Installation and Maintenance Manual	IM 684-4
	Group: **Applied Air**
	Part Number: **IM684**
	Date: **February 2007**

Forced Draft Gas Fired Furnace on McQuay Rooftop Systems

FC ****A* with RM7897A Flame Safeguard

When writing to McQuay for service or replacement parts, refer to the model number of the unit as stamped on the serial plate, attached to the unit. If there is an in-warranty failure, state the date of installation of the unit and the date of failure along with an explanation of the malfunctions and the description of the replacement parts required. Parts are warranted for ninety (90) days unless covered by original unit warranty.

Table of Contents

McQuay Model Designation

Furnace Model	20	25	32	40	50	64	65	79	80	100	110	140	150	200
Output Capacity (MBh)	200	250	320	400	500	640	650	790	800	1000	1100	1400	1500	2000

SERVICED BY:

TELEPHONE NO: **INSTALLATION DATE:**

Installer: Leave this manual with owner. It is to be posted and maintained in legible condition.

General

This forced draft gas burner is specifically designed for use with the furnace on McQuay rooftop heating and air conditioning units which are for outdoor installation only. Each model size has unique burner head components to tailor the shape of the flame to each particular stainless steel combustion chamber, to match the capacity requirement, and to offer a desirable turndown potential when arranged for modulation. This is a forced draft burner with a high pressure combustion air fan and will operate against pressure. This eliminates the need for draft inducers, chimneys, draft hoods, barometric dampers, and Breidert caps.

Warranty Exclusion

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

⚠ WARNING

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

Ventilation & Flue Pipe Requirements

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

Factory Mounting

This burner and gas train have been installed and wired at the factory. See “Gas Piping Routing Into Unit” on page 6. **Also note that models 150 through 200 have the burner removed for shipment; see Vestibule (Models 150 through 200) on page 7.**

Factory Checkout

This complete heating plant was fired and tested at the factory. It was adjusted to the required capacity and efficiency. Modulating air and gas linkages, pressure regulators, and stops were adjusted for proper operation at all firing levels. The unit was fired through several complete sequences of start-up through shutoff to check operation. A check was made of the air switch, gas pressure switch, high limit operation, and combustion characteristics including CO_2 and CO (at several firing rates on modulating burners).

If the burner was specified for operation at higher altitudes, combustion air adjustments were compensated to result in proper settings at the higher altitude. This checkout normally eliminates on-the-job start-up problems; however, the equipment is subject to variable job conditions and shipping shocks can change adjustments, cause damage, and loosen connections and fasteners. Therefore, it is necessary to go through the complete start-up procedure even though the unit may appear to be operating properly.

Installation

General

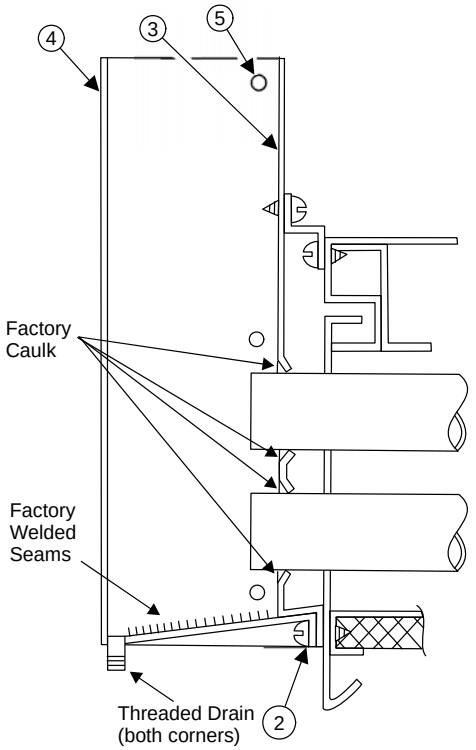
The installation of this equipment must be in accordance with the regulations of authorities having jurisdiction and all applicable codes. It is the responsibility of the installer to determine and follow the applicable codes. Sheet metal parts, self-tapping screws, clips, and such items inherently have sharp edges, and it is necessary that the installer exercise caution. This equipment must be installed by an experienced professional installation company that employs fully trained and experienced technicians.

Flue Box (see Figure 1)

The flue box is not installed at the factory because it would increase the width of the unit beyond the allowable shipping width. All holes are pre punched, the fasteners are furnished and everything is shipped inside a box in the burner section. On Models 150 through 200, it is shipped in the same crate as the vestibule. Remove and discard the shipping cover installed over the furnace tube outlets before installing the flue box.

1. Remove the screws (2) in the casing of the unit that line up with the bottom lip holes of the flue box tube sheet (3). These screws will later be replaced, at which time they will also attach the bottom of the flue box to the unit.
2. Install flue box wrapper sheet (4) by sliding it up from below. Attach with side screws (5). At this time reinstall bottom screws (2).

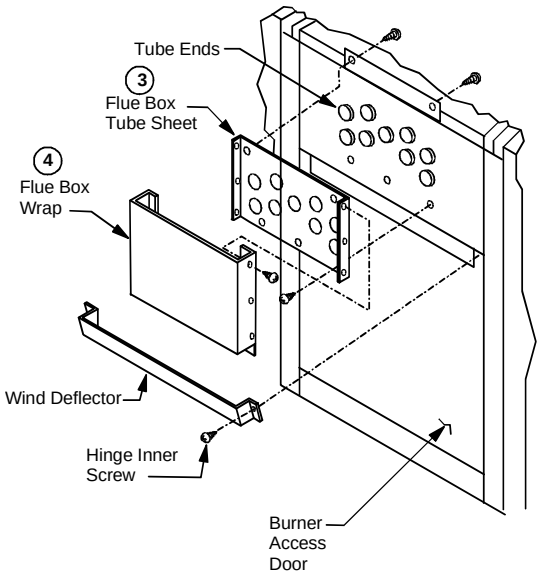
Figure 1. Flue Box



Wind Deflector

The wind deflector is not installed at the factory because it would increase the width of the unit beyond the allowable shipping width. The deflector is shipped in a box in the burner section. Install the wind deflector over the combustion air intake opening of the burner compartment before operating the burner. Use inner hinge screws on top hinged door (see Figure 2). Side hinged doors have holes for mounting (see Figure 5). Models 020 and 025 have a different style wind deflector. It mounts on the door and has a top opening flush with the roof of the unit (see Figure 14).

Figure 2. Wind Deflector, Models (032 thru 140)



Electrical

The McQuay burner receives its electrical power from the main unit control panel. No additional power wiring must be routed to the burner. The sequencing of the burner is also controlled through this panel and therefore is factory wired. No additional wiring will be required. Note that models 150 through 200 furnaces require reassembly of some electrical connections as the burner is removed for shipment.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, severe personal injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

If you smell gas:

1. Open Windows and ventilate area thoroughly.
2. Don't touch electrical switches.
3. Eliminate open flames, pilot lights, arcing or sparking equipment, or other sources of ignition.
4. Evacuate the area.
5. Immediately call your gas supplier from a different area.

Do not use and store gasoline or other flammable vapors or liquids in open containers near this appliance or in areas sharing ventilation with it.

Gas Pressure Requirements

The pressure furnished to the appliance gas pressure regulator immediately before the main gas valve must not exceed 13.9 in. W.C. or be below the minimum specified in Table 7, Column 14. When the supply pressure is above 13.9 in. W.C., a high pressure regulator must precede the appliance gas pressure regulator. The inlet gas pressure must not exceed the maximum pressure rating of the high pressure regulator, and the outlet pressure must furnish gas to the appliance pressure regulator within the pressure range mentioned above.

Gas Piping

The connection size at the burner is shown in Table 7 under columns 17 and 18. Gas piping must be sized to provide the minimum required pressure at the burner when the burner is operating at maximum input. Consult your local utility on any questions on gas pressure available, allowing piping pressure drops, and local piping requirements.

Install all piping in accordance with the National Fuel Gas Code (ANSI Z223.1), (NFPA 54-1999) and any applicable local codes.

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

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

Valve & Regulator Venting

Valve diaphragm vents, pressure regulator vents, and pressure switch vents are located in the outdoor burner vestibule and therefore vent tubing is not run to the outside of this vestibule. If local regulations require that this be done, it is a part of the field gas piping hookup. Remove any plastic protector plugs from regulator and valve vents.

Normally Open Vent Valve

Vent valves such as required by IRI for over 1000 MBh input units must always be routed to the outdoors. This is field piping.

Table 1. Capacity of pipe natural gas (CFH)

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

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

Table 2. Specific gravity other than 0.60

SPECIFIC GRAVITY	MULTIPLIER
0.50	1.100
0.60	1.000
0.70	0.936
0.80	0.867
0.90	0.816
1.00	0.775
PROPANE-AIR	
1.10	0.740
PROPANE	
1.55	0.622
BUTANE	
2.00	0.547

Table 3. Pressure drop other than 0.3"

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

Gas Piping Routing Into Unit

On-The-Roof Piping (Models 020-140)

1. Remove knockout (1) at corner of burner vestibule door and saw out corner of door. See Figure 3b. Make saw cuts (2) tangent to round hole and square with door edges.
2. Install pipe corner plate (3) on vestibule, locating on pre-punched holes. See Figure 3c. This part is shipped inside the vestibule.
3. Route gas supply pipe through hole. Carefully plan pipe route and fitting locations to avoid interference with swinging of doors, etc.

Figure 3a. Pipe Routing

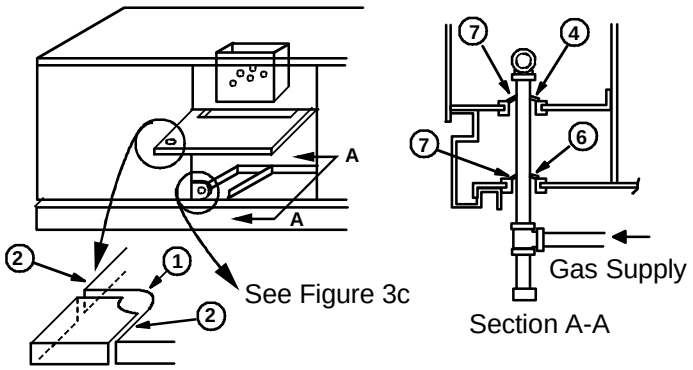
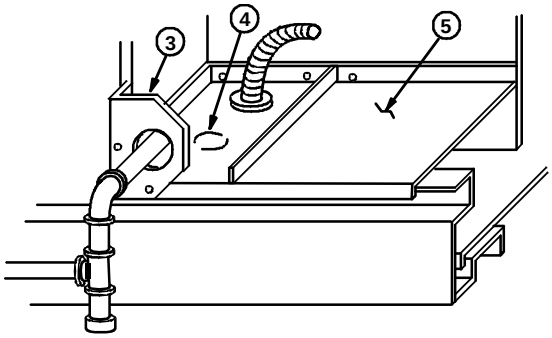


Figure 3b. Knockout

Through-The-Curb Piping (Models 020-140)

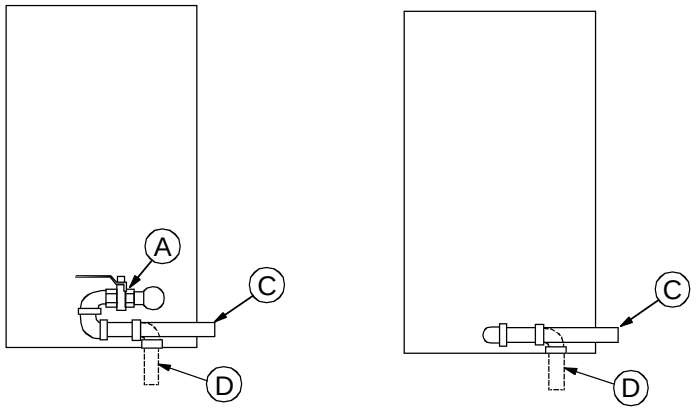
1. Remove bottom access panel (5). See Figure 3c.
2. Remove knockout (4) and make an opening (6) through bottom deck directly below knockout hole.
3. Route gas pipeline through these openings and seal them off with suitable grommets (7). See Figure 3a Section A-A.
4. Replace bottom access panel (5).

