized parts will void the manufacturers warranty.**

2.1 Maintenance Schedule

The following procedures should be carried out at least annually. The heating section should be inspected and cleaned at the beginning of the heating season. The cooling section should be inspected and cleaned at the beginning of the cooling season. See **FIGURE 1A**, for Model SDH, PDH, SHH, RDH, PXH, RHH, and RXH control locations in the electrical compartment. See **FIGURE 1B**, page 6, for control locations in Models PEH and REH. See the paragraphs indicated in the schedule for maintenance procedure information.

Basic Heat Section, Blower Section, and Optional Modules

All Models -

- Check the filters. Clean or replace as needed. (Paragraph 3.1)
- Clean all dirt, lint, and grease from the motor and blower,
- Check the belt for tension and wear. Replace a belt that may fail before next scheduled maintenance. (Paragraph 3.2)
- Check all wiring for any damaged wire. Replace damaged wiring. Check the unit wiring diagram for requirements.
- Systems with Option AR8 (dampers/no mixing box) - Check the dampers; clean as needed. (Paragraph 3.6)

Gas-Fired Models PDH, SDH, SHH, RDH, and RHH -

- Clean all dirt, lint, and grease from the venter assembly.
- Check the heat exchanger both internally and externally. (Paragraph 3.4.1)
- Check the burner for scale, dust, or lint accumulation. Clean if needed. (Paragraph 3.4.2)
- Check the gas valve to ensure that gas flow is being shutoff completely. (Paragraph 3.4.6)
- Check the vent or vent/combustion air system for soundness. Clean openings. Replace any parts that do not appear sound.
- Clean the heat section condensate drain line (two on Models RHH and SHH; one on other models with Option CS2).
- Model SHH** - Clean the vent condensate drain line.

Electric Heat Models PEH and REH

- Clean all dirt, lint, and grease from the heating elements and heat section cabinet.

Optional Mixing Box - See Paragraph 3.6

- Check the mixing box and dampers. Clean as needed.

Optional Cooling Coil Module - See Paragraph 3.7

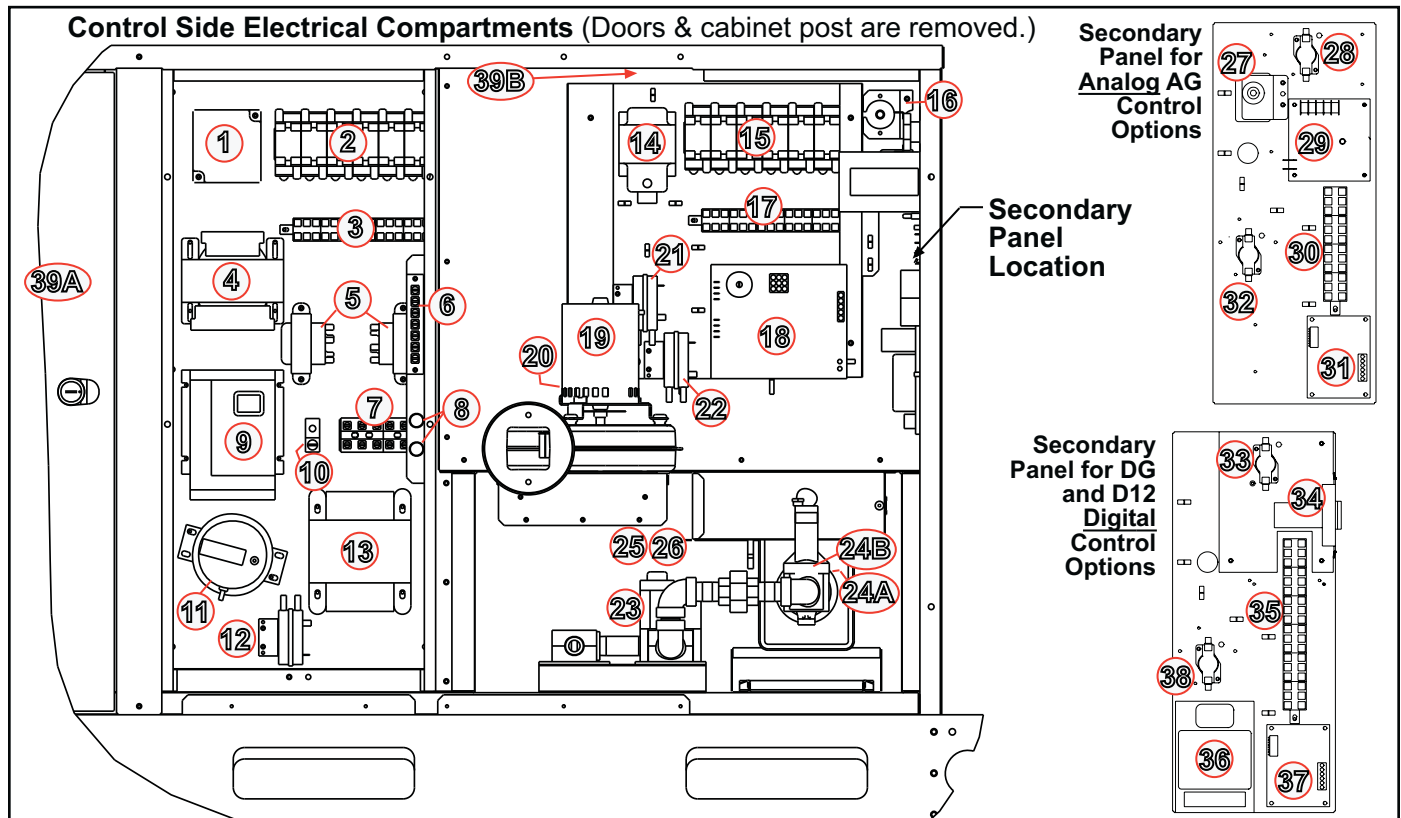
- Clean the condensate pan and drain.
- Clean the cooling coil.

Optional Evaporative Cooling Module - See Paragraph 3.8

- Clean or replace the media. Clean the optional filters.
- Flush the water distribution line.
- Clean the pump screen and pump (pump and float system).

2.2 Control Locations

FIGURE 1A - Standard & Optional Control Locations - Models PDH, SDH, RDH, SHH, PXH, RHH, RXH



In the Left Electrical Compartment (high voltage and low voltage):

- 1) Optional Phase Loss Control (Option BF)
- 2) Plug-in Relays
- 3) Terminal Blocks
- 4) Transformer (for optional evaporative cooling module)
- 5) Transformers (right for controller; left for signal conditioner)
- 6) Terminal Board for thermostat
- 7) Line Voltage Terminal Blocks
- 8) Fuse Holders
- 9) Motor Starter or Variable Frequency Drive (Option VFD)
- 10) Grounding Lug
- 11) Optional Dirty Filter Switch (Remote Console Option)
- 12) Air Proving Switch
- 13) Transformer (venter motor, 460 & 575 volt PDH/SDH/RHH/SHH, plus 208 & 230 volt SHH & RHH)

Primary Panel in the Heat Section Electrical Compartment (low voltage):

- 14) Transformer (damper)
 - 15) Plug-in Relays
 - 16) High Temperature Limit Control
 - 17) Terminal Blocks
 - 18) Integrated Control Module (circuit board)
 - 19) Venter Motor
 - 20) Venter Motor Capacitor (hidden by venter motor)
 - 21) High Speed Combustion Air Pressure Switch
 - 22) Low Speed Combustion Air Pressure Switch (units with 2-speed venter, Opts AG 40, 60, 61, 62; DG 1, 2, 5, 6; D12 B, C) or Models RHH, SHH - Condensate Pressure Switch
- Gas Train Components (for D12G or AG58, see page 12):**
- 23) Single-Stage or Two-Stage Gas Valve
 - 24A) Pressure Switch for Modulation (Options AG40; DG 2 & 6; and D12B)
 - 24B) Modulating Gas Valve (Options AG40; DG 2 & 6; & D12B)
 - 25) Optional High Gas Pressure Switch (Opt BP2 not shown)
 - 26) Optional Low Gas Pressure Switch (Opt BP3 not shown)

Secondary Panel in the Heat Section Electrical Compartment with Analog Controls (low voltage):

- 27) Unit-Mounted Ductstat (Options AG 3, 60)
- 28) Time Delay Relay (Venter)
- 29) Optional Freezestat (Option BE2)
- 30) Terminal Blocks
- 31) Optional Venter Speed Controller (Opts AG 58, 60, 61, 62)
- 32) Time Delay Relay (Speed change, Opts AG 58, 60, 61, 62)

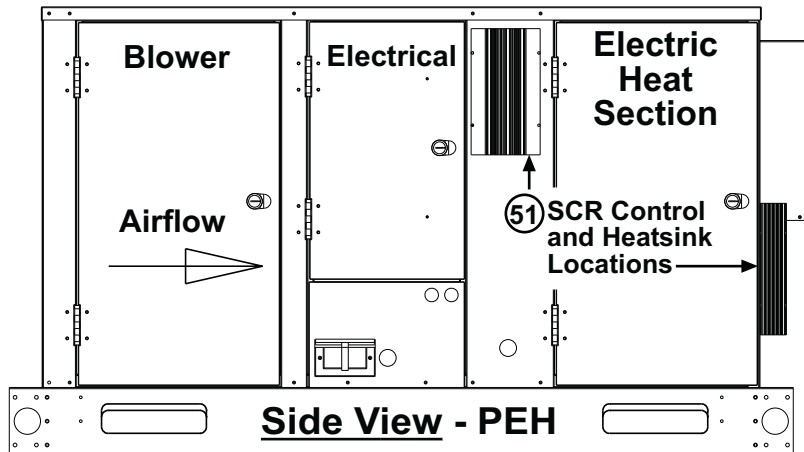
Secondary Panel in the Heat Section Electrical Compartment showing low voltage Digital Controls and Opt AG40 for field-supplied computer control:

- 33) Time Delay Relay (Venter)
- 34) Programmable Controller (Opts DG 1, 2, 5, 6; D12 B/C/F/G)
- 35) Terminal Blocks
- 36) Signal Conditioner (Options DG 2, 6; AG40; D12 B, C)
- 37) Venter Speed Cntrlr (Opt DG 1, 2, 5, 6; AG40; D12 B/C/G)
- 38) Time Delay Relay (Speed change, Opts DG 1, 2, 5, 6; AG40; and D12 B/C/G)

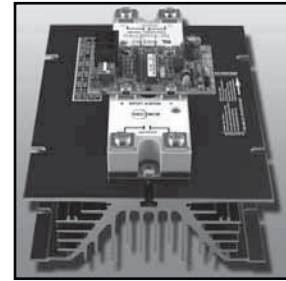
Other:

- 39A) Reverse Flow Limit Switch (in the blower cabinet on RDH/PDH/SDH Sizes 75-150)
- 39B) Reverse Flow Limit Switch (on heat section wall above the electrical compartment on RDH/PDH/SDH Sizes 175-400A and all RHH and SHH)
- 40) Safety Door Switch (SDH and SHH) on Heat Section Door (not shown in FIGURE 1A)
- 41) Optional Convenience Outlet (Option BC2) - requires its own electrical supply (on the cabinet panel below the left electrical compartment door; not shown in FIGURE 1A)
- 42) Optional Lockable Service Switch (Option BA6) (on the cabinet panel below the left electrical compartment door; not shown in FIGURE 1A)
- 43) Vent Temperature Limit (RHH & SHH)

FIGURE 1C - Locations of the SCR Power Controls with Heatsinks used on Model REH and PEH units with Modulating Heat Control Option D12D



SCR Power Control and Heatsink in Option D12D (one or two required depending on amps)



DANGER
High voltages are present on the terminals of the SCR power controller(s).

3.0 Maintenance Procedures

3.1 Filters - All Models

Check the filters.

Clean permanent filters, allow to dry, and re-install.

Replace dirty disposable filters. Exposure to humid makeup air can accelerate filter degradation. Systems with disposable filters require more frequent filter inspection.

PDH/SDH/RDH Sizes	75/100	125/150	175/200/225	250/300	350/400A
PEH/REH Sizes	10A/20A/40A	15B/30B/60B	N/A	30D/60D/90D/120D	40E/80E/120E
PXH/RXH	000A	000B	000C	000D	000E
RHH/SHH	N/A	N/A	130/180	260	350
Filters - (Qty) Width x Height in inches	(2) 16 x 25	(2) 20 x 25	(2) 16 x 16; (2) 16 x 20	(3) 16 x 16; (3) 16 x 20	(1) 16 x 16; (2) 20 x 20; (3) 16 x 20

Dirty Filter Switch - If equipped with a dirty filter switch, check the condition of the sensing tubes to be sure that they are not blocked. Check the wiring connections. To set a new switch, see Installation Manual, Paragraph 7.6. Replacement switch is **P/N 105507**.

3.2 Belt, Blower, and Motor - All Models

Remove dirt and grease from the motor and blower.

Check the belt for wear and tension. Adjust belt tension as needed. Adjust the belt tension by turning the adjusting screw on the motor base. Replace worn belts. (**IMPORTANT:** If a belt is replaced, after 8 hours of operation, recheck the tension.)

Linked Belts - If the belt needs tightening, the recommended method of tightening the belt length is to count the number of links and remove one link for every 24. (A link is made up of two joining sections of belt. For easier removal of links, turn the belt inside out. But be sure to turn it back before installing. If belt is removed or replaced, be sure to align directional arrows on the belt to the proper drive rotation.) The belt tension should be checked after the first 24 hours of running at full load and at regular maintenance inspections. Be sure that the belt is aligned in the pulleys.

Solid Belts - Adjust the belt tension by turning the adjusting screw on the motor base until the belt can be depressed 3/4" (19mm). After correct tension is achieved, re-tighten the locknut on the adjustment screw. Be sure that the belt is aligned in the pulleys.

The motor supplied has lifetime lubrication and sleeve bearings. If the motor has been replaced with one that has oil cups or grease fittings, lubricate the motor.

Check current draw to motor rating plate.

Blower bearings are permanently lubricated cartridge ball bearings and do not require greasing.

3.0 Maintenance Procedures (cont'd)

3.3 Electrical Compartment

Check the wiring and connections. Replace any wiring that is deteriorated.

CAUTION: If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C, except for sensor lead wires which must be 150°C. See Hazard Intensity Levels, page 2.

Controls identified below apply to all models unless specifically listed.

3.3.1 Reverse Flow Limit Control - PDH, SDH, RDH, RHH, SHH



P/N
211754

Function: The reverse flow limit control is an automatically reset, temperature activated safety control.

Service: If it is determined that the reverse flow limit control needs replacing, use only a factory-authorized replacement part that is designed for the size of heater.

Location: PDH/SDH/RDH 75-150 in the blower section. PDH/SDH/RDH 175-400 and all RHH/SHH in the heat section. For approximate location, see **FIGURE 1A**, page 5.

3.3.2 Transformer



Service: Use a voltmeter to verify that there are 24 volts output from a transformer. If the transformer is not functioning, it must be replaced. Use a replacement transformer identical to the factory-installed model.

Location: See **FIGURE 1A**, page 5, or **1B**, page 6, for location.

3.3.3 Door Switch - Models SDH, SHH



P/N
217262

Function: Prevents unit from operating when the heat section door is open.

Service: If it is determined that the door switch needs replacing, use only a factory-authorized replacement part that is designed for the heater.

Location: Models SDH/SHH heat section.

3.3.4 Condensate Pressure Switch - Models RHH & SHH



P/N 217085

Function: If the condensate drain is blocked causing the sensing pressure to be outside the switch setpoint, the pressure switch will shutoff the gas valve. The gas valve will remain off until the problem is corrected.

Service: If it is determined that the condensate pressure switch needs replacing, use only a factory-authorized replacement part that is designed for the heater.

Location: See **FIGURE 1A**, page 5, Item 22, for location.

3.3.5 Built-in On/Off Control Switch, Option BA6



Function: Optional lockable service control switch.

Service: If it is determined that the control switch needs to be replaced, use only the factory-authorized replacement part that is designed for the heater.

Location: Switch is conveniently mounted below the electrical compartment on the outside of the unit.

Application: The switch on Models PDH, SDH, SHH, PXH, RHH, RDH, and RXH is P/N 205908. The switch used on Models PEH and REH differs by size; see chart below.

OPTION BA6 REQUIRED DISCONNECT SIZE for Electric Heat MODELS PEH and REH (AMPS)						
	208/1/60	240/1/60	208/3/60	240/3/60	460/3/60	575/3/60
10 KW	80	100	N/A	N/A	N/A	N/A
15 KW	100	125	N/A	N/A	N/A	N/A
20 KW	125	200	80	80	60	60
30 KW	200	200	100	125	60	60
40 KW	N/A	N/A	125	200	80	60
60 KW	N/A	N/A	200	200	100	100
80 KW	N/A	N/A	200	250	125	125
90 KW	N/A	N/A	250	N/A	200	125
120 KW	N/A	N/A	N/A	N/A	200	200

Available Disconnect Switch Sizes (Amps): 60 (P/N 205906), 80 (P/N 205907), 100 (P/N 205908), 125 (P/N 207678), 200 (P/N 207679) and 250 (P/N 222422)

Note: These ratings are based upon 115% of the total FLA for heat modules plus motor.

3.3.6 Ignition Control Module for Gas Heat Section - applies to all gas controls EXCEPT Options D12G and AG58

Reference: For Troubleshooting and explanation of LED lights, see Paragraph 4.1.

