Adjustment, Start and Stop

4

Introduction

In this chapter you will find instructions on how to adjust, start, and stop the burner system. Become familiar with burner control methods before attempting to make adjustments.

⚠ DANGER

- **The ThermAir burners, described herein, are designed to mix fuel with air and burn the resulting mixture. All fuel burning devices are capable of producing fires and explosions if improperly applied, installed, adjusted, controlled, or maintained.**
- **Do not bypass any safety features; fires or explosion could result.**
- **Never try to light a burner if it shows signs of damage or malfunction.**

Adjustments

There are two separate system procedures:

System 1

Adjust the ThermAir burner with a ratio-regulator.

System 2

Adjust the ThermAir burner without a ratio-regulator.

System 1: Burner Adjustment with a Ratio Regulator

If you are adjusting a ThermAir burner equipped with a ratio-regulator for the first time, you must follow these steps:

1. Reset the system
2. Verify air flow
3. Ignite the burner
4. Set high fire gas
5. Set low fire gas
6. Verify gas settings
7. Stop procedure

Step 1: Reset the System

1. Set the low gas pressure switch to 20% below the “Main Gas Inlet Pressure” range as specified in the appropriate datasheet.
2. Set the high gas pressure switch to 20% above the “Main Gas Inlet Pressure” range as specified in the appropriate datasheet.
3. Close all the burner gas valves, manual and automatic.
4. Try to ignite the burner; be sure the flame monitoring system indicates a flame failure.
5. Activate the pressure switches and other limit interlocks. Be sure the switches fail as intended in the event of a power failure.

⚠ DANGER

- **If simulated limits or simulated flame failure do not shut down the fuel system within the required failure response time, immediately correct the problem before proceeding.**

6. If the burner is firing into a duct or chamber with a circulating fan, start the fan to produce a full process air flow past the burner.
7. Adjust main gas inlet pressure to the ratio regulator within the range specified in the appropriate datasheet.

⚠ WARNING

- **Gas inlet pressures must stay within the specified range. Pressure above the specified range can damage the ratio regulator.**
- **Pressure below the specified range can impair the ability of the ratio regulator to control the gas flow.**
- **Operating the system outside the specified range can cause excess fuel consumption and the possible accumulation of unburned fuel in the chamber. In extreme cases, this accumulation of unburned fuel may cause fires or explosions.**

8. Start the combustion air blower.

Step 2: Verify Air Flow

TA0015, 0025, 0040, 0075, 0100, 0200

1. Make sure that the pressure tap located on the chamber is open.
2. Connect the manometer to the chamber pressure tap.
3. Measure the chamber air pressure.
4. Determine actual air flow from the burner specific datasheet “Air Flow vs. Chamber Pressure Chart” for the burner being setup.
5. Remove the manometer.
6. Close the pressure tap.