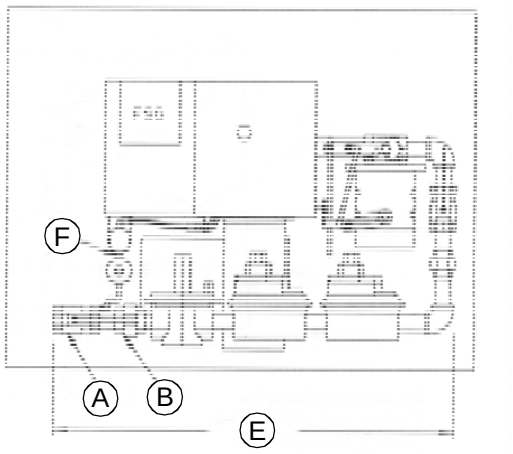
Figure 3c. Pipe Corner Plate



Typical Piping Connections

Figure 4. Connections





A = Shutoff Cock (ball valve)
B = Union - Furnished.
C = Gas Pipe - Routed in through front
D = Gas Pipe - Routed in through curb
E = Factory Piped Gas Trains
F = Pilot Gas Tubing

Gas Piping (Models 150 Through 200)

The gas piping cannot be routed up to the burner from within the curb on Models 150 through 200. Gas piping must be routed across the roof to under the burner vestibule, or a pitch pocket can be provided there. The installer must cut a hole in the bottom panel of the overhanging burner vestibule through which to route the gas line up to the burner gas train. The bottom panel of the vestibule is at approximately the same elevation as the top of the curb.

Gas Piping Within The Vestibule

The gas piping layout within the vestibule will vary according to the complexity and size of the gas train relative to the available room within the vestibule. As an example, a gas train with a high pressure regulator and an extra safety shutoff valve (when required for IRI, etc.) will require careful use of the available space. The examples shown in Figure 4 indicate typical piping layouts.

Field Gas Piping Required

The gas train components have all been factory installed and require only a connection to the supply gas line. The manual shutoff valve is located within the burner vestibule. If local codes require a manual shutoff valve that is accessible from outside the unit, that valve must be relocated or an additional valve added. In locating such a valve, it is to be readily accessible and located such that no obstructions interfere with operation of the handle.

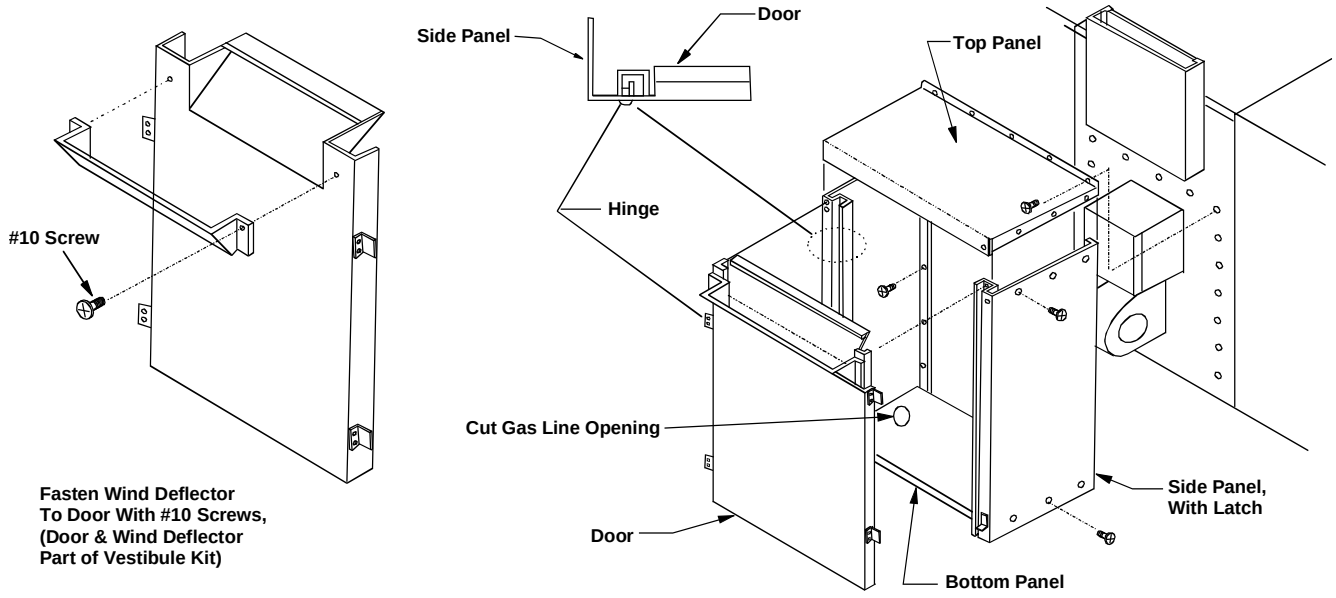
Condensate Drain

All units are equipped with a 3/4" I.P. condensate drain pipe projecting from the back side of the furnace section (see Figure 13 and Figure 14) and the flue box corners (see Figure 1). If applicable codes or regulations require, this can be routed to a drain. A trap is not recommended and heat tape or some other method of freeze protection is required.

Vestibule (Models 150 through 200)

These two furnace sizes exceed the allowable shipping width. For this reason the burner is disconnected and removed for shipment. A sheet metal vestibule weather enclosure is also disassembled for shipment. At installation, the burner must be remounted, the tagged electrical connections re-attached, and the vestibule re-assembled and mounted as shown in Figure 5. These items are packed in a crate and shipped as a separate item.

Figure 5. Vestibule



Start-Up & Operating Procedures

Start-Up Responsibility

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

1. The furnace must not exceed the specified Maximum MBh Input. See “Verify Input Rate” on page 14.
2. The furnace must not operate at an airflow below the specified Minimum Airflow CFM. On variable air volume systems it must be determined that the furnace will not be operated if or when system cfm is reduced below the specified minimum airflow cfm.
3. It must be established that the gas supply is within the proper pressure range. See “Gas Pressure Requirements” on page 4.

Start-Up Procedure

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

⚠ WARNING

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

Before Start-Up

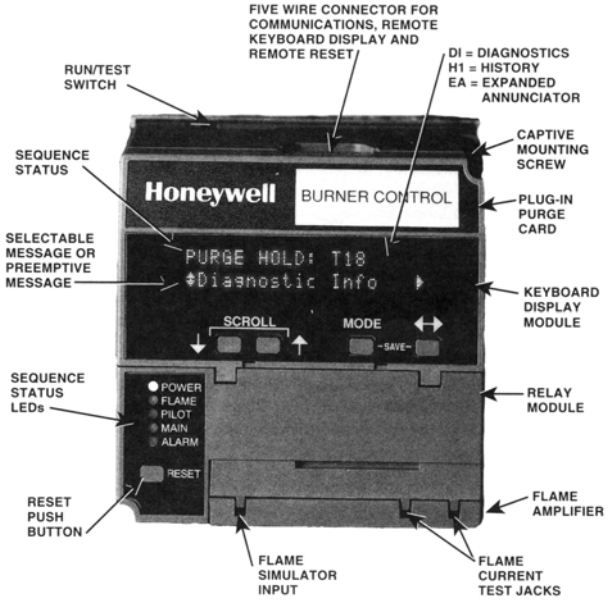
1. Notify inspectors or representatives who may be required to be present during start-up of gas fuel equipment. These could include the gas utility company, city gas inspectors, heating inspectors, etc.
2. Review the equipment and service literature and become familiar with the location and purpose of the burner controls. Determine where the gas and power can be turned off at the unit, and before the unit.
3. Determine that power is connected to the unit and available.
4. Determine that the gas piping, meter, and service regulator have been installed, tested, and meet the equipment requirements.
5. Determine that proper instruments will be available for the start-up. A proper start-up requires the following: voltmeter, manometer or gauges with ranges for both manifold pressure and inlet gas pressure, keyboard display module or a 20K ohm/volt meter for flame safeguard, signal strength measurement, CO_2 indicator, carbon monoxide indicator, and a stopwatch for timing the gas meter.

Start-Up Preliminary

Close main and pilot gas cocks. Install a keyboard display module or connect a 20K ohm/volt meter to the test jack on the flame safeguard. See Figure 6a.

1. Check the burner fan wheel for binding, rubbing, or loose setscrews. Inspect the air damper and gas valve linkages for binding and check the linkage fasteners for tightness.
2. Check power. Position control switch on burner panel to AUTO. The POWER LED on the flame safeguard should come on and, after 10 seconds, the burner motor should start. Check for Counter-clockwise rotation as viewed through blower housing inlet. If motor does not start, press the reset button on the flame safeguard. If motor still does not start, consult the appropriate section of the Troubleshooting Chart on page 19. Continue on to Item 3 when burner motor will run when the switch is positioned to AUTO.
3. Check voltage. With the switch at AUTO, measure the voltage across flame safeguard terminals 5 and L2. If it is not between 108 and 132 volts, check the voltage and tapping connections to the supplying transformer at the unit's main control panel.
4. Purge the gas lines. Close the main gas valves and turn the electrical switches off. Make sure there are no arcing or sparking switches, motors, or other equipment, pilot lights, open flames, or other sources of ignition in the areas sharing ventilation. Disconnect the pilot gas tube at the pilot pressure regulator and bleed the gas line of all air. Close the pilot cock and reconnect the pilot tubing.
5. Leak check. Using a rich soap-water mixture and a brush, check the gas lines for leaks. Correct all leaks before starting burner.

Figure 6a. RM7897A Flame Safeguard



Low Fire Start

Modulating burners are controlled for low fire start. The modulating gas valve actuator will position the gas valve to the low fire position each time the burner is to light.

Pilot Start-Up

Open the pilot gas cock (gas test cock remains closed) and position the switch to AUTO to start the burner motor. After 30 (or 90) seconds the pilot valve opens (as indicated when the indicator LED marked PILOT comes on) and the pilot should ignite. The flame signal should read 1.5 to 5.0 volts DC. The LED marked MAIN should come on when the pilot flame has been detected by the flame safeguard and it has energized the main gas valve. On the initial start-up, if the pilot does not light and the flame safeguard locks out, reset it and make several attempts to light the pilot before assuming problems other than more air in the gas lines. If the initial pilot operation is erratic, it may be well to wait until after a period of main flame operation has further purged the gas lines before trying to "adjust out" something that may actually be air in the lines. If the burner is equipped for modulation or two-stage operation, observe the flame signal reading at all firing positions. Cycle the flame safeguard to determine that the burner goes to the low fire position for light off and that the pilot will ignite and operate. See Service on page 11 for pilot adjustments, etc.

Main Flame Start-Up

1. At the conclusion of the pilot start-up and with the gas test cock closed, measure the air box pressure (see Table 7) by holding a rubber manometer tube tightly over the burner air pressure port. The tube must surround the hole and seal tightly against the door to measure the static pressure through the hole. Modulating burners are to be at their "high fire" position for this measurement. Table 7, Column 8, indicates typical readings and any appreciable deviations from these would indicate a burner air problem that should be found before attempting to fire the unit. These problems could include linkage adjustments disturbed during shipment, etc.
2. With control switch at OFF, connect the manometer to the main manifold pressure tap and open the gas test cock.
3. Position the switch to AUTO and the unit will go through the prepurge cycle, the pilot will light, and the main flame will come on. Watch the manometer during the light off attempt. The manifold pressure should rise to about 90% of the specified value within 2 seconds and the main flame should ignite immediately when the pressure approaches this value. If the burner has not lit within a few seconds after pressure is indicated on the manometer, shut down the unit and check for problems (refer to the Troubleshooting Chart on page 19). Modulating burners should have their controllers set to call for high fire although they will have a forced low fire start. If combustion appears normal, proceed with combustion tests.
4. Combustion tests. These tests should be run after the furnace has been running 10 to 15 minutes.
   a. Check input: See "Verify Input Rate" on page 14.
   b. Check CO_2: See "Check CO2, CO & Stack Temperature" on page 14.
   c. Check CO: See "Check CO2, CO & Stack Temperature" on page 14.
5. On modulating burners, cycle the burner from high to low fire, observing flame and repeating CO_2 and CO tests at low fire after burner has been running 10 to 15 minutes.
6. Cycle the unit through several start-ups with controls calling for first low fire and finally high fire. Watch for any indications that the unit is not operating as expected, and for inconsistencies that could indicate future problems.