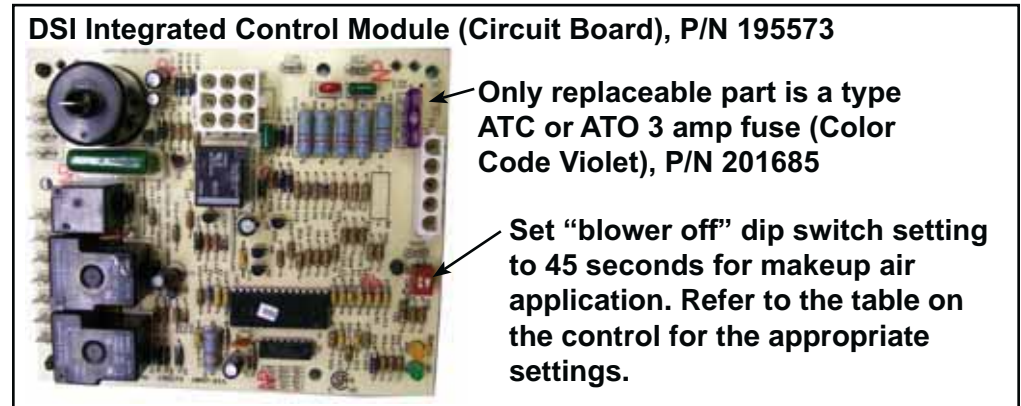
Normal Heat Cycle Operating Sequence

Abnormal Heat Cycle Functions

DSI Integrated Control Module (circuit board) - The module monitors the operation of the heater including ignition. The only replaceable component is the 3 amp Type ATC or ATO fuse. If the fuse is blown, the problem is most likely an external overload. Correct the problem and replace the fuse.

Do not attempt to disassemble the control module. However, each heating season check the lead wires for insulation deterioration and good connections.

Proper operation of the direct spark ignition system requires a minimum flame signal of 1.0 microamps as measured by a microammeter.



1) Call for Heat - The heating/cooling system controller calls for heat. The ignition system circuit board checks to see that the limit switch is closed and the pressure switch is open. If the limit switch is open, the circuit board responds as defined in the "Abnormal Heat Cycle, Limit Switch Operation". If the pressure switch is closed, the circuit board will do four flashes on the green LED and wait indefinitely for the pressure switch to open. If the pressure switch is open, the circuit board proceeds to prepurge.

2) Prepurge - The circuit board energizes the venter motor and waits for the pressure switch to close. If the pressure switch does not close within 30 seconds of the venter motor energizing, the circuit board will do two flashes on the green LED. The circuit board will leave the venter motor energized indefinitely as long as the call for heat remains and the pressure switch is open.

When the pressure switch is proven closed, the circuit board begins the prepurge time. If flame is present any time while in prepurge, the prepurge time is restarted. If flame is present long enough to cause lockout, the circuit board responds as defined in "Fault Modes, Undesired Flame".

The ignition system circuit board runs the venter motor for a 20 second prepurge time, then proceeds to the ignition trial period.

3) Ignition Trial Period - The ignition system circuit board energizes the spark and main gas valve. The venter remains energized. If flame is sensed during the first 16 seconds, the spark is de-energized. If flame has not been sensed during the first 16 seconds, the control de-energizes the spark output and keeps the gas valve energized for an additional one second flame proving period. If flame is not present after the flame proving period, the control de-energizes the gas valve and proceeds with ignition re-tries as specified in "Abnormal Heat Cycle, Ignition Retry". If flame is present, the circuit board proceeds to steady heat.

4) Steady Heat - Circuit board inputs are continuously monitored to ensure limit and pressure switches are closed, flame is established (sensor on both burner sections), and the system controller call for heat remains. When the call for heat is removed, the ignition system circuit board de-energizes the gas valve and begins postpurge timing.

5) Post Purge - The venter motor output remains on for a 45 second postpurge period after the system controller is satisfied.

Interrupted Call for Heat - If the system controller call for heat is removed before the flame is recognized, the circuit board will run the venter motor for the post purge period and de-energize all outputs.

If the call for heat is removed after successful ignition, the circuit board will de-energize the gas valve and run the venter motor through post purge.

Ignition Retry - If flame is not established on the first trial for ignition period, the ignition system circuit board de-energizes the gas valve, and the venter motor remains

3.0 Maintenance Procedures (cont'd)

3.3 Electrical Compartment (cont'd)

3.3.6 Ignition Control Module Gas Heat Section - applies to all gas controls except Options D12G and AG58 (cont'd)

Ignition System Fault Modes

Abnormal Heat Cycle Functions (cont'd)

energized for an inter-purge period of 10 seconds. The spark and gas valve are then re-energized, and the circuit board initiates another trial for ignition.

If flame is not established on the second trial for ignition, the circuit board de-energizes the gas valve and venter motor remains energized. The spark and gas valve are re-energized and the circuit board initiates another trial for ignition.

If flame is not established on the third trial for ignition period, the circuit board de-energizes the gas valve, and the venter motor remains energized for an inter-purge period of 10 seconds. The circuit board then re-energizes the gas valve and spark and initiates another trial for ignition.

If flame is not established on the fourth trial for ignition (initial try plus 3 re-tries), the circuit board de-energizes the gas valve and goes into lockout. The circuit board goes to one flash on the green LED to indicate ignition failure lockout.

Limit Switch Operation - The limit switch is ignored unless a call for heat is present (W energized). If the limit switch is open and a call for heat is present, the control de-energizes the gas valve, runs the blower motor on heat speed, and runs the induced draft (venter) motor. The control will be in soft lockout and flashing fault code "3", before returning to normal operation.

When the limit switch re-closes or the call for heat is lost, the control runs the induced draft motor through post purge and runs the blower through the selected fan off delay.

Pressure Switch - If the pressure switch opens before the trial for ignition period, the venter motor will run through the pressure switch recognition delay (2 seconds), the gas valve will be de-energized, and the venter motor will run through the postpurge time. The ignition system circuit board will re-start the heat cycle at the pressure switch proving state if the call for heat still exists.

Pressure switch opening for less than 2 seconds during the trial for ignition period shall not interrupt the heat cycle. (Gas valve will de-energize while the pressure switch is open.)

If the pressure switch opens after a successful ignition, the circuit board will de-energize the gas valve. If flame is lost before the end of the 2 second pressure switch recognition delay, the circuit board will respond to the loss of flame. If the pressure switch remains open for 2 seconds and the flame remains, the circuit board de-energizes the gas valve and the venter motor runs through postpurge.

Undesired Flame - If flame is sensed longer than 20 seconds while the gas valve is de-energized, the circuit board shall energize the venter motor. When flame is no longer sensed, the venter motor will run through postpurge. The circuit board will do a soft lockout, but will still respond to open limit and flame. The FLAME (yellow) LED shall flash rapidly when lockout is due to undesired flame.

Gas Valve Relay Fault - If the circuit board senses the gas valve as energized for more than one second when the circuit board is not attempting to energize the gas valve, or the gas valve is sensed as not energized when it is supposed to be energized, then the circuit board will lockout with the green LED off. The control assumes either the contacts of the relay driving the gas valve have welded shut, or the sensing circuit has failed. The venter motor is forced off to open the pressure switch to stop gas flow unless flame is present.

If the gas valve was sensed as closed when it should be open, and has not de-energized after the venter motor was shutoff for 15 seconds, then the venter motor is re-energized to vent the unburned gas.

Soft Lockout - The circuit board shall not initiate a call for heat while in lockout. The circuit board will still respond to an open limit and undesired flame. Lockout shall automatically reset after one hour. Lockout may be manually reset by removing power from the circuit board for more than one second or removing the call for heat for more than one and less than 20 seconds.

Hard Lockout - If the circuit board detects a fault on the board, the status LED will be de-energized, and the circuit board will lockout as long as the fault remains. A hard lockout will automatically reset if the hardware fault clears.

Power Interruption - During a momentary power interruption or at voltage levels below the minimum operating voltage (line voltage or low voltage) the ignition system will self-recover without lockout when voltage returns to the operating range.

Power interruptions of less than 80mS shall not cause the circuit board to change operating states. Power interruptions greater than 80mS may cause the circuit board to interrupt the current operating cycle and re-start.

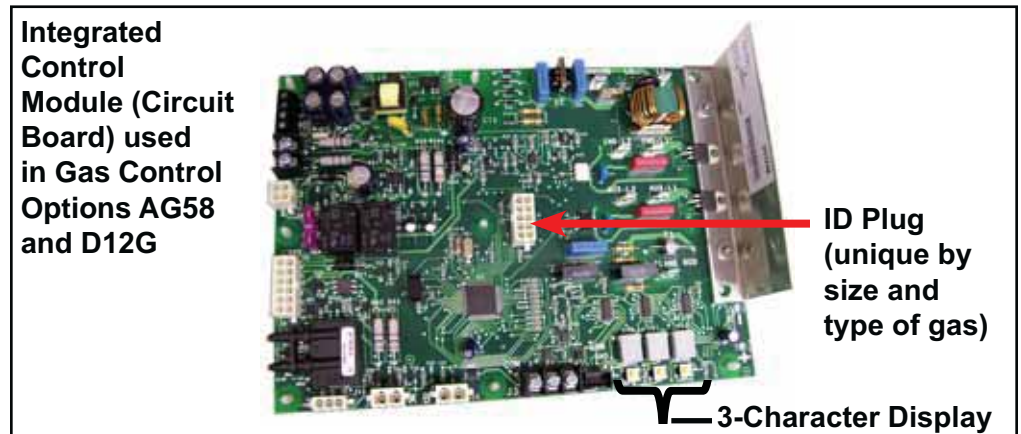
3.3.7 Ignition Control Module and Spark Board for Gas Heat Section with Option AG58 or D12G - applies to RDH Sizes 175-400, RHH, & SHH

IMPORTANT: The board has an ID plug that is unique for each model, size, and type of gas. A replacement board will require either a new ID plug or reuse of the ID plug from the board being replaced.

REFERENCE: Operating and Lockout Error Codes displayed on the ignition controller 3-character display are listed in Troubleshooting Paragraph 4.2.

Integrated Control Module for Gas Control Options AG58 and D12G - The control module is located in the control compartment with an additional board to control spark that is attached to the removable shield on the end of the burner. Except for the replaceable parts shown, do not attempt to disassemble either board. Each heating season check the lead wires for insulation deterioration and good connections.


If replacement is required, these boards must be replaced with identical parts.



The control has a built-in, self-diagnostic capability. The control continuously monitors its own operation and the operation of the heat section including direct spark ignition, safety and modulating valves, and venter motor speed. The 3-digit display on the control indicates the current system state, warnings, failures, and test modes.

LED 3-Character Display (displayed on power up)	
Display Info (example only)	Description
RDH	Furnace series or model name
400	Heat Section Size
nAt or LP	Fuel type
1.01	Software version

Spark Ignition Board, P/N 257975, is located on the removable shield at the end of the burner.



CAUTION: Due to high voltage on the spark wire and electrode, do not touch when energized. See Hazard Intensity Levels, page 2.

1) Call for Heat - The FX06 controller or 7350M thermostat calls for heat (there is a closure between "R" and "W" and at least 2 VDC to the analog input). The ignition system circuit board will check the modulating valve position and move to lightoff position. It checks to see that the limit switch is closed and the pressure switch is open. If the pressure switch is closed, the circuit board will wait indefinitely for the switch to open. If the switch is open, the circuit board proceeds to prepurge.

2) Prepurge - After the actuator moves to its lightoff position, the circuit board energizes the venter motor and waits for the pressure switch to close. If the pressure switch does not close at the beginning of a heat cycle, the venter motor will run for two minutes, then cycle off for 30 seconds, then on for two minutes, and so forth indefinitely.

When the pressure switch is proven closed, the venter motor ramps up to the appropriate lightoff speed and the circuit board begins the prepurge time. If flame is

3.0 Maintenance Procedures (cont'd)

3.3 Electrical Compartment (cont'd)

3.3.7 Ignition Control Module - Gas Heat Section with Control Option AG58 or D12G (cont'd)

3.4 Gas-Fired Heat Section - PDH, SDH, RDH, RHH, & SHH

3.4.2 Burner Maintenance

Burner Removal Instructions

Inspect and Clean the Burner

Modulating Gas Control Sequence of Operation - applies to Gas Control Option AG58 or D12G (cont'd)

present any time while in prepurge, the prepurge time is restarted. If flame is present long enough to cause lockout, refer to the Troubleshooting Guide in Paragraph 4.2. The ignition system circuit board runs the venter motor for a 30-second prepurge time, then proceeds to the ignition trial period.

3) Ignition Trial Period - The ignition system circuit board energizes the spark and main gas valve. The venter remains energized. If flame is sensed during the first 6 seconds, the spark is de-energized. If flame has not been sensed during the first 6 seconds, the control de-energizes the spark output and keeps the gas valve energized for an additional one second flame proving period. If flame is not present after the flame proving period, the control de-energizes the gas valve and proceeds with three ignition re-tries as specified in "Abnormal Heat Cycle, Ignition Retry". If flame is present, the circuit board proceeds to steady heat. After three re-tries, the board will lockout for one hour. It will require a cycling of power to reset before the one-hour limit.

4) Modulating Heat - As long as the call for heat exists, the circuit board not only modulates the gas to precisely meet varying load conditions, but also modulates the combustion air to maintain stable performance and optimize thermal efficiency across the entire modulating range. Circuit board inputs are continuously monitored to ensure limit switch is closed and flame is established. When the call for heat is removed, the ignition system circuit board de-energizes the gas valve and begins postpurge timing.

5) Post Purge - The venter motor output remains on for a 45 second postpurge period after the system controller is satisfied.

3.4.1 Heat Exchanger Maintenance

The gas furnace section includes a patented T_{CORE}²® burner and primary heat exchanger. High efficiency Models RHH & SHH also have a secondary heat exchanger. Remove any external dirt or dust accumulation. Visually check the heat exchanger for cracks and holes. If a crack or hole is observed, replace the heat exchanger.

NOTE: Inspection of the lower portion of the heat exchanger is done with the burner removed. See the Burner Maintenance section below for information on inspecting the lower portion of the heat exchanger.

This heater is equipped with a T_{CORE}²® burner.

Inspect the burner/control compartment annually to determine if cleaning is necessary. If there is an accumulation of dirt, dust, and/or lint, clean the compartment and follow the instructions below to remove and the burner for inspection and/or cleaning.

CAUTION: Use of eye protection is recommended.

1. Outside the cabinet, shut the gas supply off at the manual valve ahead of the union.
2. Turn off electric supply.
3. Open the burner cabinet door.
4. Loosen the screw holding the burner shield end and remove the burner shield end. (See **FIGURE 2**.)
5. At the union closest to the burner, disconnect the gas supply. Do not allow the portion of the gas train attached to the venturi tube to rotate.
6. **Remove Burner Assembly** - The burner assembly is designed to slide out of the heater for inspection and/or service. Carefully pull the burner assembly end (with pipe nipple attached) out of the heater. To completely remove the burner assembly, disconnect the sensor and ignitor wires. Slide the burner out of the cabinet.

With the burner assembly accessible, shine a flashlight on the burner ribbons. Look for carbon buildup, scale, dust, lint, and/or anything that might restrict flow through the spaces between the burner ribbons.

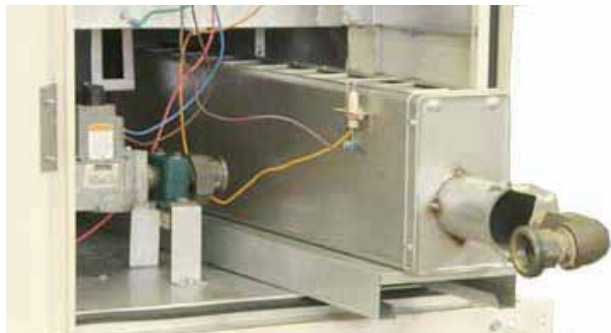
If it is determined that the burner needs to be cleaned, hold the burner assembly so that any foreign material will fall away from the burner, use a stiff bristle brush to loosen and remove any foreign material(s). If the burner is excessively dirty, remove one of the burner end caps. Remove the four screws that hold the end cap to the burner housing. Lightly tap the end cap to remove it.

Clean all foreign material from the burner and venturi. After the burner is thoroughly clean, replace the end cap making certain that it is tight against the burner housing. **NOTE:** If any of the burner components are damaged or deteriorated, replace the burner assembly.

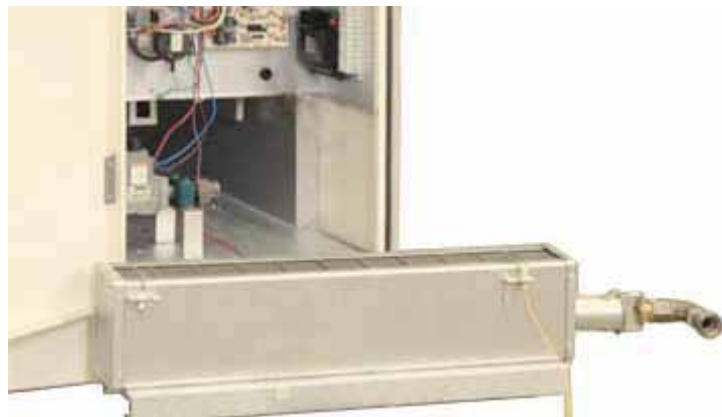
FIGURE 2 - Burner assembly is designed to slide out of the cabinet.



Loosen screw to remove burner shield end. Screw will stay attached to shield.