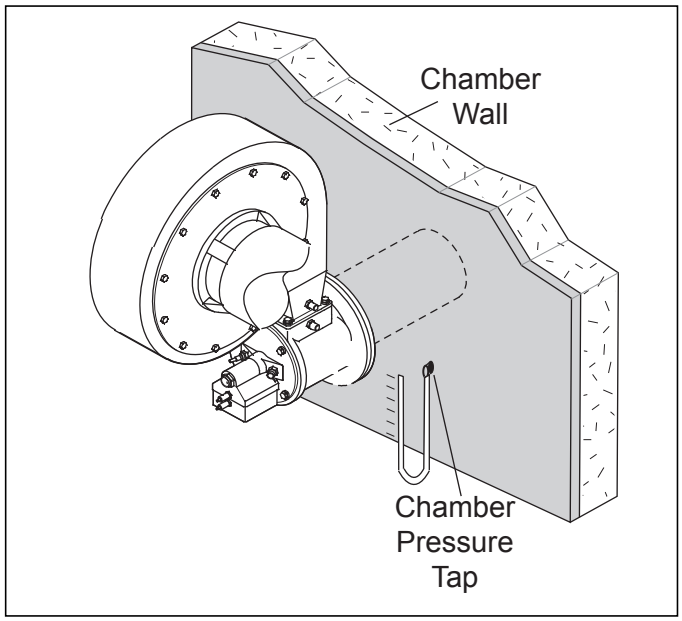


Figure 4.1 TA0015 thru TA0200

TA0300, 0400, 0500

1. Make sure that pressure taps A and C are open.
2. Connect the manometer to taps A and C.
3. Measure the air differential pressure.
4. Determine actual air flow from the burner specific datasheet “Air Flow vs. Air Orifice Differential Pressure” for the burner being setup.
5. Remove the manometer.
6. Close the pressure taps.

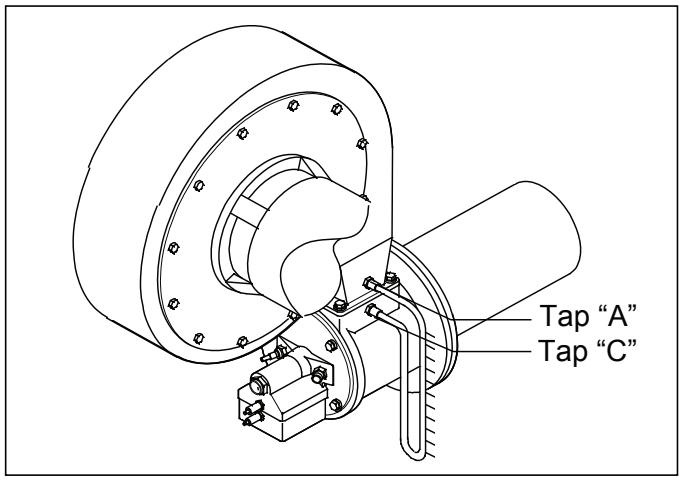


Figure 4.2 TA0300 thru TA0500

NOTE: A pressure tap is open when the screw inside the tap is unscrewed approximately half a turn.

NOTE: Chamber pressure will directly influence air flow from the blower. Air flows should be rechecked once the process reaches its operating temperature and pressure. An oxygen analyzer may be used to confirm air flow rates once the system is operating.

Step 3: Ignite the Burner

WARNING

- **This procedure is written with the assumption the burner has a flame monitoring control system installed and operating. A proper purge cycle must be part of the system and purge timing should not be bypassed.**

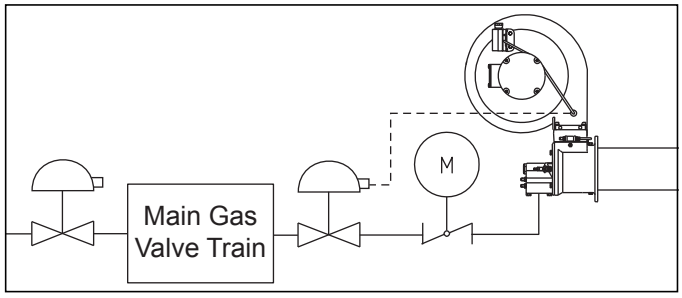


Figure 4.3 Schematic of Burner and Control Valves

1. Drive the gas control valve to low fire.

NOTE: All ThermAir burners are limited to ignition at inputs below 40% of maximum unless the control circuit in Design Guide 114 is followed.