Typical Sequence of Operation

On-off Gas Burner (see Figure 6b):

When burner is to operate, line 878 from the main control panel is energized (120 volts). Line 878 feeds through the burner switch (S3) on the burner control panel to power terminal 5 and through the normally closed contacts on the high limit control to energize terminal 6 on the RM7897A. When terminal 6 is energized, a 10 second "Initiate" sequence will run, after which terminal 4 becomes energized and starts the burner blower. Blower operation is sensed by the combustion air switch which closes terminals 7 and 6 and the prepurge period begins. At the end of the prepurge period (30, 60 or 90 seconds), terminals 8 and 10 are energized, opening the pilot gas valve and energizing the ignition transformer. After the pilot flame ignites and is detected by the flame rod, terminal 9 is energized, opening the main gas valve, and terminal 10 is de-energized, shutting off the ignition transformer.

In the event the pilot fails to light, or fails to prove itself within 10 seconds, the RM7897A will go on auto shutdown and requires manual reset.

Modulating Gas Burner Without End Switch Cycling:

Similar to ON-OFF operation described previously except at any time the burner is operating, the modulating controllers will determine the firing rate. The modulating controls position an operator which will change both gas and airflow proportionally. The modulating control will always go to the low fire position for light off.

Figure 6b. Typical electrical schematic with RM7897A

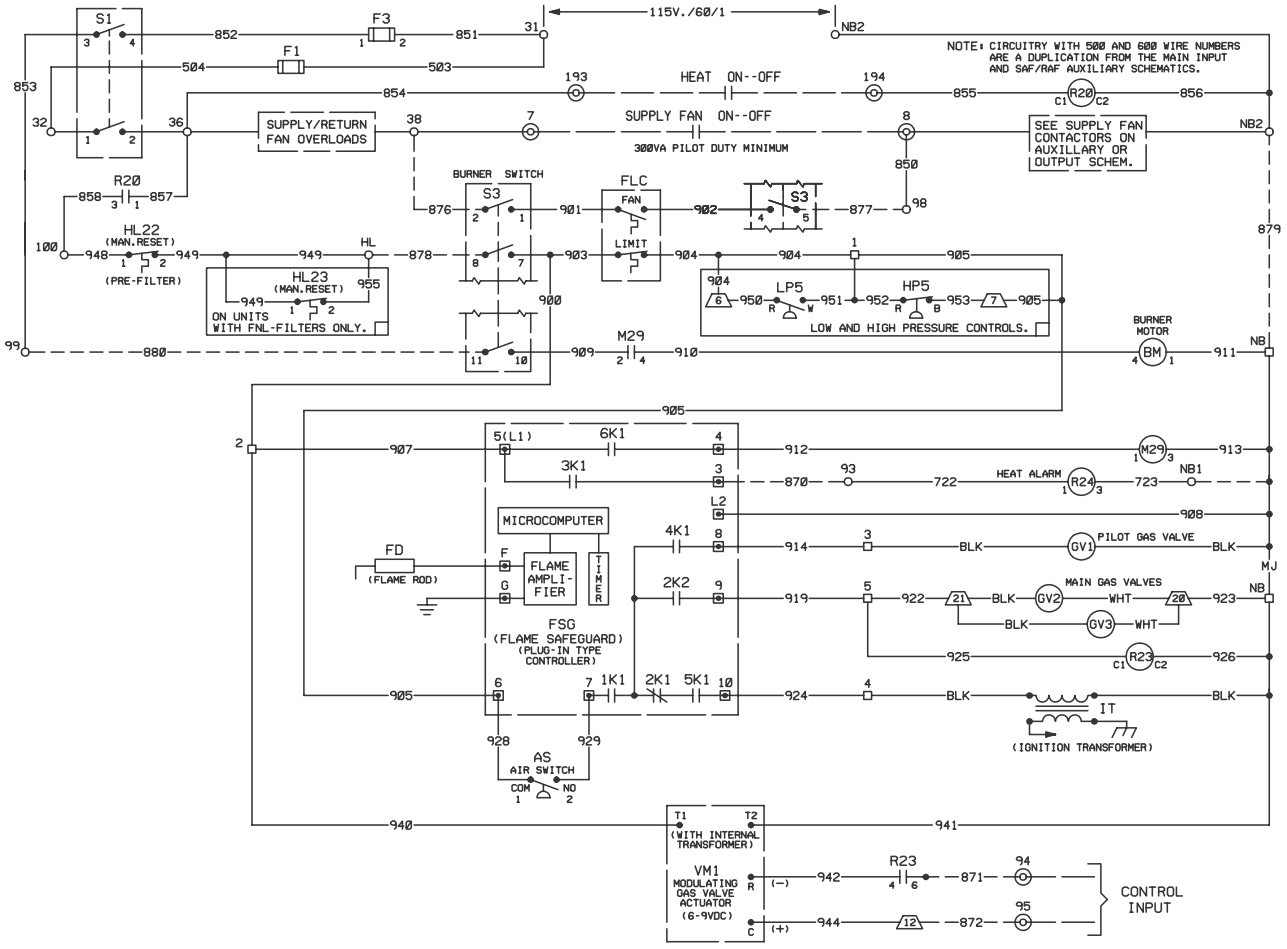
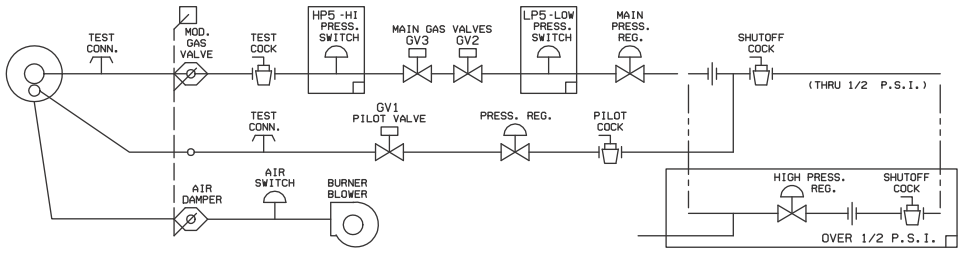


Figure 7. Piping Schematic



Service

General (see Figure 16)

The McQuay gas burner has a pre-mix pilot burner. The pilot pressure gauge tap (2) is a capped 1/4" flare male connection which can be connected to a manometer to measure both pilot air and gas pressures. Thus, these adjustments can be accurately made and checked with instruments. This manometer connection is also useful in troubleshooting the pilot. Failure of the pilot pressure regulator, pilot gas valves, and plugged or improper gas or air openings are easily diagnosed with the manometer.

Pilot Air & Gas Adjustments (see Figure 16, Items 1 & 2)

A manometer connected to the pilot pressure gauge tap (2) will indicate pilot air pressure when the pilot gas valve is closed, as during the prepurge period, and will indicate gas pressure on the pilot orifice when the pilot gas valve is open. Thus both readings are taken from this one test connection.

1. Connect manometer to pilot tap (2).
2. While the burner fan is running, the pilot gas valve is closed, and the modulating burner has its air damper at the low fire position; read the pilot air pressure. Typical readings are shown in column 5 on Table 7.
3. At the completion of the prepurge period, the pilot valve will open and the manometer will then read pilot gas pressure. Typical readings are shown in column 7 on Table 7.
4. Pilot flame signal readings should be 2.5 to 4.0 volts DC and steady at the low fire position when only the pilot is operating. When the main burner flame is also burning the readings will be higher.
5. A single stage burner that does not have low fire start, and always operates at “high fire” should have pilot flame signal readings of 2.0 to 3.2 volts DC and steady when only the pilot is operating. When the main burner flame is also burning the readings will change.
6. The pilot gas and pilot air pressure readings shown in Table 7 are typical. The pilot gas and pilot air pressure should be adjusted for optimum flame signal, not necessarily with the values shown in Table 7.
7. Vary the pilot gas pressure regulator and find the midpoint of the peak gas pressure that produces the highest pilot flame signal voltage. The voltage should decrease as the pressure is either decreased or increased beyond that peak. If peak midpoint voltage was obtained at gas pressures below 3.0 inches W.C., this would indicate more pilot air is required and there is a problem with the pilot air pickup tube. The pickup may be out of adjustment, kinked, or damaged so it is not providing adequate air to the pilot.
8. If the pilot flame signal voltage is within the range specified above, use that peak midpoint setting as the pilot gas pressure setpoint.
9. Determine that the pilot will hold in satisfactorily at BOTH high and low fire on modulating burners. Test this by observing the flame signal as the burner repositions from low fire to high fire.
10. The flame safeguard has a 10-second trial for ignition period. A properly operating pilot will light and prove itself to the flame safeguard within one second. If it takes longer than one or two seconds to prove pilot flame, the pilot is probably too lean and a higher pilot gas pressure regulator adjustment is required.

Pressure Regulator

Approximate pilot gas pressure adjustments can be made even when a manometer is not available. Snug the regulator adjusting screw to the bottomed out position and back out 2-1/2 turns for 4.0" W.C., three turns for 3.7" W.C., 3-1/2 turns for 3.2" W.C., or 4 turns for 2.9" W.C.

Pilot Orifice (see Figure 16, Item 9)

The pilot orifice is threaded into the pilot test tee (8) which must be removed to get access to the pilot orifice, for orifice drill size, see Table 7.

Ignition Electrode Adjustments (see Figure 8a)

Adjust the ignition electrode per Figure 8a. The purpose of the porcelain bushing is to provide an air seal that prevents air from blowing into the pilot burner through the ignition electrode hole. Because the bushing provides an air seal, it must be in close contact with the countersunk surface on the pilot burner, and gently held in place by the spring. The bushing should be perpendicular to the hole.

- The electrode tip should be centered within the .25 inch hole and be flush with the inside surface of the pilot burner or project up to .03 inches into the burner. The ignition spark occurs between the electrode tip and the edge of that .25 inch hole, to the point on that hole that is closest to the electrode. If the electrode is not centered, that closest point results in a shorter spark gap and consequently less of a spark to ignite the pilot. The spring will allow the bushing to be slid back from the hole to get a better view to check the electrode tip centering.
- Good alignment and fit may require slight repositioning of the electrode within the clamp and/or bending the clamp by gripping the electrode clamp with a pliers.
- Both ends of the bushing are the same. If the end that mates with the pilot burner gets damaged or if there is an imperfection in one end, the bushing can be reversed.

Flame Rod Adjustment (see Figure 8b)

Adjust the flame rod per Figure 8b. Make sure the flame rod shaft is not shorted against gun discs or pilot burner.

Pilot Location Adjustment (see Figure 9)

The location of the pilot burner relative to the opening through the gun discs can be adjusted by bending the pilot brackets. Improper adjustments can result in rough light off. The flame rod must also be adjusted so it does not short against the gun discs.