**Disconnect the gas supply at the union closest to the burner.
Pull the burner forward.**



To remove the burner, disconnect the flame sensor wires and the ignitor. Pull the burner until it slides off the support rails.

Inspect the Lower Portion of the Heat Exchanger (with burner removed)

At the burner flame entrance of each tube, shine a bright light into each heat exchanger section. With the light shining into the heat exchanger, observe the outside for visible light. Repeat this procedure with each heat exchanger section. If any light is observed, replace the heat exchanger.

Instructions to Re-Install the Burner (See FIGURE 2.)

1. Position the burner on the rails and slide the burner assembly part way into the cabinet. Re-attach the sensor and ignitor wires. Slide the burner into "working" position.
2. Re-attach the gas train. Do not allow the portion of the gas train attached to the venturi tube to turn. Be sure the burner is positioned correctly. Check to be sure that the orifice is secure and positioned correctly.
3. Re-attach the burner shield end.
4. Close and latch the burner cabinet door.
5. Turn on the electric and the gas. Check for proper operation.

3.4.3 Burner Orifice

The burner orifice usually only needs to be replaced when installing a gas conversion kit. If ordering a replacement orifice only, give BTUH content and specific gravity of gas, as well as the model and serial number of the unit. When removing or replacing the burner orifice be careful not to damage the venturi tube and/or the bracket.

3.0 Maintenance Procedures (cont'd)

3.4 Gas-Fired Heat Section - PDH, SDH, RDH, RHH, & SHH (cont'd)



Ignitor, P/N 209339

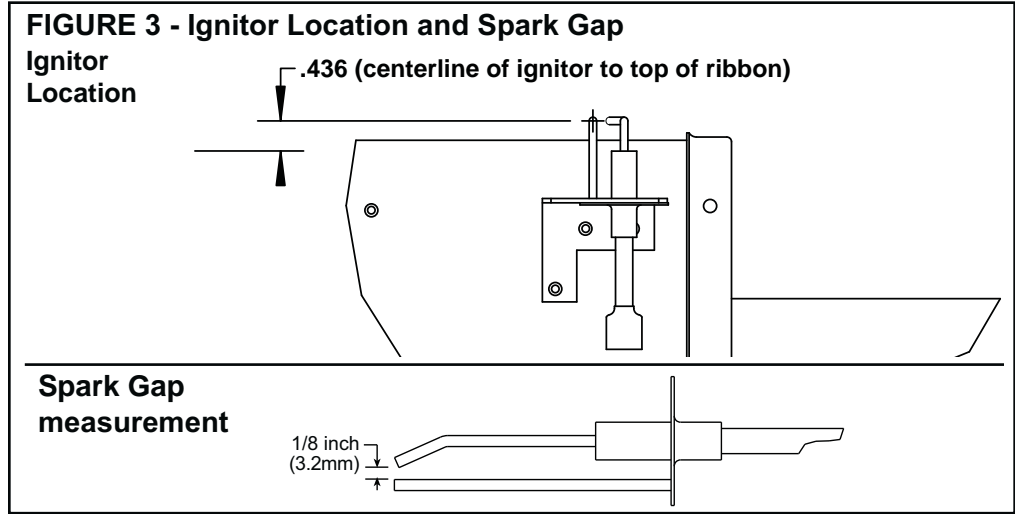
Flame Sensor, P/N 209973



3.4.4 Ignition System

Ignitor - Locate the ignitor. Disconnect the wire; remove the screw and the ignitor. Clean the ignitor assembly with an emery cloth.

Spark gap must be maintained to 1/8". **IMPORTANT:** When re-assembling, the brown ground wire must remain attached to the ignitor.



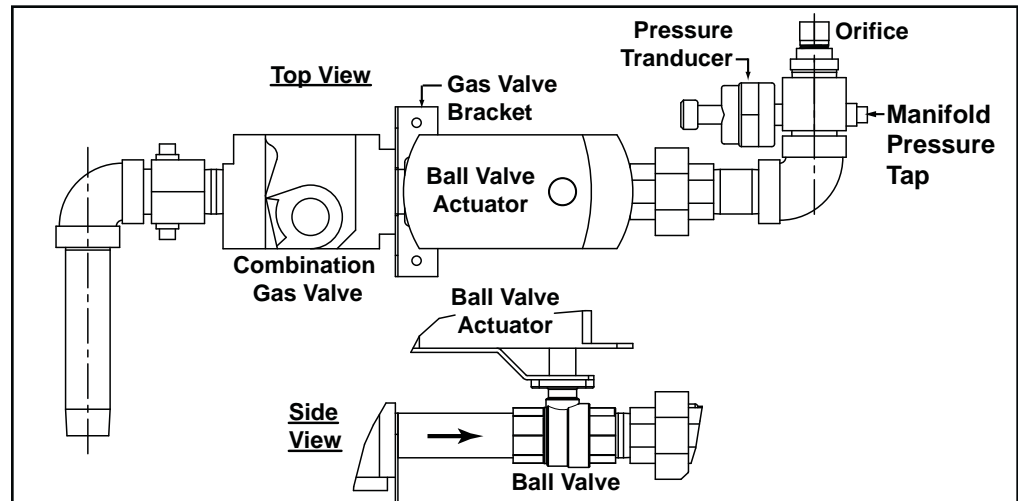
CAUTION: Due to high voltage on the spark wire and electrode, do not touch when energized. See Hazard Intensity Levels, page 2.

Flame Sensor - Locate the flame sensor. Disconnect the wire; remove the screw and the flame sensor. Clean with an emery cloth.

3.4.5 Gas Train Components

FIGURE 4 - Gas Train Component Locations for a Burner with 8:1 turndown (Modulating Gas Control Option AG58 or D12G) - applies only to Model RDH Sizes 175-400, Model RHH, and Model SHH

The gas train components differ depending on the gas control option selected. See the location of gas train components in **FIGURE 1A**, page 5, and below in **FIGURE 4**.



Single-Stage and Two-Stage Gas Valves

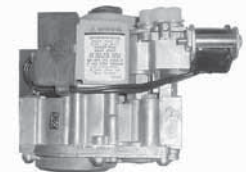
Carefully remove external dirt accumulation and check wiring connections.

The combination gas valve must be checked annually to ensure that the valve is shutting off gas flow completely.

Single-Stage Gas Valves



Two-Stage Gas Valve



WARNING

The operating valve is the prime safety shutoff. All gas supply lines must be free of dirt or scale before connecting to the unit to ensure positive closure.

CAUTION: DO NOT bottom out the gas valve regulator adjusting screw. This can result in unregulated manifold pressure causing excess overfire and heat exchanger failure.

FIGURE 5 - Pressure Tap for Checking Gas Flow Shutoff

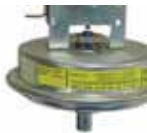
Instructions for checking valve shutoff:

- 1) Locate the 1/8" NPT pressure tap on the combination valve (**FIGURE 5**).
- 2) With the manual valve turned off to prevent flow to the gas valve, connect a manometer to the 1/8" outlet pressure tap in the valve. **NOTE:** A manometer (fluid-filled gauge) is recommended.
- 3) Turn the manual valve to the ON position and the heater OFF. Use your finger to fully block the main burner orifice for several seconds. Observe the manometer with the orifice blocked. If any pressure is indicated, the gas valve is leaking. **A leaking gas valve must be replaced before the heater is put back in operation.**



Modulating Gas Valve and Gas Pressure Switch - Options AG40, DG2, DG6, D12B

Natural Gas Pressure Switch , P/N 211130



Propane Pressure Switch , P/N 211710



Function: The gas valve controls modulation and the gas pressure switch monitors gas pressure to control operation of the two-speed venter.

Service: The modulation gas valve and switches have no field maintenance requirements except careful removal of external dirt accumulation and checking of wiring connections.

Use only factory-authorized parts.

Location: See **FIGURE 1A**, page 5, for location.

Modulating Gas Valve - Options AG58, D12G

The gas train has a ball valve with an actuator (see **FIGURE 6**) to control gas flow. The ball valve and actuator are located downstream of the combination single-stage valve as shown in **FIGURE 4**.

Carefully clean external dirt accumulation from the actuator.

FIGURE 6 - Ball Valve and Actuator in Gas Control Options AG58 and D12G



Ball Valve Actuator Modulates the Gas Flow
Actuator Set Screw (shown on the right or closed position)



Modulating System Gas Valve (Ball Valve and Actuator) Adjustment

Inspect the position of the ball valve shaft.

- In the fully open position, the dash marks on the top of the shaft should be aligned with the gas piping.
- In the fully closed position, the dash marks on the top of the shaft should be aligned at a 90° angle across the gas piping.

If the ball valve shaft is not properly aligned or if the manifold pressure does not match the settings in the chart started below, the ball valve will need to be adjusted.

Manifold Pressure (" w.c.) Measured at the Pressure Tap by the Gas Transducer - Gas Control Option AG58 or D12G				
RDH Size	RHH/SHH	Gas Type	High Setting 100% on ModHeat	Low Setting 0% on ModHeat
175	130	Natural	3.4	0.15
		Propane	10.0	0.30

(continued)

3.0 Maintenance Procedures (cont'd)

3.4 Gas-Fired Heat Section - PDH, SDH, RDH, RHH, & SHH (cont'd)

3.4.5 Gas Train Components (cont'd)

Manifold Pressures for Option AG58 or D12G Gas Modulation System (cont'd)

Manifold Pressure (" w.c.) Measured at the Pressure Tap by the Gas Transducer - Gas Control Option AG58 or D12G (cont'd)				
RDH Size	RHH/SHH	Gas Type	High Setting 100% on ModHeat	Low Setting 0% on ModHeat
200	180	Natural	3.4	0.15
		Propane	10.0	0.25
225	--	Natural	3.4	0.15
		Propane	10.0	0.30
250	--	Natural	3.4	0.15
		Propane	10.0	0.25
300	260	Natural	3.4	0.15
		Propane	10.0	0.30
350	--	Natural	3.4	0.15
		Propane	10.0	0.25
400A	350	Natural	3.4	0.15
		Propane	10.0	0.25

To adjust AG58 or D12G gas modulation ball valve on Model SHH, RHH, or RDH (Sizes 175-400), follow instructions below:

1. Checking modulation requires a 0-10 DC volt generator and a manometer capable of reading to 0.10" w.c. .
 - a) Connect the manometer to the manifold pressure tap next to the transducer (**FIGURE 4**, page 14).
 - b) Connect the leads from the 0-10 DC volt generator to the "analog + and _" screw terminals on the control board after marking, removing, and capping the wires already at those terminals.
 - c) Initiate a call for heat with either the thermostat (Option CL36, modulating wall heating/cooling Model T7350M) if equipped with Option AG58 or the FX06 controller (refer to Form CP-PREEVA-D12B/D/E/F/G) if equipped with Option D12G.
2. Run the unit at 100% by setting the DC voltage at 10 volts; measure the manifold pressure. If the manifold pressure matches the High Setting value in the chart (above), continue to Step No. 3. If the manifold pressure does not match the value in the chart and the ball valve is fully or close to fully open, adjust the pressure screw(s) on the Honeywell valve (See **FIGURE 5** and the **CAUTION** on page 15) until the pressure matches the chart. When the manifold pressure measured at the manometer matches the pressure listed in the chart, make a note for future reference of the position of the ball valve stem in relation to the dash marks on the actuator.
3. Reduce the DC volts to 2 volts and allow the ball valve to go to its lowest setting. Check the manifold pressure on the manometer. If the manifold pressure matches the Low Setting value in the chart, skip to Step No. 4. If the manifold pressure does not match the low (0%) value on the chart, the ball valve will need to be adjusted. Follow these steps:
 - a) While the unit is still firing at 0% modulation, remove the ball valve actuator. To do this, locate the screw on the rear of the actuator and remove it. Loosen the actuator set screw (See **FIGURE 6**, page 15), and carefully remove the actuator by lifting it straight up. Do not disconnect any wires.
 - b) Using adjustable pliers, slowly turn the ball valve stem until the manifold pressure on the manometer matches the low setting on the chart.
Important NOTE: If the valve is adjusted too far closed and the flame goes out, let the unit recycle and then manually open the ball valve to the 100% open position noted in Step No. 2. When the unit is firing at full fire, re-attach the actuator to the ball valve, and repeat the procedure beginning with Step No. 2.
 - c) When the manometer readings match the values in the chart and before re-installing the actuator, the burr left on the ball valve stem from the previous set screw setting needs to be removed. Either lightly file the burr on the valve stem to prevent the set screw from returning to the previous position or remove the valve stem, rotate it 180° so that the set screw contacts the opposite side of the stem, and re-install the valve stem.
 - d) Re-install the actuator making sure it is level on the ball valve mounting plate.
 - e) Re-check the setting by going to full fire (Set **DC volts to 10 volts**) and then returning to 2 volts. Measure the manifold pressure. The adjusted gas pressure should be close to the value on the chart. If not, repeat the procedure.
4. When the settings are in agreement with the chart and testing is complete, remove the manometer. Remove the wire leads from the DC volt generator and replace the thermostat or FX06 control wiring.

Gas Manifold Transducer - part of Gas Control Options AG58 or D12G



Location: See FIGURE 4, page 14 .

Function: With Option AG58 or D12G gas control, the transducer reads the manifold pressure and sets the venter motor speed to precisely match the designed combustion settings.

Service: If the transducer needs to be replaced, use only a factory-authorized replacement part designed for the purpose.

Optional Gas Pressure Switches



Location: Low pressure switch is at the entrance to the gas train. The high pressure switch is at the burner end.

Function: To monitor gas pressure and shut down the heat section if gas pressure becomes too low or too high. The low pressure switch is an auto reset type and

is set at 50% of the maximum manifold pressure. The high pressure switch requires manual reset and is set at 125% of manifold pressure.

Service: There are no replaceable parts and the settings are non-adjustable. If replacement is required, use identical factory-authorized safety switches.

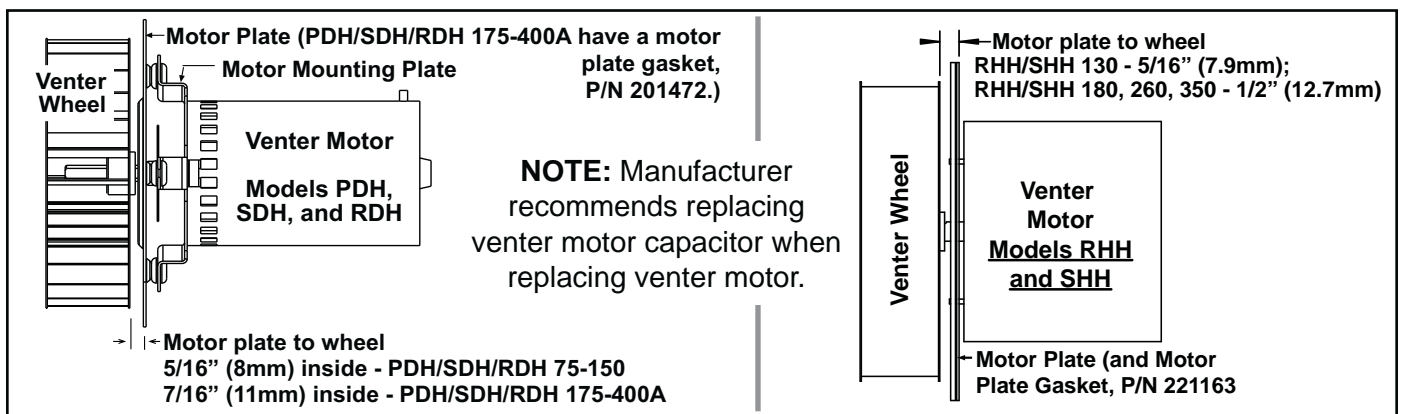
3.4.6 Venter Motor, Wheel, and Pressure Sensing Tap

Venter Motor and Wheel Assembly Replacement Instructions

Remove dirt and grease from the motor casing, the venter housing, pressure sensing tap, and the venter wheel. Venter motor bearings are permanently lubricated. Follow these instructions for replacement of the venter motor and wheel assembly. Keep all hardware removed to be used in re-assembling and installing the replacement parts.

1. Turn off the gas and disconnect the electric power.
2. Open the burner/control compartment door panel.
3. Disconnect the two or three venter motor wires at the DSI control or the venter speed control board, capacitor wires at the capacitor (if applicable), and ground screw (located on the control panel).
4. Holding the venter motor, remove the three, four, or six screws that attach the venter motor mounting plate to the venter housing. Remove the motor and wheel assembly from the heater.
5. Re-assemble with the replacement venter motor and wheel assembly. See FIGURE 7, for correct spacing. If there is a motor plate gasket, check it. If the gasket is damaged, replace it.

FIGURE 7 - Venter Wheel Position on Shaft



6. Follow the wiring diagram to connect the venter wires.
7. Close the door panel. Restore power to the heater and turn on the gas. Light, following the instructions on the lighting instruction plate. Check for proper operation.

Vent Temperature Limit Switch - RHH & SHH



P/N 221158

Function: The vent temperature limit switch is a manual reset, temperature activated safety control. Its purpose is to prevent the vent gas temperature from exceeding a temperature that will harm the PVC vent pipe. Setpoint is 145°F.

Service: If the vent temperature limit switch is activated, identify and correct the cause before resetting the switch. The switch could be activated by one or more of the following:

3.0 Maintenance Procedures (cont'd)

3.4 Gas-Fired Heat Section - PDH, SDH, RDH, SHH (cont'd)

3.4.7 Combustion Air Pressure Switch



3.4.6 Venter Motor, Wheel, and Pressure Sensing Tap (cont'd)

Vent Temperature Limit Switch (cont'd) - Models RHH & SHH

- Manifold gas pressure is too high
- The heat content of the fuel is too high
- Reduced circulating airflow due to dirty and/or plugged air moving components
- Excess dirt on the heat exchangers
- Failed heat exchanger (s)

Location: On the side of the venter housing.