2. Make sure the combustion air blower is running.

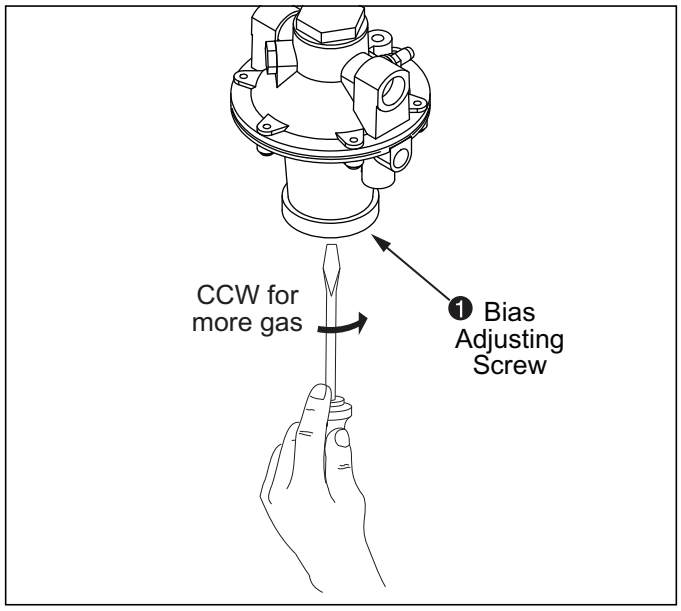


Figure 4.4

3. Open all manual gas valves feeding the burner.
4. Initiate the ignition sequence through the flame monitoring control system.
5. If burner does not ignite.
   a. Attempt to ignite burner again to purge air from the gas piping.
   b. If burner still does not ignite, turn bias adjusting screw ❶ a half turn counterclockwise to increase gas flow.
   c. Attempt to ignite the burner (Repeat Step 5).
   d. Repeat step **b** and **c** until burner ignites. If necessary, refer to Chapter 5 for troubleshooting tips.
6. Flame signal strength: Adjust gas flow with bias adjusting screw ❶ for lowest gas flow that maintains a stable flame signal.
   • Counterclockwise, for more fuel
   • Clockwise, for less fuel
7. Verify low fire flame:
   a. Shut off gas. When chamber temperature is below 250°F (121°C), shut off combustion air blower.
   b. Restart combustion air blower and ignite burner.
   c. Verify repeatability of ignition and low fire flame signal.

Step 4: Set High Fire Gas

1. If the burner has and is ignited, drive the main gas control valve to high fire (full open).
2. Verify air flow with the burner firing, repeat Step 2 “Verify Air Flow”.

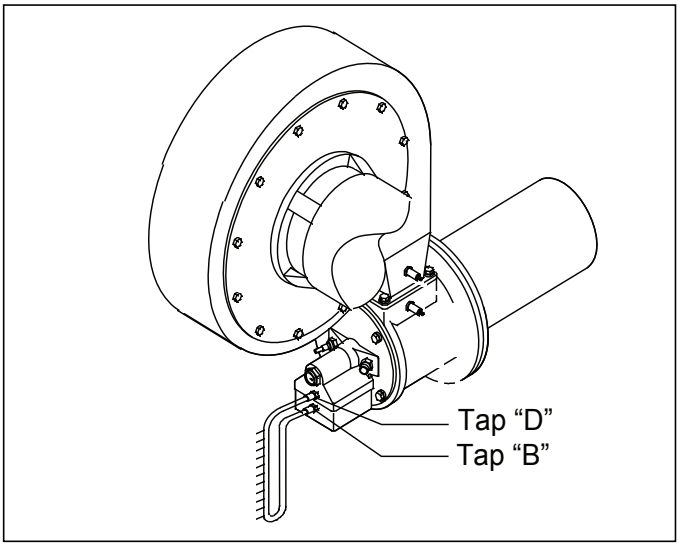


Figure 4.5

3. Make sure that pressure taps B and D are open.
4. Connect the manometer to taps B and D.
5. Measure the gas differential pressure.
6. Use the gas curve from the appropriate ThermAir datasheet for the gas being used to find the differential gas pressure needed at high fire.

NOTE: Select the appropriate gas orifice differential pressure based upon the desired amount of excess air in the burner.