Figure 8a. Ignition Electrode

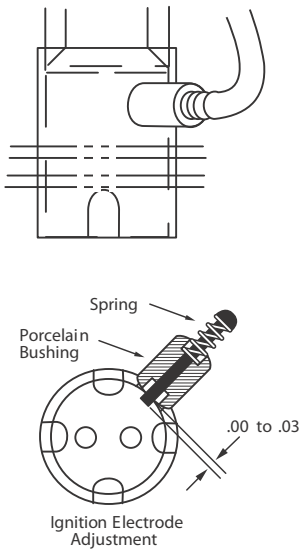


Figure 8b. Flame Rod

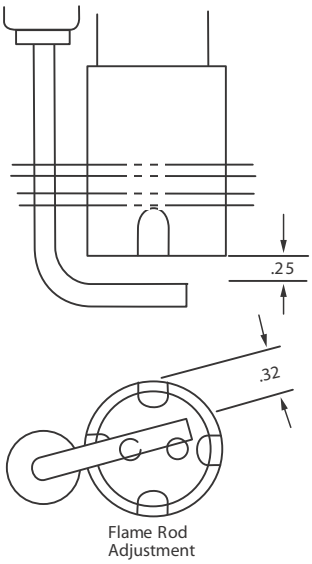
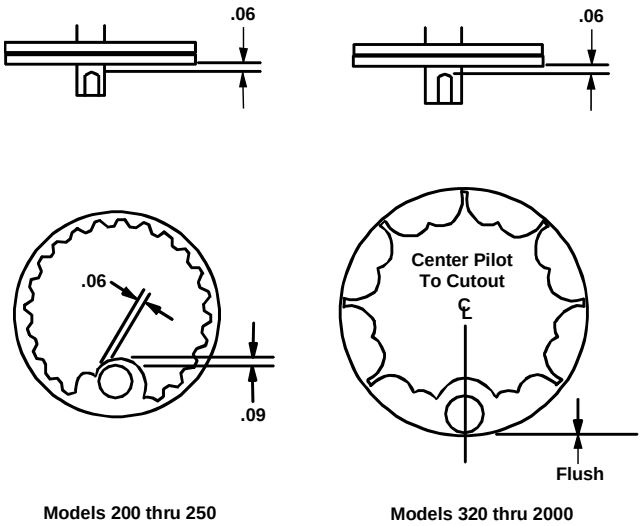


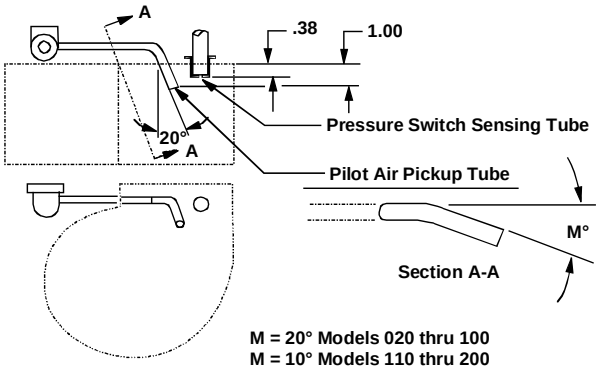
Figure 9. Pilot Location



Air Pickup Tube Adjustment (see Figure 10)

The proper location for the tube is indicated in Figure 10. When changes in the pilot air pressure are required, the pilot air pickup tube can be repositioned. Tipping the tube further into the airstream (increasing angle M°) will increase the pilot air. Bending it more perpendicular to the airstream (decreasing angle M°) will decrease the pilot air. If the tube is kinked or flattened, pilot air is reduced. This can lead to unstable pilot operation and nuisance tripping of the flame safeguard. Once kinked, the tube will probably have to be replaced.

Figure 10. Air Pickup Tube

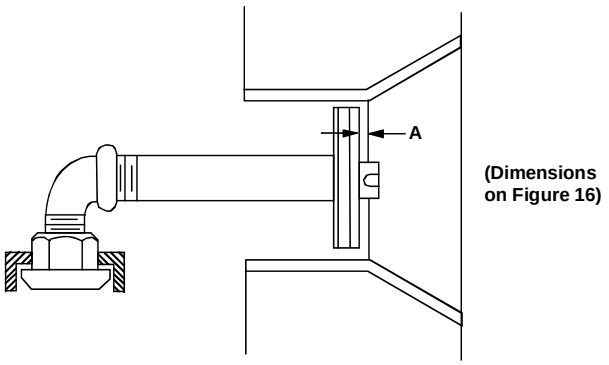


Gun Assemblies

The McQuay gas burner has an easily removable gun assembly which includes the complete pilot burner assembly and the main flame burner head. The position of this assembly within the burner blast tube determines the shape of the flame. This is adjusted at the factory and normally does not require readjustment in the field.

The burner discs must be perpendicular to the blast tube to have a symmetrical flame. The discs must not be positioned forward into the conical portion of the blast tube. Moving the discs toward this conical portion of the blast tube spreads the flame. Move the discs farther back into the cylindrical portion of the tube lengthens and narrows the flame.

Figure 11. Gas Burner



In general, if the discs are located too far back in the blast tube, uneven heat distribution will result. The back of the exchanger will get too hot and the front will remain cool. Rough light off of the main flame can also result. If the discs are located too far forward, the widened, shortened flame will cause the front of the exchanger to get too hot, and the back will remain cool. Poor combustion can also result, as will be indicated by a CO test.

The gun assembly can be adjusted forward and backward by first loosening the three bolts on the bracket where the gas pipe enters the burner box. Other adjustments are made by tightening the pipe fittings in the gun assembly.

Modulating Linkage Adjustment

All burners are factory adjusted and test fired prior to shipment and therefore at most should require only minor adjustments. **The dimensions given for linkage adjustments, etc., are intended to serve as a guide when replacing components. It is not intended that on start-up the service technician will go through the burner and readjust deviations to these dimensions.**

Procedure (see Figure 16):

1. Adjust firing rate positioner crankarm. Side of swivel to edge of slot equals B.
2. Adjust "positioner to valve" pushrod to dimension C, clamp to clamp.
3. Adjust "valve to air damper" pushrod to dimension D.
4. Adjust air damper arm length to dimension E.
5. With the firing rate positioner at its minimum fire position, tighten the air damper arm to arm damper shaft while the damper blade is positioned to opening F.
6. Adjust the air damper side fills for minimum gap along the side of the air damper blade. Do not adjust so tight that the blade binds or scrapes.
7. Adjust slide damper to dimension H.
8. If all these adjustments have been made to these specification, the air damper end opening should be F at the minimum fire position and G at the high fire position.
9. Finally, fine tune these adjustments with instruments. Connect a manometer to the tap on the manifold to measure gas pressure at the orifice. When the modulating operator is positioned to the minimum fire position and the burner is operating, readjust C to obtain the specified minimum fire gas pressure on the orifice. Typical: .44 in. W.C. natural gas. Readjust D to obtain an even, quiet flame and the specified CO_2 and CO.
10. Reposition modulating operator to high fire position and adjust the pressure regulator to specified manifold pressure.

Altitude Considerations

For altitudes of 2000 feet and higher, the gas burner must be derated 4% for every 1000 feet of altitude.

Example: An 800 MBh output furnace at an altitude of 3000 feet is derated (0.04 x 3 = 0.12). At 1000 MBh input (1000 x 0.12 = 120 MBh), the actual input is (1000 - 120 = 880 MBh) at 3000 feet.

The method of derating the burner is to reduce the manifold pressure for the pilot and main burner. First, refer to Table 7. Multiply the 100% Gas Manifold Orifice Pressure shown under Column 10, and then the Pilot Gas Pressure shown under Column 7, by the following altitude factors:

2000 feet = 0.845	5000 feet = 0.640
3000 feet = 0.774	6000 feet = 0.578
4000 feet = 0.706	7000 feet = 0.518

Combustion Testing

Proper start-up and maintenance requires periodic combustion tests and the systematic recording of those test results for future reference. Before making combustion air adjustments, check for proper input rate.

Verify Input Rate

To determine the input rate it is necessary to know the BTU per cubic foot of gas being used. If this is not known, contact the gas supplier. Check input rate by timing the gas meter dial with all other appliances and their pilot lights off. If 1000 BTU/cu. ft. gas is being used the input can be verified using Table 7, the measured manifold pressure, and checking the orifice drill diameter.

To verify the input rate using the gas meter, use a stopwatch and time one revolution of the dial. Calculate the input with the following formula:

$$\text{MBh Input} = \frac{A \times B \times 3.6}{C}$$

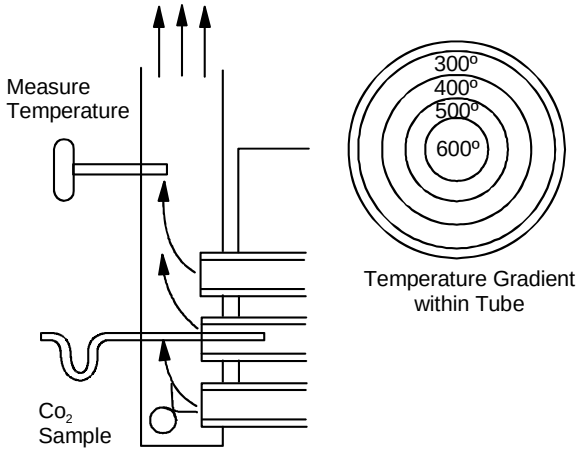
Where: A = BTU/cu. ft. of gas
Typical: Natural gas= 1000, LP gas=2500
B = Cu. ft. per revolution of meter dial
C = Seconds required for 1 revolution of meter dial

Check CO_2, CO & Stack Temperature

Flue gas samples are to be taken from inside one of the secondary tubes. If the sample is taken from the flue box rather than the tube, the sample will be diluted with outside air and lower readings will result. If flue gas temperature is to be measured, this must be done in the flue box, not in the tube. The temperature gradient within the tubes will cause high readings near the center of the tube and low readings near the edge. Measure temperatures within the flue box where a good mix will be present. The flue box includes two 5/16" holes for test purposes. One hole lines up with the end of a secondary tube for taking flue gas samples. The other hole, through the side of the flue box, is for thermometer insertion.

If the CO_2 and/or CO readings are not within the range indicated, see Troubleshooting Chart on page 19 and refer to Sections 4.1 and 4.2.

Figure 12. Checking Temperature



Typical Readings:

CO_2 9½ to 10½ percent at maximum rate
9 to 10 percent at minimum rate

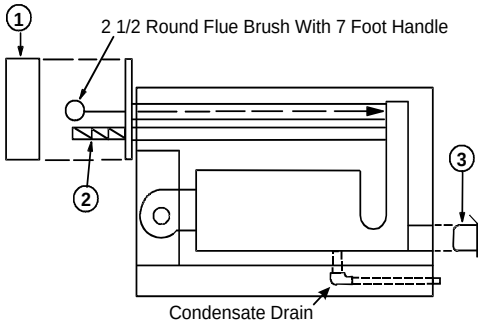
CO .001 percent (10 PPM) or less

Cleaning Heat Exchangers

Models 032 thru 200 (see Figure 13)

1. Remove the flue box front wrap (1) and the rear inspection cover (3).
2. Remove and clean the turbulator (2) from each tube and clean the flue box.
3. Clean each tube with a 2-1/2" round flue brush.
4. Remove the bushings, and if required, clean the combustion chamber and header through the rear inspection door port.
5. Reinstall the inspection cover (3). Snug the screws but do not overtighten and crush the insulation.
6. Reinstall a turbulator in each tube approximately flush with the tube ends, locking them in place with the wedge clip on each turbulator.
7. Reinstall the flue box front wrap (1).

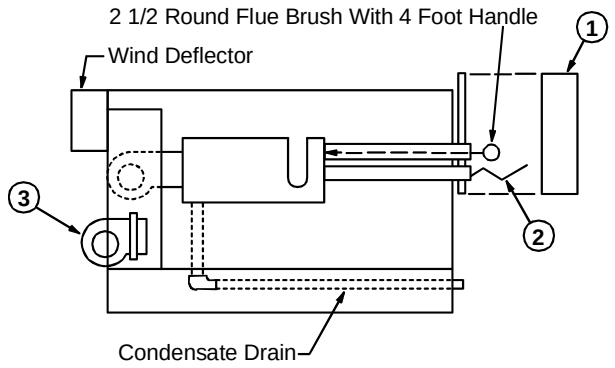
Figure 13. Models 032 thru 200 Heat Exchanger



Models 020 thru 025 (see Figure 14)

1. To gain access to the inside of the combustion chamber, detach the burner from the furnace and set it on the floor of the vestibule (see Figure 14, Item (3)). The burner is attached to the furnace studs with four nuts. Conduit lengths allows this movement of the burner without disconnecting wiring. The union on the gas line must be opened.
2. Remove the flue box front wrap (1).
3. Remove and clean the turbulator (2) from each tube and clean the flue box.
4. Clean each tube with a 2-1/2" round flue brush.
5. Remove the bushings and if required clean the combustion chamber and header through the burner mounting tube.
6. Reinstall the burner and reinstall a turbulator in each tube approximately flush with the tube end, locking them in place with the wedge clips on each turbulator.