Function: Monitors flow of combustion air.

Service: If it is determined that the pressure switch needs replacing, use only the factory-authorized replacement part that is designed for the model and size of heater being serviced. Two-stage units with a two-speed venter and units with electronic modulation have two pressure switches. **NOTE:** A single-stage or two-stage unit operating above 6000 ft elevation requires a high altitude high speed pressure switch.

Location: See **FIGURE 1A**, page 5, for location.

P/N's & Settings - Models SDH, PDH, RDH				
SDH, PDH, RDH Size	High Speed (applies to all gas controls)		Low Speed (applies only to units with gas controls using a 2-speed venter)	
	Switch P/N	Setting (" w.c.)	Switch P/N	Setting (" w.c.)
75	197030	0.4	205442	0.2
100	197030	0.4	205444	0.3
125	196388	0.5	205444	0.3
150	197028	0.7	205444	0.3
175	201158	1.1	197030	0.4
200	201158	1.1	197030	0.4
225	201158	1.1	197030	0.4
250	201158	1.1	197030	0.4
300	201158	1.1	197030	0.4
350	201158	1.1	197030	0.4
400A	201158	1.1	197030	0.4

P/N's & Settings - RHH & SHH		
RHH/SHH Size	High Speed (applies to all gas controls)	
	Switch P/N	Setting (" w.c.)
130	201161	1.3
180	201161	1.3
260	201159	1.4
350	221228	2.3

3.4.8 High Temperature Limit Control

Sizes 75-150, **P/N 210854**
 Sizes 175-225, **P/N 210855**
 Sizes 250-400, **P/N 211066**



Function: The limit control is an automatically reset, temperature activated safety control with a capillary sensor. Sensor is extended across the heater discharge.

Service: If it is determined that the limit control needs replacing, use only a factory-authorized replacement part that is designed for the size of heater.

Location: For switch location, see **FIGURE 1A**, page 5.

3.4.9 Vent or Vent/Combustion Air System

Check the complete system at least once a year. Inspection should include all joints, seams, concentric adapter box (Model SDH), combustion air inlet opening, and the vent terminal cap. Clean openings. Replace any defective parts. Refer to the venting manual for requirements.

On a Model SHH, clean the vent condensate drain. After cleaning, fill the trap with water.

3.4.10 Heat Section Condensate Drain(s)

At the beginning of the cooling season or more often if needed, clean the heat section condensate drain(s). (Models PDH, SDH, and RDH will have none or one. Model SHH will have one or two.) Before starting the unit, fill traps with water to ensure proper operation. If condensate drain is not needed in the winter, drain the trap before heating season. If condensate drain is used in below freezing temperature, provide a means of freeze protection.

3.5 Electric Heat Section - Models PEH, REH

WARNING

Turn off the power locking the disconnect switch. Allow the heating elements to cool.

CAUTION: Wearing eye protection is recommended when cleaning the heating elements and cabinet.

3.5.1 Electric Heating Elements

Single Heating Element
(Each heat section includes an assembly of single elements.)



Service: Check the heating elements at the beginning of the heating season. Carefully clean all dust and dirt from the heating elements using a brush or steel wool. With a vacuum or air hose, clean the inside of the cabinet especially the bottom and sides where dirt and dust will accumulate.

If a replacement is needed, order a complete heat section assembly (5kw single phase or 10kw three phase).

Location: See the control location illustration in **FIGURE 1B and 1C**, pages 6 and 7.

Service: The electric heat section has a transformer, relay, digital controller, contactors, fuses, and a distribution block.

Quantities and types of fuses and contactors depend on the size of unit.

If the electric heat section has SCR control (Option D12D), the controller(s) with heatsink are positioned as shown in **FIGURE 1C**.

DANGER

High voltages are present on the terminals of the SCR power controller(s).

If replacements are required, check with your distributor and use only factory-authorized parts.

3.6 Dampers and Controls

Reference NOTE: Codes for electrical options are listed on the wiring diagram.

Damper Motor



Inlet Air Dampers

Location: Dampers and damper motors are located in either the blower section (Option AR8) or the optional mixing box (GE Options).

Function: Dampers operate in response to the control selected. Damper controls are shown below.

Service: Clean dampers and controls of dust and dirt.

2-Position Damper Motor (Options AR8 and GE 3, 6, 7)

Function: The 2-position damper motor opens and closes the dampers in response to unit operation, a system switch, or a field-supplied time clock. Motor closes dampers on heater shutdown.

Service: There is no service required on this motor other than external cleaning. If the motor needs replaced, replace with an identical damper motor or damper motor replacement kit.

Service: There is no service required on this motor other than external cleaning. If the motor needs replaced, replace with an identical damper motor.

Modulating Motor (Options GE 4, 8, 10, 11, 12, 13, 14, 15, 16, 21, 22)

Function: The modulating damper motor actuates the dampers in response to discharge air temperature, building pressure, or DDC control. Some options have damper "stops" or warmup (or cooldown) delay based on return air temperature. Motor closes dampers on heater shutdown.

Service: There is no service required on this motor other than external cleaning. If the motor needs replaced, replace with an identical damper motor.

Potentiometer (adjustable damper dial) (Options GE 4, 8, 10, 14)

Function: The potentiometer is a manually set switch used with modulating dampers to set a minimum outside air damper opening. Depending on the option selected, it is either mounted in the mixing box or remotely located.

Service: If the potentiometer needs replaced, replace it with an identical switch.

Potentiometer, P/N 16110



Return Air Controller, P/N 126170



Return Air Controller (Options GE 7, 13, 14)

Function: The return air controller senses the temperature of the incoming return air. On a two-position outside air damper system, it activates the motor to open and close the outside air damper. On a modulating system, the return air controller maintains 100% return air until the set temperature is reached at which point the mixed air controller (with or without potentiometer) controls the dampers based on the mixed air control setting. When in the heating mode, the temperature of the "mixed" return and outside air entering the heater must always be 35°F or above.

Service: If the controller needs replaced, replace it with an identical control.

3.0 Maintenance Procedures (cont'd)

3.6 Dampers and Controls (cont'd)

Mixed Air Controller, P/N 16109



Mixed Air Controller (Options GE 11, 12, 13, 14)

Function: The mixed air controller senses the temperature of the air entering the heater. It automatically operates the damper motor to modulate the outside and return air dampers based on the temperature setting. When in the heating mode, the temperature of the “mixed” return and outside air entering the heater must always be 35°F or above.

Service: If the controller does not function properly, replace it with an identical control.



Pressure Null Switch, P/N 88052

Pressure Null Switch (Option GE15)

Function: The pressure null switch is a diaphragm operated differential pressure switch used in makeup air applications to control building pressure. It maintains a selected positive or negative pressure setpoint by changing the amount of outside air being introduced to the building through the modulating outside air dampers. As more pressure is required in the building, the pressure null switch activates the damper motor driving the outside air damper towards the full open position and the recirculated air damper towards the closed position. Conversely, as less pressure is required, the switch drives the dampers in the opposite direction.

Service: Check wiring connections and sensor tubes. If the controller needs replaced, replace it with an identical control.

Economizer Logic Module, P/N 220637



Economizer Logic Module and Enthalpy Sensor (Options GE 21, 22)

Function: The economizer logic module is used in makeup air cooling applications to control the outside air damper to provide the most economical inlet air mixture. During economizer logic module operation, the mechanical cooling is operated by stage 2 cooling on the space thermostat. The economizer logic module is automatically locked out during heating and holds the outdoor air damper at the minimum position setting.

Service: Check wiring connections. If the economizer logic module or sensor needs replaced, replace it with an identical control.



Enthalpy Sensor, P/N 196290

3.7 Optional Cooling Coil Module

3.7.1 Cooling Coil

Inspect the cooling coil at the beginning of the cooling season or more often if needed. Open the coil cabinet door. Inspect the coil for debris, dirt, grease, lint, mold, or any element which would obstruct heat transfer or airflow. Inspect coils and tubing for physical damage. Inspect feeders, piping connections, coil headers, and return bends for signs of fatigue, rubbing, and physical damage.

To clean the coils, use the proper tools and follow the instructions carefully to avoid damaging the coil. Use of a non-acid based coil cleaner is recommended. Due to possible damage to the coil, high pressure spray is not recommended.

Instructions:

1. Verify that the electrical power has been turned off and disconnect switch locked.
2. Open the coil cabinet door.
3. Use a soft brush to remove any dirt and debris from both sides of the coil.
4. Spray with cold or warm (not hot) water and a cleaning solution (non-acid based coil cleaner is recommended). Due to possible damage to the coil, high pressure spray is not recommended. First spray the leaving airflow side, then the inlet airflow side. As much as possible, spray the solution perpendicular to the face of the coil. Follow the instructions on the cleaning solution. When cleaning process is complete, rinse both sides with cool, clean water.

WARNING

If equipped with optional ultra-violet light, DO NOT use light for service lighting. Never expose eyes or skin to ultra-violet light.

3.7.2 Condensate Pan and Drain

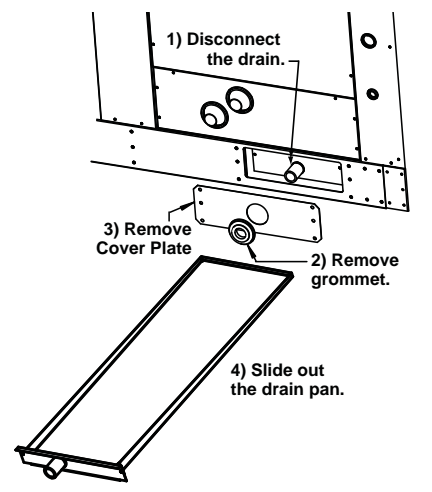
At the beginning of the cooling season or more often if needed, clean the cooling cabinet condensate drain pan, traps, and piping. The drain pan will slide out of the unit for cleaning. To remove the drain pan, disconnect the drain, remove the screws holding the small plate around the drain, remove the grommet, remove the plate, and carefully slide out the drain pan. (See **FIGURE 8**.)

After cleaning, re-install all parts and fill traps with water to ensure proper operation. The combination of airborne particles and moisture in the air handler can result in

algae formation in the drain pan and traps. The drain pan and traps must be cleaned regularly to avoid blockage that can slow or stop water flow, resulting in backup into the cabinet.

**FIGURE 8 -
Slide Out
Drain Pan**

NOTE: Indoor unit is illustrated. Outdoor unit is the same except drain is in the bottom panel not the base.



3.7.3 Optional Ultra-Violet Light

WARNING

DO NOT use ultra-violet light for service lighting. Never expose eyes or skin to ultra-violet light.

The ultra-violet light is located in the blower compartment. It has its own power supply. Disconnect all power before performing maintenance or service.

Replace the bulb(s) periodically to maintain design specifications. Replace the bulb(s) after 6000 hours of operation or one year, whichever comes first. For best performance, replace the bulb(s) at the beginning of each cooling season.

The bulb(s) should be light blue when lit. If the bulb color changes to red or flickers, replace the bulb. Output can be checked with a UVC radiometer. Replace bulb when output falls to 70% of initial reading.

Use factory-authorized replacement bulb only. Other bulbs may plug into the fixture but could cause overheating and should not be used.

3.7.4 Optional Reheat Module

Reheat Module Coils - Follow the instructions in Paragraph 3.7.1 to clean the reheat module coils.

Reheat Module Compressor Maintenance and Replacement

Compressor Handling

Do not lift compressor by copper tubing. To prevent internal damage, compressors **must ALWAYS be held upright.**

DANGERS

The reheat circuit is a high pressure system. Hazards exist that could result in personal injury or death. It is therefore required that the removal and installation of this scroll compressor be performed by a technician qualified in R410A refrigerant. See Hazard Intensity Levels, page 2.

Never use oxygen to pressurize a refrigeration system. Oxygen can explode on contact with oil and could result in personal injury or death. When using high pressure gas such as nitrogen for this purpose, ALWAYS USE A PRESSURE REGULATOR that can control the pressure down to 1 or 2 psig. Failure to use a regulator will result in extremely high pressure which could exceed the burst pressure of the compressor or other system components and result in personal injury or death. See Hazard Intensity Levels, page 2.

WARNING

For your safety, wear eye protection, gloves, and protective clothing when handling refrigerant and oil and when brazing. Have a fire extinguisher nearby. See Hazard Intensity Levels, page 2.

3.0 Maintenance Procedures (cont'd)

3.7 Optional Cooling Coil Module (cont'd)

3.7.4 Optional Reheat Module (cont'd)

Refrigerant System Maintenance

The following instructions include major points of consideration that will ensure proper installation and protect you from potential personal injury. Please use the following 13 Steps as a checklist, taking each item in order before proceeding to the next. If more information is required, contact the Factory Distributor.

DANGER

To avoid electrical shock, power to the compressor MUST REMAIN OFF during performance of Steps 1 through 9 below. LOCK DISCONNECT SWITCH OFF (open).

Step 1. Verify Proper Application

Verify that the replacement compressor is identical to the model being replaced. All system components are matched to the compressor. Replacing a compressor with a model other than the manufacturer specified replacement for these PREEVA® units will void the product warranty. See part numbers for R410A reheat pump compressors listed in the table below.

Step 2. Determine Cause of Initial Failure and Remove the Compressor

In order to prevent a second failure, the cause of the original failure must be determined. Identify the cause and make the necessary repairs.

CAUTION: DO NOT LIFT compressor by copper tubing; damage will occur. Compressor must remain upright.

WARNING

Wear eye protection and gloves when handling refrigerant or oil and when brazing.

- a) **BEFORE REMOVING THE FAULTY COMPRESSOR**, remove refrigerant charge using proper recovery procedures. Call 1-800-441-9450 for the name of the nearest Dupont authorized distributor or 1-800-ASK-KLEA (IGI) for information on their refrigerant reclaim programs.
- b) Disconnect wires. All compressor wiring is connected using a black molded plastic plug. Remove the plug from the compressor.
- c) Open access ports so that pressure does not build up in the system. Before unbrazing stubs from the compressor, cut suction and discharge tubing with a tubing cutter.

Replacement Scroll Compressors for Reheat Module (R410A Refrigerant)	SDH, PDH, RDH	SHH, RHH	PEH, REH	PXH, RXH	ARI Tonnage	Voltage	Compressor Model*	P/N
IMPORTANT: The Model of the replacement compressor MUST BE IDENTICAL to removed compressor.	75, 100, 125, 150, 175, 200, 225	130, 180	10A, 20A, 40A, 15B, 30B, 60B	000A, 000B, 000C	2.4	208-240/1/60 (AK2 and AK3)	ZP29K5E-PFV	216673
						208-240/3/60 (AK5 and AK6)	ZP29K5E-TF5	216674
						460/3/60 (AK7)	ZP29K5E-TFD	216675
						575/3/60 (AK8)	ZP29K5E-TFE	234055
	250, 300, 350, 400A	260, 350	30D, 60D, 90D, 120D, 40E, 80E, 120E	000D, 000E	4.8	208-240/1/60 (AK2 and AK3)	ZP57K3E-PFV	216685
						208-240/3/60 (AK5 and AK6)	ZP57K3E-TF5	216686
						460/3/60 (AK7)	ZP57K3E-TFD	216687
						575/3/60 (AK8)	ZP57K3E-TFE	216688

*Model No. of replacement R410A scroll compressor must be identical to the one removed including the "E" (ZP29KxE-xxx) which indicates POE compressor oil.

WARNING

Have a fire extinguisher near. The compressor contains oil. There is a risk of fire when unbrazing stubs.

Use a high temperature torch to disconnect the suction line and the discharge line from the compressor.

- d) Remove the mounting bolts and the compressor. Save the mounting hardware to attach the grommets and sleeves shipped with the replacement compressor.

- e) To test for acid and to assure excess oil does not remain in the circuit, remove oil from the failed compressor. Measure the amount of oil.

CAUTION: In addition to the required eye protection and gloves, care should be taken in handling POE oil because it may cause damage to certain plastics and roofing materials. See Hazard Intensity Levels, page 2.

If the oil taken from the compressor and measured is found to be significantly lower than listed in the table below, clean the excess oil through use of suction and liquid line filter driers. **Beginning in Step 4, follow the same procedure as for burnout cleanup.**

Use an acid test kit to check the oil for acid. **If acid is found, beginning in Step 4, follow procedures indicated for burnout cleanup.**

Dispose of oil and compressor using an approved environmentally safe disposal method.

Compressor Oil Charge		
PDH/SDH/RDH	75/100/25/150/175/200/225	250/300/350/400A
SHH/RHH	130/180	260/350
PXH, RXH	000A/000B/000C	000D/000E
PEH/REH	10A/20A/40A/15B/30B/60B	30D/60D/90D/120D/40E/80E/120E
Compressor	ZP29K	ZP57K
POE Oil (oz.)	21	52

Step 3. Mount the Replacement Compressor

Do not remove the dust cover or rubber shipping plugs until all other system connections are complete (i.e. new liquid line filter drier(s) installed and all tubing changes made - see *Steps 4 and 5*). The amount of time the compressor is open to the atmosphere must be kept to a minimum.

Use the new mounting grommets and sleeves that are shipped with the compressor to mount it. The sleeves will prevent over compression of the grommets. Re-use the mounting bolts from the compressor that was removed. The mounting bolts will bottom out when tight.