7. Readjust the control valve linkage to achieve the desired high fire gas flow.

NOTE: The ThermAir gas orifice is sized to limit high fire gas flow to approximately 15% excess air with a packaged burner assembly purchased with a ratio regulator and gas control valve.

8. Once the chamber conditions stabilize, (i.e. pressure and temperature), repeat items 2 through 7.
9. Check the gas pressure at the inlet to the ratio regulator. This should be at least 5" w.c. (12,5 mbar) higher than the loading line pressure. It should not exceed the maximum pressure rating of the ratio regulator.

⚠ WARNING

- **Insufficient gas inlet pressure may cause the ratio regulator to remain fully open if there is a loss of air flow to the burner. This can cause excess fuel operation and the possible accumulation of unburned fuel in the chamber. In extreme cases, this may cause explosions or fires.**

10. Remove the manometer.
11. Close the pressure taps.

Step 5: Set Low Fire Gas

1. Drive the main gas control valve to low fire.
2. Adjust the control valve linkage to provide the desired low fire gas flow.

NOTE: It is very difficult to measure the very low gas pressures experienced at low fire, and it may be necessary to rely on visual inspection of the flame. This is especially true when gas turndowns in excess of 10 to 1 are being used. The main intent is to provide a stable flame with good flame signal that will not cause the chamber temperature to overshoot.

Step 6: Verify Gas Settings

Make sure that all settings are still the same after cycling the system several times between high and low fire.

Step 7: Stop Procedure

⚠ CAUTION

- **Do not turn the combustion air blower off until the chamber temperature is below 250° (121°C). This will prevent hot gases from back flowing into the burner and blower causing damage to the burner.**

1. Stop the burner through the burner control system.
2. Run the combustion air blower until the chamber temperature drops below 250° (121°C).
3. Shut off the combustion air blower.
4. Close all manual gas valves to the burner.

System 2: Burner Adjustment Without a Ratio-Regulator

You must provide a constant fuel inlet pressure to the burner to insure proper burner operation. If you are not using a burner equipped with a ratio-regulator, you must provide a service pressure regulator in order to maintain a constant inlet pressure to the burner.

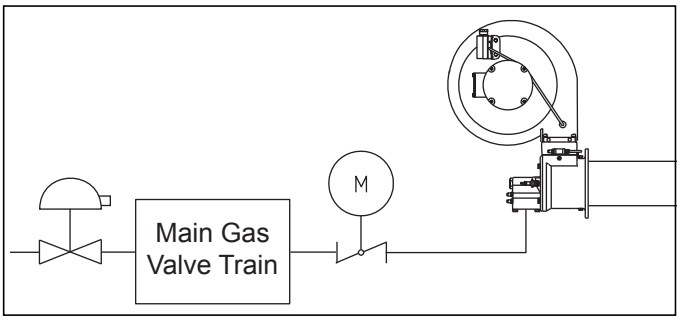


Figure 4.6

If you are adjusting a ThermAir burner equipped without a ratio-regulator for the first time, you must follow these steps:

1. Reset the system
2. Verify air flow
3. Ignite the burner
4. Set high fire gas
5. Set low fire gas
6. Verify gas settings
7. Stop Procedure

Step 1: Reset the System

1. Set the low gas pressure switch to 20% below the “Main Gas Inlet Pressure” range as specified in the appropriate datasheet.
2. Set the high gas pressure switch to 20% above the “Main Gas Inlet Pressure” range as specified in the appropriate datasheet.
3. Close all the burner gas valves, manual and automatic.
4. Try to ignite the burner; be sure the flame monitoring system indicates a flame failure.
5. Activate the pressure switches and other limit interlocks. Be sure the switches fail as intended in the event of a power failure.

DANGER

- **If simulated limits or simulated flame failure do not shut down the fuel system within the required failure response time, immediately correct the problem before proceeding.**

6. If the burner is firing into a duct or chamber with a circulating fan, start the fan to produce a full process air flow past the burner.
7. Adjust main gas inlet pressure at Tap B within the range specified in the appropriate datasheet.