Figure 14. Models 020 thru 025 Heat Exchanger



Leakage Symptoms

1. **Odor -** Odors in the building are usually brought in through the outdoor air intakes and do not indicate leakage from the furnace. Check for down draft conditions and check for location of the flue exhausts of other equipment that may be pulled into the outdoor air intake. A major and obvious furnace rupture can be a source of odor. In general, small leaks in a furnace will not be a source of odor because the pressure created by the supply fan is greater than the pressure inside the furnace. Therefore, when the supply fan is operating, leakage will be **into** the furnace, not **out of** the furnace and into the air stream. If the control system is such that the furnace comes on and warms up the heat exchanger before the supply air fan comes on, and there is odor when the supply fan first comes on, this could be caused by leakage. During the time the furnace is on and the supply fan is off, the leakage would be out off the furnace. Then, when the supply fan came on, it would blow those products of combustion into the supply duct.
2. **Low CO_2 Readings -** Low CO_2 readings that cannot be corrected can be caused by air leaking into the heat exchanger and diluting the flue gas. If this is suspected, take two consecutive CO_2 readings, one with the supply fan running and one with the supply fan off. If the CO_2 increases with the supply fan off, it could indicate leakage. Note that CO_2 samples must be taken from inside a tube, not just from inside the flue box.

Checking For Leaks

1. Open up the rear casing panel while the unit is shut off and visually inspect the heat exchanger.
2. Visually inspect the heat exchanger while the burner is operating, looking for light coming through holes. The burner must be operated for only a few minutes with the supply fan off. The heat exchanger can become hot enough to cause severe burns. take care not to touch it.
3. Perform consecutive CO_2 tests with supply fan off and on. See Item 2 under Leakage Symptoms on page 15.
4. **Smoke Bomb Test -** Cover the flue box openings, open the rear casing panel so the heat exchanger is accessible, toss a smoke bomb into the heat exchanger through the rear inspection port, replace the port cover, and with a bright light look for smoke leaking through the heat exchanger. Remove the remains of the smoke bomb and uncover the flue box openings before attempting to operate the furnace.

Causes of Failures

1. **Improper Application -** The furnace rating plate specifies a “Minimum Airflow CFM.” The furnace must not be operated when airflow is below this minimum cfm. If the furnace is being used on a variable air volume system, the control system must be such that the furnace will not operate when the supply fan cfm has fallen below this minimum specified cfm. The furnace rating plate also specifies a “Maximum MBh Input” which must not be exceeded. See “Verify Input Rate” on page 14.
2. **Control Failure -** The limit control does not function properly and shuts off the burner when the heat exchanger temperature becomes excessive. In most situations, a properly controlled unit will never require the limit control to shut off the unit. The limit control should be a backup control; a problem attributed to a limit failure generally indicates a control problem in addition to the limit failure.
3. **Excessive Condensation -** Applications which will produce condensation require an all stainless steel heat exchanger to be resistant to the effects of this condensation and to give longer heat exchanger life. The likelihood of condensation increases with:
    a. Colder supply air temperature across the secondary tubes, as on units taking in a lot of outdoor air in colder weather.
    b. Lower heat flow through the secondary tubes, as on modulating burners when operating at reduced input.
    c. High airflow across the secondary tubes such as any application with a low temperature rise furnace.
4. **Chemical Deterioration** - Refrigerant leaks, some aerosol can propellants, fumes from dry cleaning establishments, beauty shops, swimming pools, and others, often have detrimental effects on heat exchangers when they get into the combustion air supply and thereby into the combustion. Even fumes from nearby roof exhaust fans can cause problems.
5. **Inadequate or Distorted Airflow -** Internal baffles that have been repositioned or that have loosened up and moved can distort the airflow and cause failures. Construction rubbish, shipping cartons, and insulation that

has come loose can end up inside a unit and block airflow to part of the furnace, resulting in a failure. Or these items can alter the air or heat flow to the fan limit or some other control and contribute to a failure.

Replacing A Heat Exchanger

1. Remove the complete flue box, the casing panel through which the flue tubes pass, and the rear inspection cover. Open the hinged rear door.
2. The burner is mounted on and supported by the heat exchanger studs with four nuts. When removing the heat exchanger, the burner must either be removed or blocked in place. Remove the four burner mounting nuts and the two exchanger bolts located 2" above the upper burner mounting nuts.
3. When it is necessary to remove any air baffles surrounding the heat exchanger, carefully note the locations and clearances of these baffles before removing them so they can be replaced in the exact same position.
4. Remove the two bottom bolts at the back of the heat exchanger.
5. Withdraw the heat exchanger through the back of the casing.

Furnace Condensation

A furnace will produce condensation when the flue gas temperature falls below its dew point temperature. A more efficient furnace will transfer more of its heat into the building, and leave less heat in the flue gas. This results in a lower flue gas temperature and more condensate.

A modulating burner will produce more condensate than an on-off burner. As the firing rate of the burner is reduced, the flue gas temperature will be reduced, and more condensate will be produced.

A furnace that is heating a high percentage of outside air will also produce more condensate. The colder the air contacting the heat exchanger, the lower the resulting flue gas temperature, and consequently the more condensate.

Do not think a furnace has a problem because it produces condensate anymore than you would think a cooling coil has a problem because it produces condensate. However, suitable steps must be taken to manage the flow of the condensate produced.

Most condensate will be produced in the secondary tubes where flue gas will sweep it into the flue box. Condensate will also come from the combustion chamber. All models have a piped combustion chamber condensate drain, and Models 032 through 200 have a rear inspection cover that provides access to the drain line.

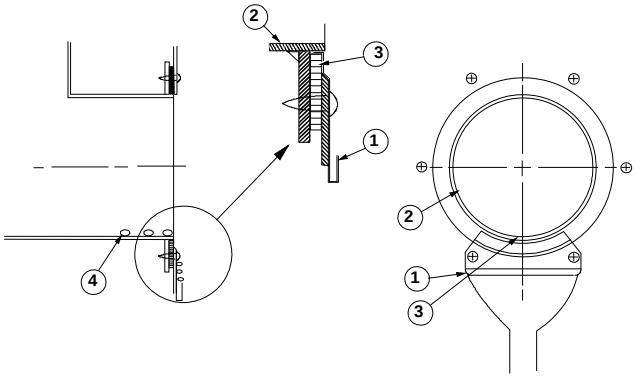
Condensate will also drip from the drains in the two outer corners of the flue box, and from the drip shield below the rear cleanout port. Condensate should not be running down the unit, except at times the wind may blow the dripping condensate mentioned above. The drip shield below the rear cleanout port must be correctly installed as shown in the following section.

Rear Inspection Cover

The rear inspection cover is equipped with a stainless steel drip shield to keep condensate away from the side of the unit if condensate drips out of the inspection cover (see Figure 15). The shield (1) must fit snugly against the bottom of the cleanout port tube (2) at (3) so condensate (4) cannot run back along the underside of the tube and into the unit or down the side of the rear panel.

Note: If an excessive amount of condensate is dripping out of the rear inspection cover, check the condensate drain for blockage and clean if necessary. Check the Rear Condensate Drain annually for blockage.

Figure 15. Inspection Cover



Combination Fan And Limit Control

The fan limit control is a hydraulic action type with a remote sensing element and connecting capillary tube. The sensing element is locked into a bracket located on one of the heat exchanger tubes about halfway toward the back of the furnace, on the side away from the blower. One corner of the bracket is bent aside to remove the element.

Normal setting of the FAN control: Fan On=125°F, Fan Off=100°F.

The LIMIT control must never be set higher than the temperature listed below. If the burner is shutting off on high limit at these settings, it indicates that there is a problem with the furnace not getting enough air or it is being overfired.

Table 4. LIMIT control set points

BURNER MODEL	LIMIT CONTROL SET POINT	BURNER MODEL	LIMIT CONTROL SET POINT
020	215	079	181
025	160	080	229
032	196	100	170
040	154	110	222
050	229	140	168
064	185	150	194
065	232	200	151

Maintenance

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

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

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

Monthly

1. Check air filters and main supply fan drives, replacing if required.
2. Check flame signal with a DC voltmeter.

Twice Yearly

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

Yearly

1. **Gas Train -** Check all valves, piping and connections for leakage. Remove burner gun assembly. Inspect and clean pilot burner, flame rod, ignition electrode, main burner discs, and blast tube. Check tightness of linkage fasteners and bolts that could work loose from vibration and movement.
2. **Combustion -** Check quality of combustion. Test CO_2 and CO and look for irregularities in fire shape. If combustion characteristics have changed since the last test, determine the cause. Changes in input changes in the BTU content of gas being supplied, reduced combustion air due to a dirty blower wheel, or flue passages in need of cleaning can cause changes in CO_2 reading. When a readjustment seems necessary, do not make the adjustment without first trying to determine if the required change is not an indication that something else is in need of correction.
3. **Flame Safeguard -** Perform a flame failure check and pilot turndown test. See control manufacturer's bulletin for further information.
4. **Motor -** Motor life can be increased by proper oiling. There are provisions in both end shields for relubrication. Re-oil each bearing with 150 drops (approximately 1 teaspoon) SAE-20 oil.
5. If the burner is to be out of service for the summer, turn off the burner control switch and close the manual gas cocks.
6. Inspect the Rear Condensate Drain for blockage.

Flame Safeguard

See manufacturer's bulletin for more detailed information or for information on flame safeguard other than the RM7897A.

The Honeywell RM7897A is a microprocessor based integrated burner control that will do self-diagnostics, troubleshooting, and status indication, as well as the burner sequencing and flame supervision.

Keyboard Display Module

The Honeywell S7800A1001 module is an optional device available for use with the RM7897A. It can be a permanent accessory added to the RM7897A or it can be carried by the service technician as a tool that is very easy to mount when servicing the RM7897A. It mounts directly onto the RM7897A and has a 2 row by 20 column display. The module will indicate flame signal dc volts, sequence status, sequence time, hold status, lockout/alarm status, total hours of operation, total cycles of operation, and can provide 127 different diagnostic messages for troubleshooting the system.

The module will give a fault history. It can be mounted to the RM7897A and will retrieve information on the six most recent faults.

Consult the Honeywell bulletin 65-0090-1 “7800 Series, Keyboard Display Module” and 65-0118-1 “7800 Series, System Annunciation, Diagnostics and Troubleshooting.”

Operation

Initiate Period: When the relay module is powered it goes through a 10 second “Initiate” period. It will also enter into the “Initiate” period if electrical power problems such as low voltage or momentary interruption occur while the unit is operating. Operation of the burner fan motor is delayed throughout the “Initiate” period.

Standby: After the initiate period is completed, the module will enter the standby mode and await a call for heat by the temperature control system.

Normal Start-Up

Prepurge: Upon a call for heat the prepurge period will begin. If the air switch does not detect fan operation within 10 seconds into the prepurge, a recycle to the beginning of the prepurge will occur.

Ignition Trial: The pilot gas valve and the ignition transformer are powered for 10 seconds following the prepurge. Pilot flame must be proven at the end of that 10 second period or a shutdown will occur.

Run: If Pilot flame is proven at the end of the 10 second ignition trial. the main gas valve will be powered. If a flameout occurs, the module will recycle within 3 seconds, and initiate a new prepurge period. If pilot flame continues to be detected, the module will be in Run until the power is interrupted to terminal 6, indicating that the temperature control system no longer requires heat, or that the high limit or another control has opened.