Step 4. Install New Filter Drier(s) (Select procedure that applies.)

IF the oil measured in Step 2 was not significantly less than the amount shown in the table or the test for acid in **Step 2 did NOT indicate burnout**, install a new R410A refrigerant liquid line filter drier. The filter drier must be rated for no less than 600 psig and be the proper size for the circuit. Because R410A refrigerant requires POE oil which absorbs moisture quickly, it is important to change the filter drier any time the circuit is opened.

It is recommended to use a tubing cutter when cutting out a filter drier as the desiccant absorbs and holds moisture better when it is cool. Heat from a torch may cause moisture to leave the filter and be absorbed in the oil.

Continue to **Step 5**.

IF the oil measured in **Step 2** was significantly less than shown in the table or the test for acid in **Step 2 did indicate compressor burnout**, do the following:

- Install a liquid line filter drier. **If there is acid**, install an acid removing filter drier. Size the acid-removing filter drier at least one capacity size larger than normally required for the circuit.
- Install a temporary filter drier in the suction line. When there is acid, a 100% activated alumina suction filter drier is recommended. The suction line drier should be sized properly for the circuit and have a service access fitting to monitor pressure drop across the drier. (**NOTE:** Suction line filter drier must be removed after 72 hours of operation.)

Step 12 includes the remaining procedures required for cleanup of a burnout.

Continue to **Step 5**.

Step 5. Braze on Suction and Discharge Lines

CAUTION: Do not leave system open to the atmosphere any longer than minimum required for installation. POE oil in the compressors is extremely susceptible to moisture absorption. Always keep ends of tubing sealed during installation. See Hazard Intensity Levels, page 2.

3.0 Maintenance Procedures (cont'd)

3.7 Optional Cooling Coil Module (cont'd)

3.7.4 Optional Reheat Module (cont'd)

Reheat Module Compressor Maintenance and Replacement (cont'd)

Brazing materials must be able to withstand the high pressure of R410A refrigerant. A high temperature, silver phosphate type brazing with 5% or greater alloy is recommended.

To prevent oxidation, purge tubing with 2-3 psig of regulated dry nitrogen while it is being brazed. After the unit has been properly leak tested, the nitrogen remaining in the circuit can be used as part of the purge while brazing. Open the service valve as needed to release the nitrogen. Do not allow moisture to enter the system.

The installer is responsible for brazing and for complying with appropriate standard refrigerant piping procedures.

CAUTION: All brazing should be done using a 2 to 3 psig dry nitrogen purge flowing through the pipe being brazed. See Hazard Intensity Levels, page 2.

CAUTION: Do not open the service valves until after the condenser unit circuits are leak tested. See Hazard Intensity Levels, page 2.

CAUTION: When brazing, protect all painted surfaces and components from excessive heat. Wet wrap all valves but do not allow moisture to enter the tubing. See Hazard Intensity Levels, page 2.

Step 6. Check Reheat Refrigerant Circuit for Leaks

After installation is complete, pressurize the system with helium or dry nitrogen to approximately 150 psi (maximum pressure is 450 psi). Check for leaks using soap bubbles or other leak-detecting methods. Repair as needed to ensure a leak free circuit.

Step 7. Evacuate the Reheat Circuit

Use a vacuum pump and micron gauge. The circuit must be evacuated to hold a 500 micron vacuum. Vacuum must be pulled on both the discharge (high) and suctions (low) side. Do the suction side first; and the compressor discharge side second. To establish that a circuit is leak-free and moisture-free, a standing vacuum test is recommended. Close off the valve to the vacuum pump and observe the micron gauge. If the vacuum gauge does not rise above 500 microns in one minute, the evacuation should be complete. If the vacuum gauge does rise above 500 microns in one minute, evacuation is incomplete or the system has a leak. Repeat as needed until evacuation is complete.

NOTE Evacuation will not remove moisture from POE oil. Moisture must be prevented from getting in the oil.

Continue and/or repeat **Steps 6 and 7** until evacuation is complete.

CAUTION: Do not use the replacement compressor as an evacuation assist and *never* apply voltage to a compressor while it is in a vacuum. See Hazard Intensity Levels, page 2.

Moisture and air are harmful to the system because they increase the condensing temperature, raise the discharge gas temperature, cause formation of acids, and cause oil breakdown.

CAUTION: Do not leave a circuit open to the atmosphere any longer than minimum required for installation. POE oil in the compressor is extremely susceptible to moisture absorption. Evacuation will not remove moisture from POE oil. See Hazard Intensity Levels, page 2.

Step 8. Check the Electrical System

After the system has been evacuated, reconnect the electrical plug to the compressor or the wires to the compressor terminals. It is a normal practice to replace all starting components any time a compressor is changed.

WARNING

Do not apply voltage to the compressor when the plug is removed or terminals disconnected. See Hazard Intensity Levels, page 2.

Crankcase Heater

Connect the crankcase heater. The crankcase heater is energized continuously and is extremely important to proper compressor operation and long life.

The crankcase heater must be energized for at least 24 hours before starting the unit or after a power outage of more than 8 hours. Be sure to disable reheat controls before turning on power to warmup crankcase heater.

CAUTION: Crankcase heater must be allowed to warm up for at least 24 hours prior to startup. Disable reheat controls before turning on power to warmup crankcase heater. See Hazard Intensity Levels, page 2.

Step 9. Charge the Reheat Pump Circuit (R410A refrigerant only.)

Follow the instructions below to charge the circuit. R410A refrigerant MUST BE charged as a LIQUID.

NOTE: Outdoor temperature must be between 70-95°F (21-35°C) for verifying superheat and subcooling. If temperature is not within this range, consult the factory service department before charging.

Check the rating plate for the reheat circuit charge. Charge the refrigerant slowly through the gauge port on the liquid line. R410A refrigerant must be charged as a liquid. R410A refrigerant cylinders are rose colored (pink) and have a dip tube for charging liquid from an upright position. If there is no dip tube, verify that the refrigerant is R410A and turn the cylinder upside down.

WARNING

Do not release refrigerant to the atmosphere. When adding or removing refrigerant, the qualified technician must comply with all national, state/province, and local laws.

Step 10. System Startup

Connect refrigerant pressure gauges and electric meters.

CAUTION: Be sure to connect pressure gauges to the suction and discharge lines before start-up so that compressor rotation can be checked immediately. Scroll compressors will be destroyed if allowed to operate in reverse. See Hazard Intensity Levels, page 2.

Record the ambient temperature. Adjust the system controller so that a call for cooling exists.

NOTE: If the system has digital controls, outdoor ambient lockouts may prevent mechanical cooling. Temporarily override lockouts by lowering the cooling setpoint. (Refer to the digital programmable control instruction manual.) When testing is complete, reset the controller.

Because it is a possible to unknowingly connect 3-phase power in such a way as to cause the scroll compressor to rotate in reverse, it is very important to check this on startup.

Immediately at startup, observe the gauges. If the suction pressure rises and discharge pressure drops, the compressor is operating in reverse and must be shut down. Turn off the power and switch the 3-phase line voltage wiring connections before restarting the unit.

(Important NOTE: If allowed to operate for several minutes in reverse, the compressor's internal protector will trip. If a compressor is repeatedly allowed to restart and run in reverse, the compressor will be permanently damaged.)

3.0 Maintenance Procedures (cont'd)

3.7 Optional Cooling Coil Module (cont'd)

3.7.4 Optional Reheat Module (cont'd)

Reheat Module Compressor Maintenance and Replacement (cont'd)

Step 11. Check Circuit Subcooling and Superheat of Reheat Circuit

PREPARATION:

- To verify superheat and subcooling, outdoor temperature must be between 70-95°F (21-35°C). If temperature is not within this range, consult the factory service department before charging.
- Operate for 30 minutes for system to stabilize.

Check SUBCOOLING of the Reheat Circuit - Measure and record temperature and pressure of the liquid line at the condenser coil outlet in the reheat circuit.

STEP 1) Record Measurements: Temperature = _____ °F (°C) and Pressure = _____ psig

STEP 2) From Temperature/Pressure Conversion Chart, APPENDIX, page 38, convert Measured Pressure (STEP 1) to _____ °F (°C)

STEP 3) Subtract Measured Temperature (STEP 1) from Temperature from Conversion Chart (STEP 2)
_____ °F (°C) - _____ °F (°C) = _____ °F (°C) degrees of Subcooling

Recommended reheat circuit subcooling with outdoor temperature range of 70-95°F (21-35°C) is 14-18°F (7.8-10°C).

Too much subcooling indicates a refrigerant overcharge. To reduce the subcooling, remove excess refrigerant. Too little subcooling indicates a refrigerant undercharge. To increase subcooling, slowly add R410A refrigerant.

WARNING

Do not release refrigerant to the atmosphere. When adding or removing refrigerant, the qualified technician must comply with all national, state/province, and local laws.

Determine SUPERHEAT of the Reheat Circuit - Measure and record temperature (insulate probe from surrounding air temperature) and pressure in the suction line at the compressor inlet of the reheat circuit.

STEP 1) Record Measurements: Temperature = _____ °F (°C) and Pressure = _____ psig

STEP 2) From Temperature/Pressure Conversion Chart, APPENDIX, page 38, convert Measured Pressure (STEP 1) to _____ °F (°C)

STEP 3) Subtract Measured Temperature (STEP 1) from Temperature from Conversion Table (STEP 2)
_____ °F (°C) - _____ °F (°C) = _____ °F (°C) degrees of Superheat

Recommended reheat circuit superheat at is 8-12°F (4.5-6.7°C).

Typically, too much superheat indicates that the evaporator coil is undercharged. Too little superheat typically indicates that the evaporator coil is overcharged and may potentially flood liquid refrigerant to the compressor. To reduce the superheat, adjust the thermal expansion valve by turning the adjusting stem counterclockwise. To increase the superheat, adjust the thermal expansion valve by turning the adjusting stem clockwise.

Step 12. (Select the procedure that applies.)

IF the oil measured in **Step 2** was significantly less than in the table on page 21 or the acid test in **Step 2** indicated a burnout, do the following:

- a) Operate the unit for several hours. Check the pressure drop through the

temporary suction line filter drier. If the pressure drop exceeds 8 psig, recover the refrigerant, replace the suction line filter drier with the same type as removed, replace the liquid line filter drier, evacuate the circuit, and re-charge with the recovered refrigerant).

Continue to monitor the pressure drop through the suction line filter drier and repeat the process above until the pressure does not exceed 8 psig after several hours of operation. (NOTE: System must be allowed to run no more than 72 hours with a suction line filter drier.)

- b) Allow the system to operate for 4-8 hours. Recover the refrigerant and take an oil sample. Retest the oil for acid.
- c) If the test for acid is negative, remove the suction line filter drier, replace the liquid line drier, evacuate, and re-charge the system with the recovered refrigerant.
If the test indicates acid, replace both the liquid line filter drier and the suction line filter drier and repeat b) and c).

CAUTION: After cleanup is complete, remove the suction line filter drier. See Hazard Intensity Levels, page 2.

- d) Verify subcooling and superheat (refer to **Step 11**).
- e) When the system is operating properly, remove the gauges.

IF the oil measured in **Step 2** was not significantly less than that shown in the table on page 21 or the acid test in **Step 2** did not indicate a compressor burnout, continue to the review in **Step 13**.

- Step 13 . Review ALL Steps to ensure that nothing was overlooked.**

3.7.5 Modulating Reheat Control (Option AUR1)

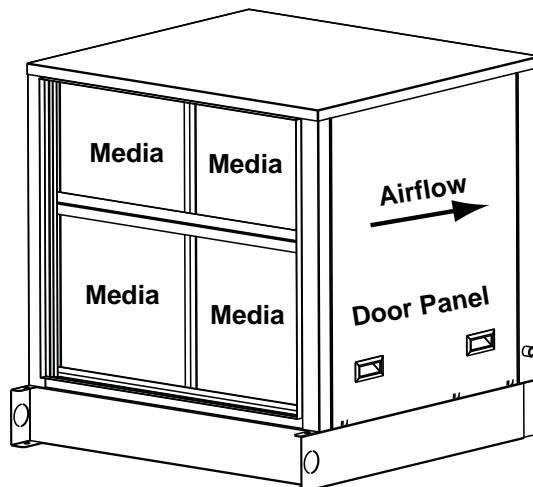
Function: Units with modulating reheat control (Option AUR1) have a temperature control board with a potentiometer, an air temperature sensor, and an electric discharge bypass valve. When reheat is active, the sensor monitors the air temperature as it leaves the reheat coil. Based on the potentiometer setpoint, the board will open or close the bypass valve. If the leaving air temperature is higher than the setpoint, the board will open the valve adding refrigerant hot gas to the refrigerant liquid before it enters the pre-cool coil. This reduces the coil's ability to absorb the heat, and thus, the reheat coil's ability to reject. If the leaving air temperature is lower than the setpoint, the opposite occurs.

Service: Check the wiring connections at the board. The board is polarity sensitive; positive connects to terminal 1 and negative to terminal 2.

The valve may be tested by measuring the resistance of the leads. Remove the power and the leads from the board before testing. Resistance between the black and white leads should be about 75 Ohms. Resistance between the green and red leads should be within 5% of the white and black.

Use only factory-authorized replacement parts.

3.8 Optional Evaporative Cooling Module



When equipped with an evaporative cooling module, the evaporative cooling module is always the first module in system. Air enters the system through the evaporative cooling media.

See the heater installation manual for additional information about the operation of the evaporative cooling module.

3.0 Maintenance Procedures (cont'd)

3.8 Optional Evaporative Cooling Module (cont'd)

Qty and Sizes of Evaporative Cooling Media and Pre-Filters

WARNING

Disconnect all power to the unit before doing any maintenance. Failure to do so can cause electrical shock, personal injury, or death.

Pre-Filters and Media - Over time, excessive amounts of dirt or mineral deposits may begin to build up on the pre-filters and media. Annually, wash scale and dirt from the metal pre-filters (pre-filters are optional and may not be on your cooler) and the entering surface of the media.

Remove the pre-filters (remove the door and slide out). Clean the metal pre-filters with soap and water and rinse thoroughly.

Clean the entering side of the media using a garden hose, mild soap, and a **soft** bristled brush. When the media becomes too clogged with mineral deposits and dirt that it cannot be cleaned, the pads should be replaced. The average pad life expectancy is approximately three cooling seasons. Order replacement media pads from your distributor.

Media - 12" Glacier-Cor® or Glasdek®							
PDH/SDH/RDH	PEH/REH	PXH/RXH	RHH/SHH	(Qty) Dimensions - inches		(Qty) Dimensions - mm	
75, 100	10A, 20A, 40A	000A	N/A	(2) 27-3/32 x 12; (1) 27-3/32 x 7-1/2		(2) 688 x 305; (1) 688 x 191	
125, 150	15B, 30B, 60B	000B	N/A	(2) 27-3/32 x 12; (1) 27-3/32 x 5-1/2		(2) 688 x 305; (1) 688 x 140	
175, 200, 225	N/A	000C	130, 180	(2) 36 x 12; (1) 36 x 7-1/2		(2) 914 x 305; (1) 914 x 191	
250, 300	30D, 60D, 90D, 120D	000D	260	(3) 36 x 12; (1) 36 x 11-3/4		(3) 914 x 305; (1) 914 x 298	
350, 400A	40E, 80E, 120E	000E	350	(4) 36 x 12; (1) 36 x 7-3/4		(4) 914 x 305; (1) 914 x 197	
Optional Pre-Filters for Evaporative Cooling Module - 1" or 2" Aluminum Filters							
PDH/SDH/RDH	PEH/REH	PXH/RXH	RHH/SHH	(Qty) Dimensions - inches		(Qty) Dimensions - mm	
				Top Row	Bottom Row	Top Row	Bottom Row
75, 100	10A, 20A, 40A	000A	N/A	(2) 16 x 12	(2) 16 x 16	(2) 406 x 305	(2) 406 x 406
125*, 150*	15B*, 30B*, 60B*	000B*	N/A	(1) 16 x 12; (1) 26 x 12	(1) 16 x 16; (1) 16 x 25	(2) 406 x 305; (1) 660 x 305	(1) 406 x 406; (1) 406 x 635
175, 200, 225	N/A	000C	130, 180	(2) 16 x 12	(2) 16 x 16	(2) 406 x 305	(2) 406 x 406
250*, 300*	30D*, 60D*, 90D*, 120D*	000D	260	(3) 16 x 12	(3) 16 x 25	(3) 406 x 305	(3) 406 x 635
350*, 400A*	40E*, 80E*, 120E*	000E	350	(1) 16 x 12; (2) 20 x 12	(1) 16 x 25; (2) 20 x 25	(1) 406 x 305; (2) 508 x 305	(1) 406 x 635; (2) 508 x 635

NOTE: Glacier-Cor® and Glasdek® are trademarks of Munters Corporation.

* These sizes require a filter stop gasket in each row.

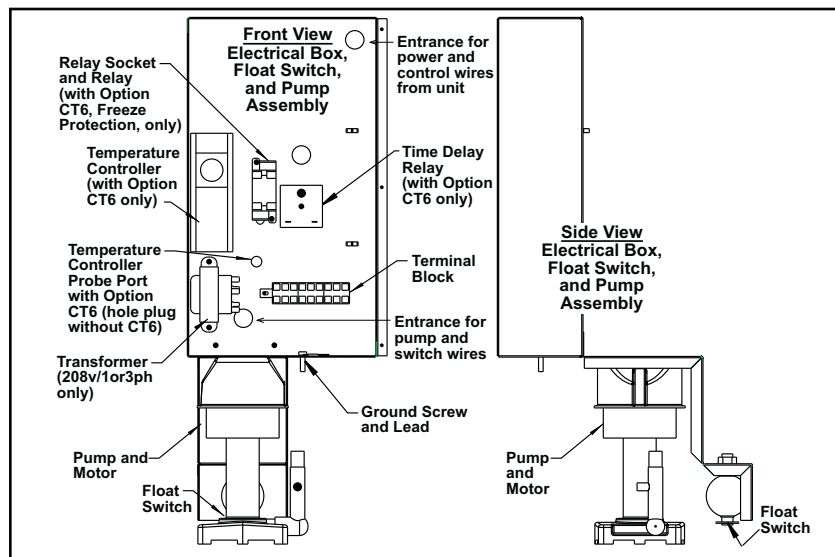
WARNING

Do not expose pump motor or any part of the electrical box to water. Evaporative cooling pump is NOT submersible.

FIGURE 9 - Remove electrical box/pump/float switch as an assembly. Shown here with Option CT6, Freeze Protection controls.

Water Pump and Inlet Basket Screen on a Float and Pump System - Annually, the pump and inlet basket screen should be removed, disassembled, and cleaned.

1. Disconnect the power supply to the unit.
2. Remove the door panel. Disconnect the two-line voltage power supply wires from the terminal block inside the electrical box. See **FIGURE 9**.
3. Disconnect the water feed line hose from the upstream side of the ball valve.



4. Remove the three sheetmetal screws holding the electrical box to the cooling module. Remove the electrical box/pump/float switch as an assembly.
5. Remove the mesh screen from around the pump and clean any buildup of debris and dirt. Carefully remove the base cover plate from the bottom of the pump. Using a mild soap solution, wash all deposits from the inside of the pump and remove all debris from the impeller.
6. Reassemble the pump. Replace the parts in exact reverse order, being careful that everything is returned to its original position.

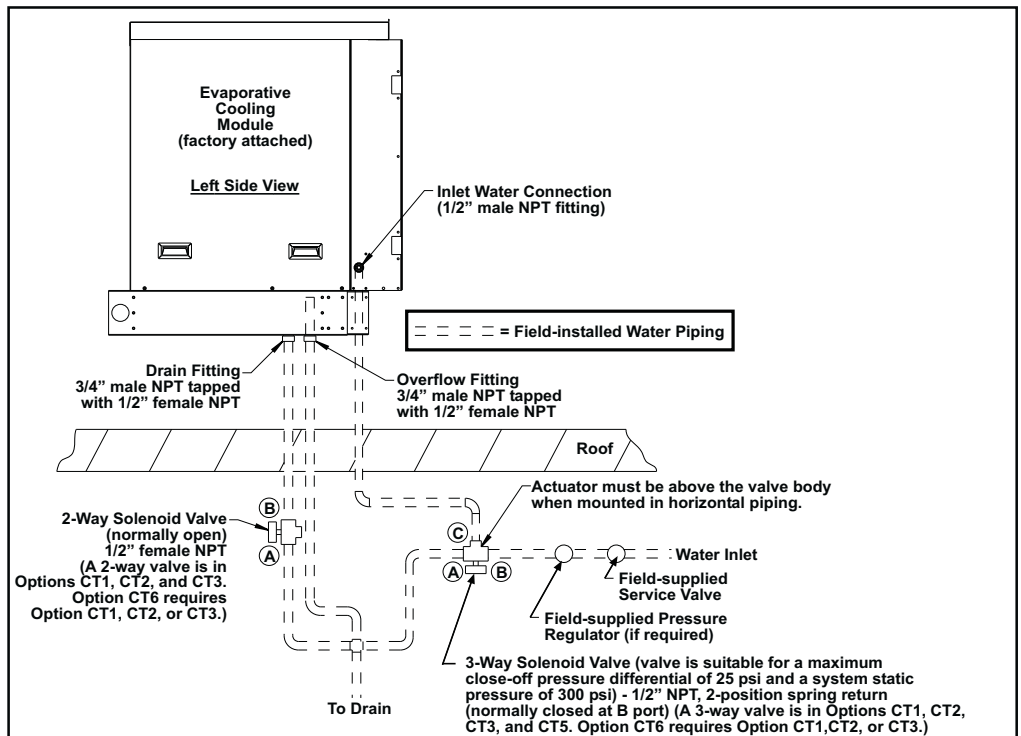
Water Distribution Line - Annually, the water distribution line should be flushed of debris and contaminants.

1. Disconnect the power supply to the unit.
2. Remove the access panel and the media pads.
3. Remove the water feed line from the downstream side of the ball valve.
4. Force a fresh water supply through the water inlet hose to thoroughly flush the distribution line.
5. Reassemble being careful to install media with airflow direction as marked on the media pads.

Troubleshooting the Operation of an Evaporative Cooling Module

PROBLEM	PROBABLE CAUSE	REMEDY
Pump doesn't run (pump & float system) – Unit is calling for cooling (i.e. console control switch is in cool or summer position) and reservoir is full.	1. Electrical connections.	1. Verify all electrical connections. Verify correct voltage at pump terminals in the junction box. See wiring diagram.
	2. Electric float switch..	2. Check position of the actuators on the electric float switch.
	3. Dirty pump.	3. Clean pump.
	4. Defective pump.	4. Replace pump.
Required water level (3"/76mm) not being maintained (pump & float control system).	1. Float valve.	1. Adjust float valve..
	2. Optional drain and fill valves.	2. Check valves for proper operation.
	3. Drain leaking.	3. Tighten drain fittings.
Water running off of media pads.	1. Excessive water flow.	1. Adjust ball valve in distribution line.
	2. Media pads need cleaned or replaced.	2. Clean or replace media pads.
Water not distributing evenly.	1. Distribution line clogged.	1. Flush distribution line..
	2. Holes in distribution line turned.	2. Check position of distribution line. Holes should be spraying upward toward diffuser. If not positioned with holes toward top, adjust position of distribution line.
	3. Pump not running on correct voltage (pump and float control system).	3. Check voltage at pump terminal in cooling module junction box.
Media pads becoming clogged and discolored quickly (scale and salt deposits).	1. Bleedoff line clogged or inadequate bleedoff (pump and float control system).	1. Clean bleed line. A uniform buildup of minerals on the entering air face of the media indicates insufficient bleedoff. Increase the rate until the mineral deposits dissipate.
	2. Excessive water flow.	2. Reduce flow by adjusting ball valve in distribution line..
Water blowoff from media pads or water being pulled from reservoir.	1. Media pads installed incorrectly.	1. Install media pads with airflow as shown on pads.
	2. Water level not 3" (76mm) (pump and float control system).	2. See second problem listed (Required water level not being maintained).

FIGURE 10 - Water Connection and Field-Installed Fill and Drain Valves for Pump and Float System and Freeze Protection Kits



3.0 Maintenance Procedures (cont'd)

3.9 Hot Water Heat - applies only to Model PXH or Model RXH with Option HW2 Hot Water Heat Module

The closed hot water system requires a proper water treatment program with regular water analyses, adequate regulated drains, and periodic inspection. Check for dirt or debris that could inhibit airflow. Clean with low pressure air blower or water. Follow the coil and control manufacturer's instructions for maintenance and service.

4.0 Troubleshooting

4.1 Check the Lights on the DSI Integrated Control Module (Circuit Board) - PDH, SDH, SHH, RHH, and RDH



Lights

IMPORTANT: When using a multimeter to troubleshoot the 24 volt circuit, place the meter's test leads into the 5 or 9 pin connectors located on the ignition control. Do not remove connectors or terminals from the electrical components. Doing so can result in misinterpreted readings due to the ignition control board's fault mode monitoring circuits.

NOTE: Applies to all models listed and all sizes except Model RDH 175-400A Model RHH, and Model SHH with Gas Control Option AG58 or D12G (See Paragraph 4.2.)

The integrated circuit board monitors the operation of the heater and includes two LED signal lights that indicate normal operation and various abnormal conditions. If the heater fails to operate properly, check this signal to determine the cause and/or to eliminate certain causes. LED is visible through viewport on Models SDH and SHH. Open the door panel on Models PDH and RDH.

Do not attempt to repair the DSI integrated control module; the only field replaceable component is the fuse.

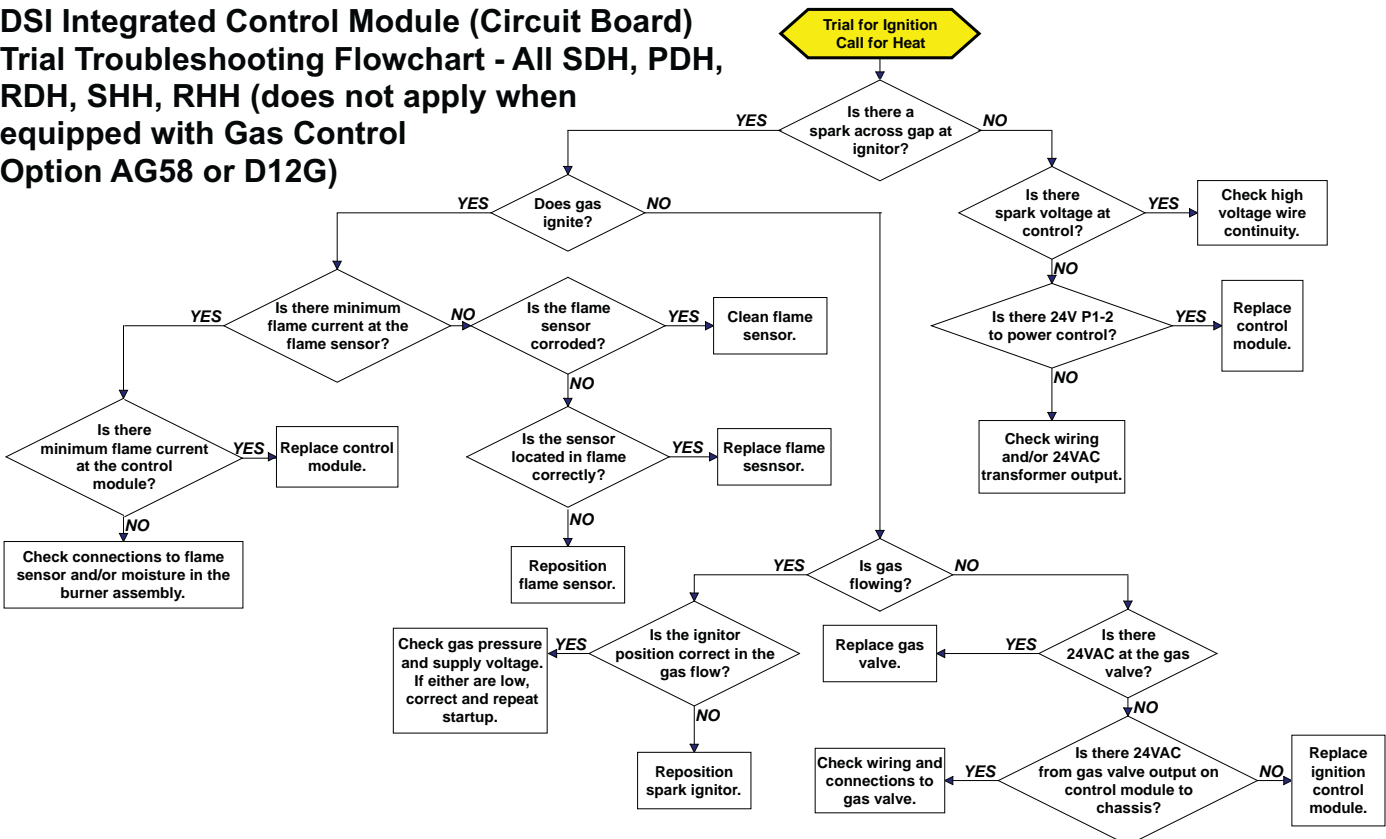
Control Status - Green LED Codes

- Steady ON.... Normal Operation, No call for heat
- Fast Flash..... Normal Operation, Call for heat
- 1 Flash..... System Lockout, Failed to detect or sustain flame
- 2 Flashes..... Pressure Switch Did Not Close within 30 Seconds of Venter Motor
- 3 Flashes..... High Limit Switch Open
- 4 Flashes..... Pressure switch is closed before venter motor is energized
- Steady OFF .. Blown Fuse, No Power, or Defective Board

Flame Status - Yellow LED Codes

- Steady ON.... Flame is sensed
- Slow Flash.... Weak flame (current below 1.0 microamps ±50%)
- Fast Flash..... Undesired Flame (valve open and no call for heat)

DSI Integrated Control Module (Circuit Board) Trial Troubleshooting Flowchart - All SDH, PDH, RDH, SHH, RHH (does not apply when equipped with Gas Control Option AG58 or D12G)



4.2 Troubleshooting - Modulating Control Module used on Model RDH Sizes 175-400, Model RHH, or Model SHH with Gas Control Option AG58 or D12G

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

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

Deep Modulation (Option AG58 and D12G) Ignition Board is in the Control Compartment (See FIGURE 1A, page 5.)

Main Board Supply Power Input Spades (L1 T1 and L2 T5)

Inducer Motor Main Power Connection Spades (IND-L2 T3 and IND-L1 T2)

Inducer Motor Capacitor Spade Connection (AUX-L2 T6)

Flame Sensor Spade Connection (T8)

ID Plug (unique by model, heat section size, & type of gas)

3 Character LED Display used to show deep modulation board codes for status, alarm, and error information.

Gas Manifold PSI Transducer Plug 3-wire (red, black, and green) Wiring Connection (J13)

On board Air Pressure Sensor for Monitoring Inducer Pressure. Venter Sensing Tubing is connected from Venter housing to "LO" pressure input point on air sensing transducer.

Contactor Signal Input Terminals (J4)

Board Power and Signal (J6)

Control Board Fuse (3A)

Plug Connection for Board Control Points (J8)

- Ball Valve Actuator Power, Drive Voltage, and Feedback Signal
- Off Board Digital Venter Air Pressure Switch and Unit Primary Limit Switch

J9, J10, J3, and J2 are not currently used.

4.0 Troubleshooting (cont'd)

4.2 Troubleshooting - Modulating Control Module used on Model RDH Sizes 175-400, Model RHH, or Model SHH with Gas Control Option AG58 or D12G (cont'd)

Gas Heat Section Modulating Control Option AG58 or D12G FUNCTIONAL ALERTS				
Code	Alert	Description	Probable Causes	Solutions
801	Failed ignition attempt (AO1) <i>Maximum number of allowed retries not met</i>	The flame could not be established during the trial for ignition period. This alert indicates the maximum number of retries has not been exceeded and furnace operation will continue with another ignition attempt.	See EO1 in the LOCKOUT ERRORS section, pages 33-34.	See EO1 in the LOCKOUT ERRORS section, pages 33-34.
802	Lost Flame (AO2)	The flame sensor signal has been lost after flame is established during a call for heat. This alert is displayed during the RECYCLE period prior to the next ignition attempt.	A. Flame sensor coated	1. Clean flame rod sensor.
			B. Flame sensor improperly mounted or grounded	1. Check flame sensor wiring integrity and ceramic for cracks. 2. Re-install / replace flame sensor.
			C. Unstable flame pattern	1. Verify that the spacing between the burner body and the burner shield is equal across the entire length of the burner. 2. Check that the seals between the heat exchanger header and heat exchanger tubes are sound; refer to Paragraph 4.1.1. 3. Ensure that the heat section door gasket is in place and the doors are properly aligned
			D. Insufficient intermediate gas manifold pressure through main gas safety valve	1. Check for faulty gas valve wiring. 2. Check 24 VAC to gas valve assembly. 3. Check inlet pressure to safety gas valve. 4. Check outlet pressure from the safety gas valve. 5. Replace safety gas valve if faulty.
			E. Insufficient gas manifold pressure to burner through modulating ball valve assembly	1. Check voltage to gas valve actuator. (2-10 VDC depending on model) 2. Check alignment and set screw connection between ball valve and actuator. See Paragraph 4.3.
803	Insufficient Combustion Air (AO3) <i>Furnace functional</i>	Furnace cannot achieve desired combustion air flow due to blockage or high altitude operation resulting in a de-rate of the furnace.	A. High altitude operation	1. Normal operation. Furnace automatically de-rates for high altitude conditions.
			B. Partially blocked vent	1. Check air inlet and outlet for blockage. 2. Check venting configuration for excessive venting length, improper sizing, etc.
			C. Leak in sensing hose	1. Check sensing hose for cracks, crimps, or loose connections.
			D. Low Line Voltage	1. Check the line voltage to the control board. Voltage should be within 10% of nameplate.
			E. Faulty venter assembly	1. Verify that the venter assembly is functioning properly by referring to the sensing pressure chart on page 16..
804	Limited Low Fire (AO4)	Automatic adaptive program is currently limiting the lower range of modulation to avoid flame loss at minimum fire conditions. The alert is displayed during the run cycle once a flame-out condition has triggered the Limited Low Fire function. This function is reset by cycling power to the board.	A. Low gas line pressure	1. Ensure gas supply is connected to furnace and check for proper line pressure.
			B. Insufficient intermediate gas manifold pressure through gas safety valve	1. Check for faulty gas valve wiring. 2. Check 24 VAC to gas valve assembly. 3. Check inlet pressure to safety gas valve. 4. Check outlet pressure from the safety gas valve – adjust as needed. 5. Replace safety gas valve if faulty.
			C. Faulty burner operation	1. Check burner orifice for proper size and blockage.
			D. Faulty flame sensor	1. Check flame rod wiring and connections. 2. Check for proper alignment of flame rod. 3. Clean flame rod sensor.
			E. Improper alignment of the modulating actuator and the gas ball valve.	1. Check that the alignment of the actuator to the ball valve is correct. The valve must be in the fully open position when the actuator is energized (ACTUATOR DRIVE = 9.6 VDC or greater). 2. Ensure that the setscrew on the actuator is tightened to the ball valve stem.
			F. Blocked or improper venting	1. Check air inlet and outlet for blockage. 2. Check venting configuration for excessive venting length, improper sizing, etc.
805	Weak Flame Signal (AO5)	The flame signal level is less than optimal for this furnace. Maintenance of the flame sensing components is advised.	A. Flame sensor coated	1. Clean flame rod sensor.
			B. Flame sensor improperly mounted or grounded	1. Check flame sensor wiring integrity and ceramic for cracks. 2. Re-install / replace flame sensor.
			C. Unstable flame pattern	1. Verify that the spacing between the burner body and the burner shield is equal across the entire length of the burner. 2. Check that the seals between the heat exchanger header and heat exchanger tubes are sound; refer to Paragraph 4.1.1. 3. Ensure that the heat section door gasket is in place and the door is properly aligned.