LED Display

There are five labeled LED's located on the front of the RM7897A which are energized to indicate operation as follows:

POWER The RM7897A is powered

PILOT The prepurge period is complete and the terminal for the pilot gas valve is powered.

FLAME Pilot flame is detected.

MAIN The ignition trial period is complete, flame is detected, and the terminal for the main gas valve is powered.

ALARM The RM7897A is on equipment protection lockout.

Troubleshooting Chart

The RM7897A flame safeguard is equipped with an LED to aid in the diagnosis of burner operation and problems. Fault identification is a series of fast- and slow-blinking LED lights. The fast blinks identify the tens portion of the fault code (two fast blinks is 20), while the slow blinks identify the units portion of the fault code (two slow blinks is 2). Two fast blinks followed by two slow blinks would be fault code 22. This identifies a flame signal absent at the end of the pilot flame establishing period. (See Table 6 for Blinking Fault Code List.) The LED code repeats as long as the fault exists. To clear the fault, press the RESET button.

In addition, a Keyboard Display Module is available and is a valuable aid for indicating flame signal DC volts, fault messages, sequence status, etc. Refer to Flame Safeguard on page 17 for additional information on the Keyboard Display Module.

Some of the steps listed in this troubleshooting chart will be unnecessary if a Keyboard Display Module is used, as that module will pinpoint many problems.

Voltage checks can be accomplished without removing the Flame Safeguard by removing the Electrical Access Slot Covers on the side of the sub-base and then using those electrical access slots.

Table 5. Troubleshooting chart

BURNER MOTOR DOES NOT RUN (AFTER 10 SECOND "INITIATE" PERIOD AND WITH SWITCH AT AUTO):	
1.1 Power LED is off.	Power is not getting to burner.
1.2 Entire unit seems to be off.	Burner power comes from the main control panel which has a main disconnect switch, a stepdown transformer with primary winding fuses, a 120V secondary winding fuse, and an on-off service switch. If any of these were open, the burner as well as the supply fan would be inoperative. The control system also has firestat type temperature sensors which will shut down the entire unit if supply or return air temperatures exceed set points. On some control systems, the firestats only lock out the supply and return fans. Check main control schematic, as these would not be burner problems.
1.3 Supply fan will operate.	a. Check the manual reset limit control located between the filters and the supply fan and reset if required. b. Check that the control system has energized relay R20 located in the main control panel.
1.4 Power LED is on.	Push the reset button on the flame safeguard.
1.5 Resetting flame safeguard does not start motor after the 10 second "Initiate" period is completed.	a. Check Table 6. The LED code may diagnose the problem. b. Push the reset button on the burner motor. (**Note:** If motor is hot and probably tripped, it has to cool sufficiently before it can be reset.) c. Remove the left side electrical access cover on the flame safeguard sub-base and test for line voltage at terminal 4 and L2. If powered, the problem is with the burner motor or its associated controls. On Models 1100-2000, terminal 4 only controls a contactor and burner motor power comes from its own circuit breaker. If terminal 4 is dead, check for power to terminals 6 and L2. d. IF VOLTAGE IS ZERO: The power is being interrupted by the limit control, the manual reset high or auto reset low gas pressure switches (if included), the low fire end switch on the modulating operator (if included), or relay contact in the main control system. Consult the schematic and determine the interruption. e. If voltage is satisfactory at terminals 6 and L2 and terminal 4 does not become energized after 10 seconds, and pressing the safety reset button has no effect, replace the RM7897A.
BURNER MOTOR RUNS, BUT...	
2.1 Burner motor runs continuously, but burner does not start (pilot LED) does not come on after 30 (60 or 90) seconds.	a. Check Table 6. The LED code may diagnose the problem. b. The air switch sensing tube is not in the blower housing and sensing pressure. c. The air switch or its wiring is defective. 120 volts should appear between terminals 7 and L2 if airflow switch contacts are made.
2.2 Burner motor starts when the reset button on RM7897A is pressed. The motor runs for 40 (70, 100) seconds and then the burner shuts down and requires manual resetting.	a. Check Table 6. The LED code may diagnose the problem. b. If the PILOT LED did not come on for the 10 seconds before shutdown check for voltage between terminal 10 and L2 during the final 10 seconds before control locks out. If zero voltage, replace the RM7897A. c. If the PILOT LED did come on for 10 seconds before shutdown the pilot flame is not igniting or is not being detected by the flame safeguard. Check that the manual gas valves are open. d. Check the flame safeguard with a flame simulator. 1. Close the main gas test cock. 2. Plug the flame simulator into the flame safeguard. 3. When the pilot indicator light comes on, touch the simulator G post to ground. If the FLAME LED now comes on the flame safeguard is working, but it is not receiving an adequate flame signal. If the FLAME LED did not come on replace the R7847A amplifier or/and the RM7897A.
2.3 During the 10 second period before shutdown there is:	a. Check Table 6. The LED code may diagnose the problem. b. Close the main gas cock (pilot gas cock open) and observe the pilot through the inspection window as it goes through a sequence.
2.3.1 No spark or flame.	a. Close the main gas cock (pilot gas cock open) and observe the pilot through the inspection window as it goes through a sequence. b. Remove the burner gun assembly and check for shorted ignition electrode, open ignition lead, defective ignition transformer, or loose terminal screw on flame safeguard subbase. Check for voltage between terminal 10 and L2 during the final 10 seconds before the control locks out. If zero voltage, replace the RM7897A.
2.3.2 Spark but no flame.	a. Close the main gas cock (pilot gas cock open) and observe the pilot through the inspection window as it goes through a sequence. b. Improper pilot and gas adjustments. Connect a manometer to the pilot test tee and adjust per "Pilot Air and Gas Adjustments" section. If the specified settings cannot be attained, a problem is indicated.

2.4 Improper pilot air readings.	a. The pilot air pickup tube is not inserted into the blower housing, is broken, cracked, kinked, or improperly positioned. b. Plugged air tube. c. Tubing to the pilot burner is not connected, is loose or cracked. d. Plugged pilot gas orifice.
2.5 Proper pilot air and gas readings, spark but no pilot flame.	a. Porcelain sleeve around ignition electrode is not adequately reducing airflow through this opening. See “Ignition Electrode Adjustment” section. b. Air in gas lines as a result of inadequate bleeding or recent service work or construction. c. Readjustment of pilot air and gas is required. Refer to “Pilot Air and Gas Adjustment” section.
2.6 Pilot flame comes on, but flame safeguard still locks out.	a. The flame safeguard is not detecting pilot flame. Check flame safeguard using Table 6. If this confirms flame safeguard is working, and the pilot is coming on during the 10 second ignition trial period, then the pilot is not producing an adequate flame signal. Check pilot and its adjustments as listed above in 2.6-b, c and d. b. Disconnected, shorted or open flame rod lead.
MOTOR RUNS, PILOT IGNITES...	
3.1 Burner motor starts. After 30 (60 or 90) seconds the PILOT LED comes on, the FLAME LED comes on momentarily and then goes out.	a. Check Table 6. The LED code may diagnose the problem. b. The power is only momentarily proving itself to the flame safeguard. It must be proven at the end of the of the 10 second ignition trial. c. On a new start-up, this could indicate the gas lines have not been sufficiently purged of air. d. Improper flame rod position. e. Improper pilot air or gas adjustments. f. Air leakage into the pilot burner at the porcelain bushing or through cracks in pilot burner. g. Defective or improperly installed pressure regulator upstream of pilot gas cock that passes enough gas for pilot, but when main valve opens, gas pressure drops drastically.
3.2 Pilot operates, the flame safeguard does not lock out. but the main flame does not come on.	a. Check Table 6. The LED code may diagnose the problem. b. Check that the main manual gas cocks are open. c. If the Main LED does not come on, check the voltage at terminals 9 to L2. If no voltage across 9 to L2, replace the RM7897A. d. Check for defective or improperly installed pressure regulators and determine that their vents are not plugged. e. Check for defective or improperly installed main gas valves, or open wires to the valve. f. On diaphragm type gas valves, check for plugged or misadjusted bleed orifice or bleed line.
BURNER OPERATES; HOWEVER...	
4.1 Main flame light off is rough.	a. The furnace is being fired above its rated capacity. See “Verify Input Rate.” b. Heat exchanger needs cleaning. Increased pressure drop through heat exchanger reduces airflow through burner and affects combustion. c. At light off, the gas valve is opening too fast. On diaphragm type valves check the bleed orifice adjustment. Some models use a bleed orifice on the pressure regulator to smooth its opening. When replacing regulators, the bleed orifice must be reinstalled on the new regulator. d. The burner is improperly adjusted. Check gas pressure and orifice size or time a gas meter to verify firing rate; check the CO_2 to verify the combustion air adjustment. e. Check the adjustment of the burner gun assembly. Particularly check the pilot position within the gun on Models 200 and 250. f. Inspect the gun assembly and blast table for warpage or deterioration.
4.2 Flame is not symmetrical as observed through rear	a. Unproportionally high airflow. Check CO_2. b. The gun discs are not perpendicular to the blast tube, or the discs are warped or otherwise out of alignment.
4.3 Nuisance tripping of the flame safeguard.	a. Check Table 6. The LED code may diagnose the problem. b. Check gas pressure situation. Marginal pressure during normal times can become low pressure during time of demand and lead to trip-outs, etc. Pressures higher than that for which the gas train is designed can also cause problems. Line pressure should not exceed 13.9' W.C. (1/2 psi) into the standard gas train. Pressures higher than this require an additional stepdown regulator to maintain the pressure below 13.9' W.C. even at “no flow” conditions. A regulator that does not shut off tight at “no flow” will allow a small amount of gas to leak past and eventually the high pressure will build up on the downstream side, thus exceeding the rating of the gas train components. c. Undersized piping can also cause problems by delivering reducing pressure during times of maximum demand. d. On modulating burners check the pilot ignition and flame signal when operating at both high fire and low fire. e. Check that the pilot ignition electrode porcelain bushing is blocking air passage into hole in pilot assembly. Check the pilot burner for cracks that could allow air leakage into the pilot burner. On modulating burners, this leakage changes as the burner air damper changes air pressure, and perhaps the pilot will produce a strong microamp signal at low fire but not at high, etc. f. Observe the flame signal DC volts when turning on the burner switch Any movement of meter needle before the ignition cycle could indicate a short to ground. This could be an intermittent situation from moisture conditions. With pilot gas cock closed, any movement during the ignition attempt indicates ignition interference. g. Check for loose or cracked pilot gas tubes, air tubes, and fittings that could vary leakage from time to time as vibration might move them around. h. Check supply voltage and if suspicion warrants arrange to have a recording voltmeter connected to the burner for a period of time. i. Marginal flame signal. Adjust pilot air and gas and flame rod position. j. If the pilot air pickup tube is kinked or flattened from bending, pilot air is reduced. When this happens, the pilot is unstable and nuisance tripping results. Replace the pilot air pickup tube.

4.4 Modulating burners: Pilot lights, main flame comes on at low fire, but as actuator attempts to reposition for an increased firing rate the flame goes out. Then the sequence is repeated.	a. Check the burner fan air proving switch and tube. As the burner air control damper opens further to provide more air for an increased firing rate, the static pressure inside the fan scroll is reduced. This is the pressure being sensed by the air proving switch, and if it falls below its set point the burner will drop out. The adjustment screw is located next to the wiring box cover. Turn screw CCW to reduce set point. b. Use a manometer to determine if the gas pressure at the orifice is dropping prior to the flame going out. If gas pressure is dropping, check for a plugged vent on a gas pressure regulator or something that restricts the gas flow in the line so only a low flat rate can occur.
4.5 At the instant spark comes on, the flame safeguard drops out and restarts the pre-purge cycle.	a. Check Table 6. The LED code may diagnose the problem. b. Ignition interference. Flame rod or its wire is sensing voltage from ignition. Also determine that ignition electrode spark gap is within specifications.
4.6 When the flame safeguard is powered it locks out and the ALARM LED comes on.	a. Check Table 6. The LED code may diagnose the problem. b. Purge card missing or bad, terminals are energized that should not be at that stage, or there is an internal system fault. Replace purge card or RM7897A as indicated.