Gas Heat Section Modulating Control Option AG58 or D12G LOCKOUT ERRORS

Code	Alert	Description	Probable Causes	Solutions
888	Ignition Board Failure (888)	Ignition board start-up checks have detected an error.	A. Faulty transformer	1. Check 24-volt transformer for correct output. 2. Check connections and wiring to control board and other components connected to the 24 volt source. 3. Replace if necessary.
			B. Faulty control board	1. Turn off power to the furnace, wait 30 seconds and turn power back on. Re-try ignition sequence and see if the system responds. 2. Replace control board if necessary.
E01	Failed Ignition (EO1) <i>Maximum Retries (3) Exceeded</i>	The flame could not be established during multiple trial-for-ignition periods (3). The maximum number of retries has been exceeded and the furnace is in a lockout condition.	A. Insufficient gas line pressure	1. Insure gas supply is connected to furnace and check for proper line pressure.
			B Gas valve control turned "OFF"	1. Turn gas valve to the "ON" position
			C. No spark from direct spark ignition	1. Check ignition voltage (115 VAC from board to transformer) and wiring. 2. Check 24 VAC transformer for DSI board. 3. Reverse polarity on 2-wire plug feeding the spark board.
			D. Insufficient intermediate gas manifold pressure through gas safety valve	1. Check for faulty gas valve wiring. 2. Check 24 VAC to gas valve assembly. 3. Check inlet pressure to safety gas valve. 4. Check outlet pressure from the safety gas valve – adjust as needed. 5. Replace safety gas valve if faulty.
			E. Insufficient gas manifold pressure to burner through modulating ball valve assembly	1. Check voltage to gas valve actuator. (7 - 10 VDC depending on model) 2. Check alignment and setscrew connection between ball valve and actuator (See procedure in Paragraph 4.3.).
			F. Burners do not light	1. Check spark rod assembly for proper location, spark gap, etc. 2. Verify that the spacing between the burner body and the burner shield is equal across the entire length of the burner. 3. Check burner orifice for proper size and blockage.
			G. Burners light and remain lit for about 5 seconds	1. Check flame rod wiring and connections. 2. Check for proper alignment of flame rod. 3. Clean flame rod sensor.
E02	Primary Limit / Fuse Failure (EO2)	The control board safety fuse has blown or the primary temperature limit has opened indicating safe operating temperatures for this furnace have been exceeded.	A. Improper circulating airflow	1. Check filter / replace if dirty. 2. Check for improperly sized duct system. 3. Check for faulty blower motor. 4. Check for faulty blower motor wiring.
			B. Primary limit switch failure	1. Check for an open primary limit switch at ambient temperature.
			C. Fuse is blown	1. Check and replace fuse on the board. 2. Make sure fuse socket is tight, crimp fuse terminals if necessary.
			D. Faulty primary limit switch wiring	1. Check primary limit wiring continuity from the switch to the control board.
E03	Modulation Valve Failure (EO3)	The control lost the position feedback from the modulating gas valve actuator.	A. Faulty modulation valve actuator wiring	1. Ensure wiring is connected per unit wiring diagram. 2. Check for loose pins or bad connections. 3. Check for frayed wiring or shorts to ground.
			B. Modulation valve actuator failure	1. Ensure actuator has 24 V power. 2. Ensure actuator is receiving signal from the control board (2-10 VDC). 3. Check for actuator feedback to the control board (2-10 VDC)
E04	Air Sensor Failure (EO4) <i>Pressure Sensor Reading Low</i>	The air sensor reading is too low for operating conditions or the air pressure switch closed when the sensor indicates low flow <i>The pressure switch MUST be open prior to venter activation.</i>	A. Faulty wiring or connections	1. Check pressure switch wiring. 2. Check inducer wiring. 3. Check for plugged or disconnected vacuum hoses.
			B. Faulty pressure switch	1. Replace pressure switch.
			C. Faulty pressure sensor, located on the board	1. Replace board.
E05	Air Sensor Failure (EO5) <i>Pressure Sensor Reading High</i>	The air sensor reading is too high when the venter is off or the air pressure switch open when the sensor indicates high flow. <i>The pressure switch MUST close to initiate an ignition sequence.</i>	A. Faulty wiring or hose connections	1. Check pressure switch wiring. 2. Check venter motor wiring. 3. Check for broken or disconnected vacuum hoses.
			B. Blocked or improper venting	1. Check air inlet and outlet for blockage. 2. Check venting configuration for excessive venting length, improper sizing, etc.
			C. Faulty pressure switch	1. Replace pressure switch.

(continued)

4.0 Troubleshooting (cont'd)

4.2 Troubleshooting - Modulating Control Module used on Model RDH, RHH, or SHH with Opt AG58 or D12G (cont'd)

Gas Heat Section Modulating Control LOCKOUT ERRORS (cont'd)				
Code	Alert	Description	Probable Causes	Solutions
E06	Gas Sensor Failure (E06) <i>Pressure Sensor Reading Low</i>	The gas transducer reading is too low compared to the expected value for the modulating gas valve actuator position. <i>When the furnace is operating at 75% or higher -- greater than 8 VDC analog input voltage - the manifold pressure sensor must read 1.4" w.c. or higher</i>	A. Modulating actuator/ball valve not properly aligned	1 Perform modulating system gas valve alignment procedure; see Paragraph 4.3.
			B. Line pressure too low	1. Ensure line pressure is properly adjusted for the gas and application. Correct as needed.
			C. Intermediate regulated pressure to low	1. Ensure the safety gas valve(s) are properly adjusted to the specified outlet pressure. Adjust per the installation instructions as necessary.
			D. Wrong gas pressure sensor installed.	1. Ensure the proper gas transducer - either natural gas or propane - is installed. Replace as needed.
			E. Gas pressure sensor faulty	1. Ensure gas manifold transducer is installed properly and wired per the unit wiring diagram. Replace as necessary.
E07	Gas Sensor Failure (E07) <i>Pressure Sensor Reading High</i>	The gas transducer reading is too high compared to the expected value for the modulating gas valve actuator position. <i>When the furnace is operating at 75% or lower - less than 8 VDC analog input voltage -- the manifold pressure sensor must read 2.8" w.c. or lower.</i>	A. Modulating actuator / ball valve not properly aligned	1. Perform modulating system gas valve alignment procedure; see Paragraph 4.3.
			B. Line pressure too high	1. Ensure the line pressure is properly adjusted for the gas and application. Correct as necessary.
			C. Intermediate regulated pressure too high	1. Ensure the safety gas valve(s) are properly adjusted to the specified outlet pressure. Adjust per the installation instructions as necessary.
			D. Wrong gas pressure sensor installed	1. Ensure gas sensor -- either natural or propane -- is installed. Replace as necessary.
			E. Gas pressure sensor faulty	1. Ensure gas sensor is installed properly and wired per the unit wiring diagram. Replace as necessary.
E08	Improper Flame Signal (E08)	Control senses flame present when the gas valve is commanded off.	A. Flame remains lit in "Off" cycle	1. Gas valve leaks - check wiring to remove continuous 24V to gas valve. 2. Gas valve is stuck open – remove, repair, or replace gas valve.
E09	No Firing Rate Input (E09)	Call for heat is sensed (R & W closed) but firing rate is below defined voltage threshold for furnace operation.	A. Faulty wiring into the "Analog +" and "Analog -" terminals	1. Ensure wiring is connected per unit wiring diagram. 2. Check for loose pins or bad connections. 3. Check for frayed wiring or shorts to ground.
			B. No signal from source.	1. Check firing rate input voltage – must be greater than 1.5 VDC. 2. Troubleshoot controller providing firing rate input to the deep modulation ignition control board.
E08	Invalid I.D. Plug (Eid)	The installed I.D. plug is not valid for this control board.	A. Incorrect I.D. plug installed	1. Ensure I.D. plug is correct for the furnace – check label. 2. Ensure I.D. plug is properly inserted into the mating connector on the control board. 3. With the I.D. plug installed, cycle power to the furnace. The board will display the I.D. plug identity upon power-up. 4. Install correct I.D. plug as needed.

4.3 Troubleshooting - Blower Section (All Models - SDH, PDH, RDH, PEH, REH, RHH, SHH, PXH, RXH) and Gas-Fired Heat Section (SDH, PDH, RDH, RHH, SHH)

PROBLEM	PROBABLE CAUSE	REMEDY
Venter motor will not start - Models SDH/PDH/RDH/SHH/RHH	1. No power to unit.	1. Turn on power; check supply fuses or main circuit breaker.
	2. No 24 volt power to integrated circuit board.	2. Turn up thermostat; check control transformer output.
	3. Integrated circuit board fuse blown.	3. Correct cause. Replace fuse (type ATC or ATO, 32VDC, 3A).
	4. No power to venter motor.	4. Tighten connections at circuit board and/or motor and terminals. Check venter motor capacitor.
	5. Integrated circuit board defective.	5. Replace integrated circuit board.
	6. Venter motor capacitor defective.	6. Replace venter motor capacitor.
	7. Defective venter motor.	7. Replace venter motor. NOTE: Manufacturer recommends replacing capacitor when replacing venter motor.
Burner will not light - Models SDH/PDH/RDH/SHH/RHH	1. SHH - Vent temperature switch activated.	1. Identify reason (see Paragraph 3.4.6, page 16) and correct. Reset switch.
	2. SHH - Heat exchanger condensate drain pressure switch activated.	2. Clean condensate drain. Verify flow. Fill traps with water and restart heater.
	3. Manual valve not open	3. Open manual valve.
	4. Air in the gas line.	4. Bleed gas line (initial startup only).
	5. Gas pressure too high or too low.	5. Supply pressure should be 5-14" w.c. for natural gas or 11-14" w.c. for propane.
	6. No Spark:	6.
	a) Loose wire connections. b) Transformer failure. c) Incorrect spark gap.	a) Be certain all wire connections are solid. b) Be sure 24 volts is available. c) Maintain spark gap at 1/8".

Burner will not light (cont'd)	d) Spark cable shorted to ground.	d) Replace worn or grounded spark cable.
	e) Spark electrode shorted to ground.	e) Replace if ceramic spark electrode is cracked or grounded.
	f) Burner not grounded.	f) Make certain integrated circuit board is grounded to ignitor.
	g) Circuit board not grounded.	g) Make certain integrated circuit board is grounded to furnace chassis.
	h) Unit not properly grounded.	h) Make certain unit is properly field grounded to earth ground and properly phased (L1 to hot lead L2 to neutral).
	i) Integrated circuit board fuse blown.	i) Correct cause. Replace fuse (type ATC or ATO, 32VDC, 3A).
	j) Faulty integrated circuit board.	j) If 24 volt is available to the integrated circuit board and all other causes have been eliminated, replace board.
	7. Lockout device interrupting control circuit by above causes.	7. Reset lockout by interrupting control at the thermostat or main power.
	8. SDH or SHH - Interlock door switch open	8. Close access door or replace switch.
	9. Combustion air proving switch not closing.	9. a) Make sure unit is properly vented. b) Remove obstructions from vent. c) Replace faulty tubing to pressure switch.
	10. Faulty combustion air proving switch.	10. Replace combustion air proving switch.
	11. Main valve not operating.	11. a) If 24v is measured at the valve connections and valve remains closed, replace valve. b) Check and tighten all wiring connections.
	a) Defective valve.	
	b) Loose wire connections.	
	12. Integrated circuit board does not power main valve.	12. a) Check and tighten all wiring connections. b) Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required. c) Supply pressure should be 5-14" w.c. for natural gas or 11-14" w.c. for propane.
	a) Loose wire connections.	
b) Flame sensor grounded.		
c) Incorrect gas pressure.		
Burner cycles on and off - SDH/PDH/RDH/SHH/RHH	1. Gas pressure too high or too low.	1. Supply pressure should be 5-14" w.c. for natural gas or 11-14" w.c. for propane.
	2. Burner not grounded	2. Make certain integrated circuit board is grounded to ignitor.
	3. Circuit board not grounded.	3. Make certain integrated circuit board is grounded to furnace chassis.
	4. Faulty integrated circuit board.	4. If 24 volt is available to the integrated circuit board and all other causes have been eliminated, replace board.
	5. Combustion air proving switch not closing.	5. a) Make sure unit is properly vented. b) Remove obstructions from vent. c) Replace faulty tubing to pressure switch.
	6. Faulty combustion air proving switch.	6. Replace combustion air proving switch.
	7. Flame sensor grounded.	7. Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required.
	8. Cracked ceramic at sensor.	8. Replace sensor.
	9. Incorrect polarity.	9. Reverse line volt leads to integrated circuit board.
	10. Pin terminal loose at 9-pin plug.	10. Replace wire harness.
No heat - SDH/PDH/RDH/SHH/RHH	1. Incorrect valve outlet pressure or orifice.	1. Check valve outlet pressure. See rating plate for manifold pressure.
	2. Cycling on limit control.	2. Check air throughput.
	3. Improper thermostat location or adjustment	3. See thermostat manufacturer's instructions.
	4. SHH - Vent temperature switch activated.	4. Identify reason (see Paragraph 3.4.6, page 16) and correct. Reset switch.
	5. SHH - Heat exchanger condensate drain pressure switch activated.	5. Clean condensate drain. Verify flow. Fill traps with water and restart heater.
Blower motor (all Models) or venter motor (SDH/PDH/SHH/RHH/RDH) will not run	1. Circuit open.	1. Check wiring and connections.
	2. Defective integrated circuit board.	2. Replace board.
	3. Defective capacitor, starter, or motor.	3. Replace defective part(s).
Blower motor (all Models) or venter motor (PDH/SDH/RDH/SHH/RHH) turns on and off while burner is operating	1. Motor overload device cycling on and off.	1. Check motor load against motor rating plate. Replace motor if needed.
Blower motor (all Models) or venter motor (SDH/PDH/RDH/SHH/RHH) cuts out on overload	1. Low or high voltage supply.	1. Correct electric supply.
	2. Defective motor.	2. Replace motor.
	3. Poor air flow.	3. Clean motor, blower, blower guard, filter, and coils.
	4. Defective bearing or lubrication.	4. Lubricate bearings (motor permitting) or replace motor
Blower motor (all Models) cuts out on overload	1. Improper motor pulley and/or adjustment.	1. Check motor pulley and belt..
	2. Improper static pressure in ductwork	2. Adjust duct system dampers.
	3. Low voltage.	3. Check power supply.

4. Troubleshooting (cont'd)

4.4 Troubleshooting - Electric Heat Section (PEH, REH)

PROBLEM	PROBABLE CAUSE	REMEDY
Unit does not operate	1. No power to unit	1. Turn on power; check supply fuses or main circuit breaker.
	2. Blown fuses	2. Check and replace if necessary.
	3. Defective or incorrect wiring.	3. Check wiring and connections. Refer to wiring diagram provided with unit.
	4. Defective or burned out control transformer	4. Check secondary voltage with voltmeter. Replace if necessary.
Fan operates but element does not heat	1. Dirty filters	1. Check filters and clean or replace if necessary.
	2. Defective air proving switch	2. Check and replace if necessary.
	3. Blown element fuses	3. Check and replace element fuses if necessary.
Insufficient heat	1. Burned out element	1. Turn off power and check element resistance with ohmmeter. Replace if open.
	2. Blown fuses	2. Check and replace if necessary.
	3. Cycling on limit control	3. a) Check air throughput (temperature rise). b) Check motor rpm against nameplate rating. Replace motor if speed is too slow. c) Defective limit control. Check wiring and connections. Check continuity through control and replace if necessary.
	4. Defective or incorrect wiring.	4. Check wiring and connections. Refer to wiring diagram provided with unit.

4.5 Troubleshooting - Refrigeration Circuit (All Models with a DX Cooling Module)

Consult the condensing unit literature for more specific information.