Table 6. Fault codes

BLINKING FAULT CODES...		
Fault Code	**System Failure**	
Code 1-1 *Low AC Line Voltage*	Low AC Line detected.	a. Check the relay module and display module connections. b. Reset and sequence the Relay Module. c. Check the 7800 power supply and make sure that frequency and voltage meet specifications. d. Check the backup power supply, as appropriate.
Code 1-2 *AC Quality Problem*	Excessive noise or device running on slow, fast, or AC line dropout detected.	
Code 2-1 *Unexpected Flame Signal*	Flame sensed when no flame is expected during STANDBY or PURGE.	a. Check that flame is not present in the combustion chamber; correct any errors. b. Make sure that the flame amplifier and flame detector are compatible. c. Check the wiring and correct any errors. d. Remove the flame amplifier and inspect its connections. Reseat the amplifier. e. Reset and sequence the relay module. f. If the code reappears, replace the flame amplifier and/or the flame detector. g. If the fault persists, replace the relay module.
Code 2-2 *Flame Signal Absent*	No-flame time present at the end of the PIlot Flame Establishing Period; lost during the Main Flame Establishing Period or during RUN.	a. Measure the flame signal. If one exists, verify that it meets specifications. b. Make sure that the flame amplifier and flame detector are compatible. c. Inspect the main fuel valve(s) and valve connection(s). d. Verify that the fuel pressure is sufficient to supply fuel to the combustion chamber. Inspect the connections to the fuel pressure switches. Make sure they are functioning properly. e. Inspect the Airflow Switch and make sure that it is functioning properly. f. Check the flame detector sighting position; reset and recycle. Measure the flame signal strength. Verify that it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions. g. Replace the flame amplifier and/or the flame detector, if necessary. h. If the fault persists, replace the relay module.
Code 2-3 *Flame Signal Overrange*	Flame signal value is too high to be valid.	a. Make sure the flame detector and flame amplifier are compatible. b. Remove the flame amplifier and inspect its connections. Reset the flame amplifier. c. Reset and sequence the relay module. d. Check the flame detector sighting position; reset and recycle. Measure flame strength. Verify that it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions. e. If the code reappears, replace the flame amplifier and/or the flame detector. f. If the fault persists, replace the relay module.
Code 3-1 *Running/ Interlock Switch Problem*	Running or Lockout Interlock fault during Prepurge.	a. Check wiring; correct any errors. b. Inspect the fan; make sure there is no air intake blockage and that it is supplying air. c. Make sure the Lockout Interlock switches are functioning properly and the contacts are free from contaminants. d. Reset and sequence the relay module to Prepurge (place the TEST/RUN Switch in the TEST position, if available). Measure the voltage between terminal 7 and G (ground); 120 Vac should be present. Switch TEST/RUN back to RUN. e. If steps 1 through 4 are correct and the fault persists, replace the relay module.

Code 3-2 *Running/ Interlock On During Standby*	Lockout Interlock powered at improper point in sequence or On in Standby.	a. Check wiring to make sure that the Lockout Interlocks are connected properly between terminals 6 and 7. Correct any errors. b. Reset and sequence the relay module. c. If the fault persists, measure the voltage between terminal 6 and G (ground), then between terminal 7 and G. If there is 120 Vac at terminal 6 when the controller is off, the controller switch may be bad or is jumpered. d. If steps 1 through 3 are correct and there is 120 Vac at terminal 7 when the controller is closed and the fault persists, check for a welded or jumpered Running Interlock or Airflow Switch. Correct any errors. e. If steps 1 through 4 are correct and the fault persists, replace the relay module.
Code 3-3 *VPS in Improper State*	VPS (Valve Proving Switch) in wrong state during VPS Test.	a. Check wiring, making sure upstream valve is connected to terminal 9 and downstream valve is connected to terminal 17. b. Conduct Valve Seat leakage test using a manometer. c. Reset and sequence the relay module; if fault repeats, test VPS (connected to terminal 16) is functioning properly; replace if necessary. d. Reset and sequence the relay module. e. If fault persists, replace the relay module.
Code 4-1 *Purge Card Problem*	No purge card or the purge card timing has changed from the original configuration.	a. Make sure the purge card is seated properly. b. Inspect the purge card and the connector on the relay module for any damage or contaminants. c. Reset and sequence the relay module. d. If the fault code reappears, replace the purge card. e. Reset and sequence the relay module. f. If the fault code persists, replace the relay module.
Code 4-2 *Wiring Problem/ Internal Fault*	Pilot (ignition) valve terminal, main valve, ignition or Main Valve 2 was on when it should be off.	**⚠ WARNING** **Electrical Shock Hazard; Fire or Explosion Hazard.** **Can cause severe injury, death or property damage.** Remove system power and turn off power supply. a. Remove system power and turn off fuel supply. b. Check wiring; correct any errors. c. inspect Pilot Fuel Valve(s), both places, and connections. d. Reset and sequence the relay module. e. If the fault persists, replace the relay module.
Code 4-3 *Flame Amplifier Problem*	Flame not sensed, sensed when it should be on or off.	a. Check wiring; correct any errors. b. Make sure the flame amplifier and flame detector are compatible. c. Remove the flame amplifier and inspect the connections. Reseat the amplifier. d. Reset and sequence the relay module. e. If the code reappears, replace the flame amplifier and/or the flame detector. f. If the fault persists, replace the relay module.
Code 4-4 *Configuration Jumper Problem*	The configuration jumpers differ from the sample taken at startup.	a. Inspect the jumper connections. Make sure the clipped jumpers were completely removed. b. Reset and sequence the relay module. c. If the fault persists, replace the relay module.
Code 5-1 *Preignition Interlock*	Preignition Interlock fault.	a. Check wiring and correct any errors. b. Check Preignition Interlock switches to assure proper functioning. c. Check fuel valve operation. d. Reset and sequence the relay module; monitor the Preignition Interlock status. e. If the fault persists, replace the relay module.
Code 5-2 *High Fire Sw. or Low Fire Sw.*	Either High Fire Switch or Low Fire Switch failure.	a. Check wiring and correct any errors. b. Reset and sequence the relay module. c. Use manual motor potentiometer to drive the motor open and closed. Verify at motor switch that the end switches are operating properly. Use RUN/TEST switch if manual potentiometer is not available. d. Reset and sequence the relay module. e. If the fault persists, replace the relay module.
Code 5-3 *Man-Open Sw.; Start Sw. or Control On*	Man-Open Switch, Start Switch or Control On in the wrong operational state.	a. Check wiring and correct any errors. b. Make sure that the Manual Open Valve Switch, Start Switch and Control are operating properly. c. Stat Switch held On too long. d. Reset and sequence the relay module. e. Reset and sequence the relay module. If the fault persists, replace the relay module (RM7838A1014; RM7838B1013 or RM7838C1004 only).

Code 6-1 *Internal Faults*	Relay Module self-test failure.	a. Reset and sequence the relay module. b. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module. c. If the fault persists, replace the relay module.
Code 6-2 *Internal Faults*	Relay Module Self-Test failure.	a. Reset and sequence the relay module. b. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module. c. If fault does not repeat on the next cycle, check for electrical noise being copied into the relay module through the external loads or possibly an electrical grounding issue. d. If the fault persists, replace the relay module.

Typical Parts List - 60 Hz

QTY.	MCQUAY PART NO.	VENDOR	VENDOR PART NO.	USED ON MODELS	DESCRIPTION
1	0342492-00	Emerson	4526	200—1000	Burner Fan: Motor 1/4 hp, 3450 rpm
1	0322486-00	Emerson	457	1100—1500	Motor 1/2 hp, 3450 rpm
1	0322484-00	Emerson	458	2000	Motor 3/4 hp, 3450 rpm
1	0348611-02	Beckett	22031-07	200—1000	Wheel, 6.25 x 3.438 (.500")
1	0342490-05	—	—	1100—1500	Wheel, 7.09x 3.16(.625")
1	0342490-04	—	—	2000	Wheel, 7.50 x 3.16 (.625")
1	0330038-00	Antunes	SMD4130	200—2000	Air Switch *
1	0344826-00	Allason	1092	200—2000	Ignition Transformer
1	0733008-03	HW	RM7897A1014	200—2000	Flame Safeguard (less amplifier & timer) *
1	0733009-01	HW	R7847A1033	200—2000	Amplifier Only (3 seconds)
—	0733010-01	HW	ST7800A1039	200—2000	Timer Only (30 seconds)
—	0733010-02	HW	ST7800A1062	200—2000	Timer Only (90 seconds)
1	0733007-01	HW	Q7800B1003	200—2000	Subbase for Flame Safeguard
1	0344884-00	HW	V4046C1005	400—2000	Pilot Gas — Solenoid Valve *
1	0340776-00	Max.	RV10	200—2000	Pressure Regulator
1	0340773-00	Con. BR	56-111-01	200—2000	Shutoff Cock, .125" I.P. x .25 Tube
1	0350196-00			200—2000	Pilot Burner Assembly Complete
—	0365577-00			200—2000	Flame Rod *
—	0300032-02			200—2000	Ignition Electrode Assembly
1	0347429-00			200—2000	Ignition Cable
1	0365185-00			1100—2000	Ignition Cable
1	0347430-00			200—2000	Flame Rod Wire
1	0365163-01			200— 000	Pilot Air Pickup Tube
1	0365163-02			1100—2000	Pilot Air Pickup Tube
1	0348799-01			200	Gun Assembly (less pilot)
1	0348799-02			250	Gun Assembly (less pilot)
1	0348799-03			320	Gun Assembly (less pilot)
1	0348799-04			400	Gun Assembly (less pilot)
1	0348800-01			500	Gun Assembly (less pilot)
1	0348800-02			640—650	Gun Assembly (less pilot)
1	0348800-03			790—800	Gun Assembly (less pilot)
1	0348800-04			1000	Gun Assembly (less pilot)
1	0357210-01			1100	Gun Assembly (less pilot)
1	0357210-02			1400	Gun Assembly (less pilot)
1	0357210-03			1500	Gun Assembly (less pilot)
1	0357210-04			2000	Gun Assembly (less pilot)
1	0373788-02			200—400	Blast Tube Assembly, 4.00 x 20º
1	0341017-03			500—650	Blast Tube Assembly, 5.00 x 20º
1	0341017-07			790—1000	Blast Tube Assembly, 5.00 x 27 1/2º
1	0341017-06			1100—1400	Blast Tube Assembly, 7.00 x 271/2º
1	0351647-01			1500—2000	Blast Tube Assembly, 7.00 x 27 1/2º
1	0341020-00			200—1000	Blast Tube Gasket, 4-5”
1	0341019-00			1100—2000	Blast Tube Gasket, 7"
1	0335367-00			200—2000	Switch Off-Auto, 4P2T
2	0594688-01	HW	B200T1025	200—320	Shutoff Cock, Main 0.75
2	0594688-02	HW	B200T1033	400—500	Shutoff Cock, Main 1.00
2	0594688-03	HW	B200T1041	640—1000	Shutoff Cock, Main 1.25
2	0594688-04	HW	B200T1058	1100—1500	Shutoff Cock, Main 1.50
2	0594688-05	HW	B200T1066	2000	Shutoff Cock, Main 2.00
1	0340782-00	Max.	RV52	200—320	Pressure Regulator, 0.75" *
1	0340781-00	Max.	RV53	400—500	Pressure Regulator, 1.00" *
1	0340778-01	Max.	RV61	640—800	Pressure Regulator, 1.25" *
1	0340778-04	Max.	RV61	1000	Pressure Regulator, 1.25” *
1	0340778-02	Max.	RV81	1100—1500	Pressure Regulator, 1.50" *
1	0340778-03	Max.	RV91	2000	Pressure Regulator, 2.00" *
1	0733365-02	HW	VR43044300	200—320	Combination Gas Control, 0.75 *
2	0733878-01	HW	V4843A1038	400—500	Main Gas Valve, 1.00 *
2	0733878-02	HW	V4843A1020	640—1000	Main Gas Valve, 1.25 *
2	0733878-03	HW	V4843A1012	1100—1500	Main Gas Valve, 1.50 *
2	0733878-04	HW	V4843A1004	2000	Main Gas Valve, 2.00 *
1	0344883-02	Maxon	63-18810	200—320	Modulating Gas Valve, 3/4
1	0344883-03	Maxon	63-18206	400—500	Modulating Gas Valve, 1
1	0344883-04	Maxon	63-18207	640—1500	Modulating Gas Valve, 1¼
1	0344883-05	Maxon	63-18208	2000	Modulating Gas Valve, 1½
1	0479361-10	HW	M6161A1004	200—2000	Floating Actuator
1	0665348-04	HW	M7161A1002	200—2000	Electronic Modulating Actuator
1	0665348-03	HW	M9161A1012	200—2000	Series 90 Modulating Actuator
1	0733371-0l	W/R	5A75-10	320—2000	Fan Limit Control
1	0733371-02	W/R	5A75-12	200—250	Fan Limit Control
1	0342505-00	SUP.	DC1209CN	200—2000	Ball Joints for Modulating Linkage
1	0234632-00	SUP.	CAS-500	200—2000	Crankarm for Modulating Motor
1	0342506-00	SUP.	CAL-375	200—2000	Crankarm for Air Damper