SYMPTOM	POSSIBLE CAUSE	REMEDY
A. Compressor will not start.	1. Power off, loose electrical connections or fuse open.	1. Check disconnect switch, fuses and wiring. Replace parts or repair as necessary
	2. Compressor contactor not closing.	2. Check voltage to contactor coil, transformer, slave relay, system. Replace parts as necessary.
	3. Internal compressor thermal overload open.	3. If compressor is hot, allow 2 hours to cool. See D. below.
	4. Compressor defective.	4. Check compressor for electrical failure. Compressor may be seized; check refrigerant. If necessary, replace compressor.
	5. High or low pressure switch open or defective.	5. If manual reset (high pressure), reset switch. (Switch opens at 600 psi and will not reset above 400 psi.) If auto reset (low pressure) does not reset and everything else is OK, replace low pressure switch.
B. Compressor starts but cuts out on low pressure (switch activates at 35 psig.)	1. Low refrigerant charge.	1. Check subcooling; see condensing unit manual or Paragraph 3.7.4, Step 11.
	2. Airflow restricted.	2. Check for dirty evaporator coil, dirty filters, dampers closed, iced evaporator coil, improper belt, check motor amps, check duct design.
	3. Restriction in refrigerant line.	3. Check subcooling and superheat; see condensing unit manual or Paragraph 3.7.4, Step 11. Check operation of the thermal expansion valve. Check for pressure drop across the filter drier.
	4. Defective low pressure switch.	4. Check switch (opens 35 psi; closes 50 psi). If defective, replace switch
C. Compressor starts but cuts out on high pressure switch.	1. Refrigerant overcharge.	1. Check subcooling; see condensing unit manual or Paragraph 3.7.4, Step 11.
	2. Condenser fan motor defective.	2. Check fan motor.
	3. Condenser coil inlet obstructed or dirty.	3. Check coil and inlet clearances and for possible air recirculation.
	4. Air or non-condensables in system.	4. Check high side equalized pressure reading with equivalent outdoor temperature.
	5. Defective high pressure switch.	5. Check switch (opens at 600 psi and will not reset above 400 psi.). If defective, replace high pressure switch..
	6. Restriction in discharge or liquid line.	6. Check subcooling and superheat; see condensing unit manual or Paragraph 3.7.4, Step 11. Check operation of thermal expansion valves.
D. Compressor cuts out on thermal overload.	1. Low voltage.	1. Check voltage.
	2. Sustained high discharge pressure.	2. Check running amperage and conditions described in I.
	3. High suction and discharge pressures.	3. Check thermal expansion valve setting, check for air in system.
	4. Defective compressor overload.	4. If compressor is hot, allow compressor to cool for 2 hrs. Recheck for open circuit.
	5. Improper refrigerant charge.	5. Check subcooling; see condensing unit manual or Paragraph 3.7.4, Step 11.
	6. Bearings or pistons too tight.	6. Check for low oil level.
	7. Allow time for compressor to cool.	7. Check dome temperature of the compressor.
E. Noisy compressor.	1. Reverse rotation.	1. Check at startup. If the suction pressure rises and the discharge pressure drops, shut down the compressor. Switch the 3-phase wiring connections.
	2. Refrigerant overcharge.	2. Check pressures and subcooling; see condensing unit manual or Paragraph 3.7.4, Step 11.
	3. Liquid floodback.	3. Check thermal expansion valve setting. Check subcooling for refrigerant overcharge; see condensing unit manual or Paragraph 3.7.4, Step 11.
	3. Tubing rattle.	3. Dampen tubing vibration by taping or clamping. Carefully bend tubing away from contact where possible.
	4. Compressor defective.	4. Check internal parts. Replace defective parts or compressor.

F. Noisy unit operation.	1. Blower rotational noise.	1. Check blower, motor and drive for faulty adjustment or noisy bearings, loose parts, and/or blower out of balance.
	2. Air noise.	2. Check ductwork. Air velocity too high.
	3. Chattering contactor.	3. Check for adequate control voltage, check for shorts or breaks, check thermostat, check contact points.
	4. Tubing rattle.	4. Dampen by taping or clamping, carefully bend tubing away from contact when possible.
G. High suction pressure	1. Excessive load on evaporator coil.	1. Check superheat; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Check for high entering wet bulb temperature. Check for excessive air.
	2. Compressor is unloaded.	2. Check head pressure. Check thermal expansion valve. If valve is not functioning properly, check pressure drop across filter drier.
	3. Expansion valve not secured to suction line or defective.	3. Check the thermal expansion valve; ensure bulb is attached properly and insulated.
H. High discharge pressure.	1. Refrigerant overcharge.	1. Check subcooling; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Adjust refrigerant charge.
	2. Thermal expansion valve setting.	2. Check superheat; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Adjust valve as needed.
	3. Air inlet to condenser dirty or obstructed.	3. Check for proper clearances and possible air recirculating.
	4. Condenser fan motor defective.	4. Check condenser fan motor and capacitor.
I. Suction pressure is too low.	1. Refrigerant undercharge.	1. Check subcooling; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Add refrigerant as needed.
	2. Thermal expansion valve setting.	2. Check superheat; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Adjust valve as needed.
	3. Blower running backward.	3. Interchange any two wires from 3 phase disconnect.
	4. Loose blower, pulley or belts.	4. Check drive pulley alignment, belt tension.
	5. Defective or improperly adjusted expansion valve.	5. Check superheat and adjust thermal expansion valve.
	6. Dirty filter.	6. Check filter and evaporator coil.
	7. Too little airflow or low entering air temperature.	7. Check airflow and entering air wet bulb conditions.
	8. Restriction in suction or liquid line.	8. Check refrigerant circuit for restriction.
J. Head pressure too low.	1. Insufficient refrigerant charge.	1. Check subcooling; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Check for leak. Repair; add refrigerant.
	2. Defective or improperly adjusted expansion valve.	2. Check superheat; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Adjust thermal expansion valve.
	3. Low suction pressure.	3. See "I. Suction pressure too low" above.
	4. Defective compressor.	4. See "G. High suction pressure" above.
K. Compressor short cycles.	1. Improper refrigerant charge.	1. Check subcooling and superheat; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> .
	2. Defective high or low pressure control.	2. Check high or low pressure switch.
	3. Liquid floodback.	3. Possible tight bearings, see above.
	4. Defective expansion valve.	4. Check superheat and thermal expansion valve.
	5. Poor air distribution.	5. Check ductwork for recirculating.
	6. High discharge pressure.	6. See "H. High discharge pressure" above.
	7. Leaking discharge valves in compressor.	7. See "G. High suction pressure" above.
L. Running cycle is too long or unit operates continuously.	1. Refrigeration undercharged.	1. Check subcooling; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Add refrigerant.
	2. Dirty filter or evaporator coil.	2. Check filter, coil, and airflow.
	3. Dirty or clogged condenser coil.	3. Check coil and airflow.
	4. Air or other non-condensables in system.	4. Check equalized high side pressure with equivalent outdoor temperature.
	5. Defective compressor.	5. See "high suction pressure" above.
	6. Restriction in suction and liquid line.	6. Check for restrictions in refrigerant circuit.
	7. Control contacts stuck.	7. Check wiring.
M. Supply air temperature is too high.	1. Refrigerant undercharge or leak in system.	1. Check subcooling; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Check for leaks.
	2. Evaporator plugged with dirt or ice.	2. Check evaporator, airflow, and filter.
	3. Improperly adjusted or defective expansion valve.	3. Check superheat & adjust thermal expansion valve, check bulb.
	4. Defective compressor.	4. Check compressor for proper operation.
	5. High discharge pressure.	5. See "high discharge pressure" above.
	6. Airflow is too high.	6. Check external static pressure.
N. Supply air temperature is too low.	1. Airflow is too low.	1. Check evaporator coil; check filters, check for closed dampers or grills, check drive for loose parts, belts, or misalignment; check external static pressure.
	2. Return air temperature too low.	2. Check entering air wet bulb conditions.
O. Liquid line is too hot.	1. Refrigerant undercharge.	1. Check subcooling; see condensing unit manual or Paragraph 3.7.4, <i>Step 11</i> . Adjust refrigerant.
	2. High discharge pressure.	2. See H. above.

APPENDIX

Pressure/ Temperature Chart for R410A Refrigerant for Checking Reheat (dehumidification) Circuit Subcooling and Superheat

NOTE: For pressure/temperatures for checking subcooling and superheat of the cooling circuit with a refrigerant other than R410A, refer to the heat/cool system (I-PDH/SDH/PEH/SHH/PXH or I-PreevA RDH/REH) or condenser installation manual. The reheat circuit is always R410A refrigerant.

NOTE: Information in this chart was taken from the Temperature Pressure Chart printed in Form IC-2-04 by the Sporlan Valve Company, Washington, MO 63090.

R410A Refrigerant		
Pressure	Temperature	
PSI	°F	°C
1.8	-55	-48.3
4.3	-50	-45.6
7.0	-45	-42.8
10.1	-40	-40.0
13.5	-35	-37.2
17.2	-30	-34.4
21.4	-25	-31.7
25.9	-20	-28.9
27.8	-18	-27.8
29.7	-16	-26.7
31.8	-14	-25.6
33.9	-12	-24.4
36.1	-10	-23.3
38.4	-8	-22.2
40.7	-6	-21.1
43.1	-4	-20.0
45.6	-2	-18.9
48.2	0	-17.8
49.5	1	-17.2
50.9	2	-16.7
52.2	3	-16.1
53.6	4	-15.6
55.0	5	-15.0
56.4	6	-14.4
57.9	7	-13.9
59.3	8	-13.3
60.8	9	-12.8
62.3	10	-12.2
63.9	11	-11.7
65.4	12	-11.1
67.0	13	-10.6
68.6	14	-10.0
70.2	15	-9.4
71.9	16	-8.9
73.5	17	-8.3
75.2	18	-7.8
77.0	19	-7.2
78.7	20	-6.7
80.5	21	-6.1
82.3	22	-5.6
84.1	23	-5.0
85.9	24	-4.4
87.8	25	-3.9
89.7	26	-3.3
91.6	27	-2.8

R410A Refrigerant		
Pressure	Temperature	
PSI	°F	°C
93.5	28	-2.2
95.5	29	-1.7
97.5	30	-1.1
99.5	31	-0.6
101.6	32	0.0
103.6	33	0.6
105.7	34	1.1
107.9	35	1.7
110.0	36	2.2
112.2	37	2.8
114.4	38	3.3
116.7	39	3.9
118.9	40	4.4
121.2	41	5.0
123.6	42	5.6
125.9	43	6.1
128.3	44	6.7
130.7	45	7.2
133.2	46	7.8
135.6	47	8.3
138.2	48	8.9
140.7	49	9.4
143.3	50	10.0
156.6	55	12.8
170.7	60	15.6
185.7	65	18.3
201.5	70	21.1
218.2	75	23.9
235.9	80	26.7
254.6	85	29.4
274.3	90	32.2
295.0	95	35.0
316.9	100	37.8
339.9	105	40.6
364.1	110	43.3
389.6	115	46.1
416.4	120	48.9
444.5	125	51.7
474.0	130	54.4
505.0	135	57.2
537.6	140	60.0
571.7	145	62.8
607.6	150	65.6
645.2	155	68.3

Wiring Diagram Option Identification

The Option Codes for these electrical options are shown on the wiring diagram.

Option Code	Brief Description	Option Code	Brief Description
AG1	Analog Heating Control - 1-Stage	D12B	Digital Control w/FX06 - Neutral Air/Discharge Air Temp Control (applies to PDH or SDH with or without reheat)
AG2	Analog Heating Control - 2-Stage	D12C	Digital Control w/FX06 - Space Temp Cntrl w/Discharge Air Reset (applies to SDH or PDH with or without reheat)
AG3	Analog Heating/Makeup Air - 2-Stage unit-mounted ductstat	D12D	Digital Control w/FX06 - Neutral Air/Discharge Air Temp Control (applies to PEH with SCR (modulating) heating control and 3-stage cooling with or without reheat)
AG15	Analog Heating/Makeup Air - 2-Stage remote ductstat w/dial	D12E	Digital Control w/FX06 - Recirculating Air Temp Control (applies to PEH with 2-stage heating and 3-stage cooling with or without reheat) (not recommended for makeup air)
AG16	Analog Heating/Makeup Air - same as AG15 with display	D12F	Digital Control w/FX06 - Space Temperature, 2-stage heating / 3-stage cooling (applies to SHH)
AG40	Analog Heating/Makeup Air - converts to digital for field supplied BMS	D12G	Digital Control w/FX06 - Gas-fired electronic modulation with 8:1 turn-down; 3-stage cooling; with or without reheat; discharge air temperature control (applies to SHH)
AG58	Analog Heating/Makeup Air - electronic modulation 8:1 turndown (SHH)	DG1	Digital Control w/FX05 - Space Temperature, 2-stg heating/3-stg cooling (applies to PDH or SDH without reheat)
AG60	Analog Heating/Makeup Air - same as AG3 plus 33% low fire	DG2	Digital Control w/FX05 - Space Temperature elec mod htg/3-stg cng (applies to PDH or SDH without reheat)
AG61	Analog Heating/Makeup Air - same as AG15 plus 33% low fire	DG5	Digital Control w/FX05 - Discharge Air Temperature, 2-stg htg/3-stg cng (applies to PDH or SDH without reheat)
AG62	Analog Heating/Makeup Air - same as AG61 with display	DG6	Digital Control w/FX05 - Discharge Air Temperature elec mod htg/3 stg cng (applies to PDH or SDH without reheat)
AK1	115/1 Supply Voltage	ECD1	Evap Cooler AquaSaver meter water flow system
AK2	208/1 Supply Voltage	ECD2	Evap Cooler Recirculating Pump Control
AK3	230/1 Supply Voltage	EG1	Analog Heating Control - 1 Stage thermostat (PEH)
AK5	208/3 Supply Voltage	EG2	Analog Heating Control - 2 Stage thermostat (PEH)
AK6	230/3 Supply Voltage	GE3	Damper Control - Outside air, 2-position motor
AK7	460/3 Supply Voltage	GE5	Damper Control - Outside air, 3-position motor
AK8	575/3 Supply Voltage	GE6	Damper Control - Outside & Return, 2-position motor
AN2	Contactora, IEC	GE7	Damper Control - Outside & Return, 2-position mtr w/warm up
AN10	Motor Starter with Overloads	GE8	Damper Control - Outside & Return, 3-position, unit potentiometer
AR8	On/Off Inlet Air Damper with Duct Flanges	GE10	Damper Control - Outside & Return, 3-position, remote potentiometer
AU7	Cooling Coil Cabinet with DX Coil and Reheat Pump	GE11	Damper Control - Outside & Return, modulating, mixed air
AUR1	Modulating Reheat	GE12	Damper Control - Outside & Return, modulating, mixed air w/min
BA6	Disconnect Switch - Flush-mounted, lockable, non-fusible	GE13	Damper Control - Outside & Return, modulating, mixed air w/warm up
BB8	Wiring for Energy Recovery Module	GE14	Damper Control - Outside & Return, mod, mixed air w/min & warm up
BC2	Convenience Outlet (requires separate power supply)	GE15	Damper Control - Outside & Return, modulating, building pressure
BD4	Firestat, 200°F	GE16	Damper Control - Outside & Return, modulating, BMS control
BD5	Firestat, 200°F (field installed)	GE21	Damper Control - Outside & Return, modulating, enthalpy
BE2	Low Limit, Discharge Temperature	GE22	Damper Cntrl - Outside & Return, modulating, dual reference enthalpy
BE4	Evaporator Froststat for Coils	RB2A	Remote Display - Control Options D12B-G
BF14	Phase Loss/Low Voltage Protection - with AK5, AK6, AK7 only	RC__	Remote Console - lights, switches, optional sensors
BF15	Phase Loss/Phase Reversal Protection - 3 phase only	SA1	Duct Photoelectric Smoke Detector
BG7__	Plugin DPDT Relay - Specified operation	T4 XX	Thermal Expansion Valve (R410A only)
BG9	Plugin DPDT Relay - Exhaust Fan Interlock	UV2	Germicidal Lamp
BHB1	Time Clock Card - with DG 1, 2, 5, 6	VFD1	Variable Frequency Drive
BHB2	N2 Card - with DG 1, 2, 5, 6 and D12 B, C, D, E	VFD2	Variable Frequency Drive (requires field installation)
BHB3	LonMark Card - with DG 1, 2, 5, 6 and D12 B, C, D, E	VFD3	Variable Freuency Drive (supplied by others)
BN2	Limit Control - High Ambient (burner cutoff)		
BP4	Gas Pressure Safety Switches, High and Low		
CL1	Thermostat - 1-stage heat, 24V, 40-80°F		
CL22	Thermostat - 24v non programmable, 1 or 2-stage		
CL23	Thermostat - 24v, 2-stg heat/cool, touch screen, programmable		
CL33	Thermostat - 2-stage heat/cool, 24V, programmable		
CL36	Thermostat - Modulating Heat/cool with 3-stage cooling		
CL52	Thermostat - 1-stage heat/cool, 24V, 45-88°F, programmable 5/2 day		
CL67	Space Temperature Sensor/Override - with D12 B, C, D, E		
CN1__	3-Position Switch - specified operation		
CN3__	2-Position Switch - specified operation		
CP__	Disconnect Switch (field installed)		
CT1	Evap Cooler Fill & Drain Kit - 120/1 with AK1, AK7, AK8		
CT2	Evap Cooler Fill & Drain Kit - 208/1 with AK2, AK5		
CT3	Evap Cooler Fill & Drain Kit - 240/1 with AK3, AK6		
CT5	Evap Cooler Freeze Protection - AquaSaver controls		
CT6	Evap Cooler Freeze Protection - with CT 1, 2, or 3		

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Record installation information on the back of the installation manual, Form I-PDH/SDH/PEH/SHH/PXH or Form I-RDH/REH/RHH/RXH.

Keep this manual, the installation manual and the control instruction booklet for future reference.