*See Controls, Settings and Functions on page 25

Controls, Settings and Functions

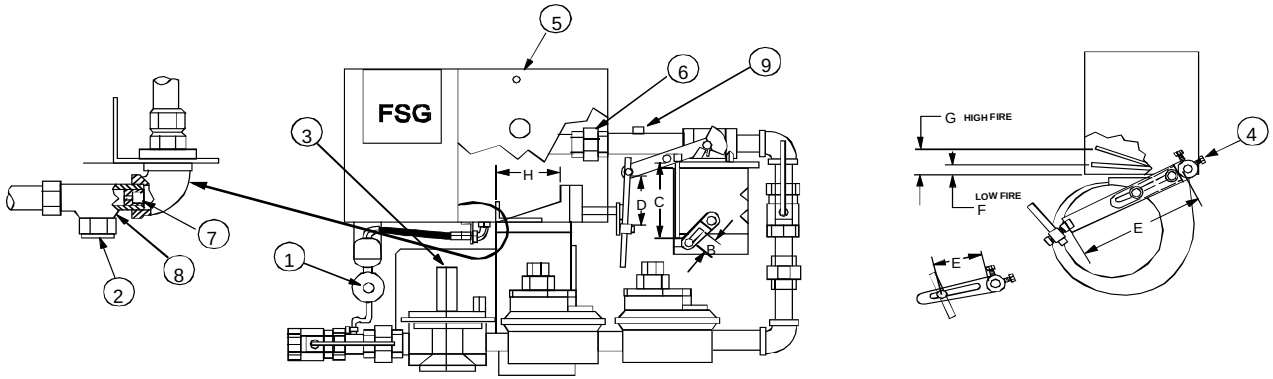
GAS HEATING CONTROLS								
SYMBOL	**DESCRIPTION**	**FUNCTION**	**RESET**	**LOCATION**	**SETTING**	**RANGE**	**DIFFERENTIAL**	**PART NO.**
AS	Blower air switch	Proves presence of combustion air.	N/A	Gas furnace control section	0.4" w.c., fixed	N/A	N/A	330038B-00
FD	Flame rod	Senses pilot flame.	N/A	Gas burner assembly	N/A	N/A	N/A	365577A-00
FSG	Flame safeguard	Proves pilot flame and controls main gas valve.	Manual	Gas furnace control section	N/A	N/A	N/A	0733008-01
GV1	Pilot gas valve	Opens to allow flow of gas to pilot burner.	Normally closed	Gas heating section	N/A	N/A	N/A	344884B-00
GV2, 3	Main gas valve	Open to allow flow of gas to main burner.	Normally closed	Gas heating section	N/A	N/A	N/A	Varies with size
HPR	High pressure regulator	Regulates pressure to main regulator.	N/A	In gas line before MPR	As specified	10"—13" w.c. (2491—3238 Pa)	N/A	Varies with size
HP5	High gas pressure switch (IRI option)	Shuts off burner if pressure goes above set point.	Manual	Gas heating section	8" w.c.(1993 Pa)	5"—35" w.c. (1245—8718 Pa)	1"—3" w.c. (249—747 Pa)	Varies with size
LP5	Low gas pressure switch (IRI option)	Shuts off burner if pressure goes above set point.	Auto	Gas heating section	4" w.c.(996 Pa)	3"—21" w.c. (747—5231 Pa)	1"—3" w.c. (249—747 Pa)	Varies with size

Table 7. Capacities and dimensions

(1)	(2)	(2A)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)								(17)	(18)
BURNER MODEL NO.	MAX. INPUT MBh OR CFH[2]	MIN.[4] INPUT MBh OR CFH[2]	MIN. CFM	MAX. TR °F	NATURAL GAS @ 1000 BTU/CU.FT.									MIN.[3] GAS INLET PRESS IN W.C.[1]	RUN-NING CUR-RENT AMPS	DIMENSIONS								GAS CONN. SIZE	
					PILOT			MAIN BURNER																STD.	HIGH PRESS. REG.
					*AIR PRES S.TYP. IN W.C.	OR F **	GAS PRESS ADJ. IN W.C.	***AIR BOX PRESS IN W.C.	STD ORF. DRILL INCH	GAS MANIFOLD ORIFICE PRESSURE (IN W.C.) FOR % OF MAX. INPUT						A	B	C	D	E	F	G	H		
										100%	90%	50%	33%												
020	250	83	2300	80	2.15	58	3.40	2.1	0.272	3.56	2.88	0.89	0.39	6.0	3.3	0.44	0.23	3.32	6.00	6.75	0.38	1.81	0.31	0.75	0.75
025	312	104	3800	61	2.05	58	3.45	2.4	0.302	3.37	2.73	0.84	0.38	6.0	3.4	0.38	0.32	3.50	6.00	6.06	0.47	2.12	0.50	0.75	0.75
032	400	133	2950	100	1.80	58	2.85	2.7	0.344	3.54	2.87	0.89	0.39	7.0	3.6	0.38	0.63	3.95	6.00	7.25	0.46	2.45	0.69	0.75	0.75
040	500	167	6000	61	1.85	58	3.30	2.9	0.422	3.75	3.04	0.94	0.45	7.0	3.6	0.25	0.80	4.12	6.25	7.25	0.52	2.40	0.88	1.00	1.00
050	625	208	4600	100	1.85	58	3.35	2.4	0.422	3.83	3.10	0.96	0.35	7.0	3.6	0.25	0.33	4.12	6.50	4.20	0.56	2.62	0.81	1.00	1.00
064	800	267	9600	61	1.90	58	3.30	3.2	0.500	3.87	3.14	0.97	0.42	7.0	3.9	0.25	0.55	4.23	6.00	4.25	0.42	2.85	2.25	1.25	1.25
065	812	271	5970	100	1.60	58	3.70	2.6	0.469	3.88	3.14	0.97	0.44	7.0	3.9	0.25	0.56	4.27	5.30	5.65	0.90	2.95	0.88	1.25	1.25
079	1000	333	12000	61	1.40	58	3.00	2.8	0.563	3.86	3.13	0.97	0.42	7.5	3.9	0.35	0.87	4.58	5.30	5.60	0.80	3.20	1.25	1.25	1.25
080	1000	333	7340	100	1.50	58	2.60	2.5	0.563	3.35	2.71	0.84	0.29	7.5	3.9	0.35	0.87	4.64	6.00	6.56	0.85	3.05	1.25	1.25	1.25
100	1250	417	15000	61	1.60	58	2.60	2.9	0.750	3.67	2.97	0.92	0.23	9.0	4.2	0.12	1.00	4.90	6.88	7.81	0.93	3.12	1.38	1.25	1.25
110	1375	495	10100	100	2.05	58	3.32	2.8	0.703	3.22	2.61	0.81	0.33	7.0	9.1	0.18	0.65	4.75	7.12	7.50	0.83	2.62	—	1.50	1.25
140	1750	583	21000	61	1.95	58	3.75	3.6	0.823	3.58	2.90	0.90	0.34	8.0	10.0	0.12	1.07	5.17	7.50	7.25	0.68	3.10	—	1.50	1.25
150	1875	788	13770	100	2.25	58	3.70	3.7	0.813	3.65	2.96	0.91	0.32	8.0	10.2	0.12	0.58	4.42	8.00	4.05	0.90	3.76	—	1.50	1.25
200	2500	833	30000	61	2.25	58	3.50	4.6	1.000	3.75	3.04	0.94	0.22	9.0	10.0	0.12	0.58	4.48	8.00	3.50	1.07	4.32	—	2.00	1.25****

*Reading is with air damper at low fire position on modulating burners, cold heat exchanger.
**Pilot gas orifice drill number size.
***Reading at high fire. Not applicable on Canadian burners.
****Except 3 psi and less = 1.50"

Figure 16. Linkage Adjustment



Valves, Dampers & Operators shown in Low Fire Position

Notes:
1. Pressure is for modulating burners with standard UL gas train. For On-Off burners, deduct 1.00".
2. GFH of natural gas @ 1000 BTU/cu. ft.
3. Gas inlet pressures over 0.50 PSI (13.9 in. W.C., 8 oz / sq. in.) require an additional high pressure regulator.
4. Minimum fire on modulating burner.
5. GSA burner = 6.00 inches

Key:
1. Pilot gas pressure adjustment
2. Pilot pressure gauge tap (1/4" flare male)
3. Main gas pressure adjustment
4. Burner air adjustment
5. Burner air pressure port
6. Main gas orifice (inside union)
7. Pilot gas orifice (inside test tee)
8. Pilot gas test tee
9. Main manifold pressure tap

Performance & Service History

Table 8. Service history

	Firing Rate	Description of Reading	Date of Readings												
1	**Max. Rate** Scale = 100	Gas Manifold Pressure (In. W.C.)*													
2		Gas Life Pressure (In. W.C.)*													
3		Flame Signal (DC Volts)													
4		Ambient Temperature (Deg. F)													
5		Flue Gas Temperature (Deg. F)													
6		Flue Gas $C0_2$ (percent)													
7		Flue Gas CO (PPM)													
8		Air Pressure in Box (In. W.C.)													
9		Burner Motor Volts													
10		Burner Motor Amps													
11	**Mid. Rate** Scale = 50	Gas Manifold Pressure (In. W.C.)*													
12		Gas Line Pressure (In. W.C.)*													
13		Flame Signal (DC Volts)													
14		Ambient Temperature (Deg. F)													
15		Flue Gas Temperature (Deg. F)													
16		Flue Gas $C0_2$ (percent)													
17		Flue Gas CO (PPM)													
18		Air Pressure in Box (In. W.C.)													
19	**Min. Rate** Scale = 5	Gas Manifold Pressure (In. W.C.)*													
20		Gas Line Pressure (In. W.C.)*													
21		Flame Signal (DC Volts)													
22		Ambient Temperature (Deg. F)													
23		Flue Gas Temperature (Deg. F)													
24		Flue Gas $C0_2$ (percent)													
25		Flue Gas CO (PPM)													
26		Air Pressure in Box (In. W.C.)													
27	**Comments** (Summarize any service work performed)	Reference Number:	(1)												
28		(1) Initial Startup of Furnace													

*** Tap Locations are shown as (2) and (9) on Figure 16.**

McQuay Training and Development

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

Warranty

All McQuay equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local McQuay Representative for warranty details. Refer to Form 933-43285Y. To find your local McQuay Representative, go to www.mcquay.com.

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

McQuay®
Air Conditioning