WARNING

- **Operating the system outside the specified range can cause excess fuel consumption and the possible accumulation of unburned fuel in the chamber. In extreme cases, this accumulation of unburned fuel may cause fires or explosions.**

8. Start the combustion air blower.

Step 2: Verify Air Flow

TA0015, 0025, 0040, 0075, 0100, 0200

1. Make sure that the pressure tap located on the chamber is open.
2. Connect the manometer to the chamber pressure tap.
3. Measure the chamber air pressure.
4. Determine actual air flow from the burner specific datasheet “Air Flow vs. Air Orifice Differential Pressure” chart for the burner being set up.
5. Remove the manometer.
6. Close the pressure tap.

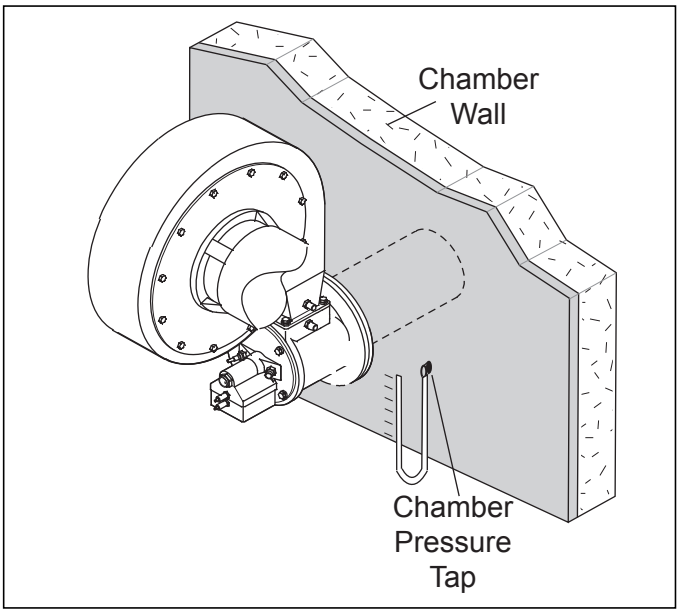


Figure 4.7

TA 0300, 0400, 0500

1. Make sure that pressure tap A and C are open.
2. Connect the manometer to taps A and C.
3. Measure the air differential pressure.
4. Determine actual air flow from the burner specific datasheet “Air Flow vs. Air Orifice ΔP” chart for the burner being set up.
5. Remove the manometer.
6. Close the pressure taps.

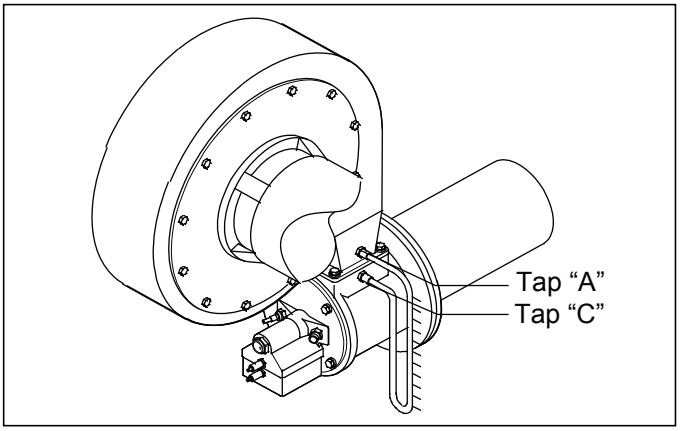


Figure 4.8

NOTE: A pressure tap is open when the screw inside the tap is unscrewed approximately half a turn.

NOTE: Chamber pressure will directly influence air flow from the blower. Air flows should be rechecked once the process reaches its operating temperature and pressure. An oxygen analyzer may be used to confirm air flow rates once the system is operating.

Step 3: Ignite the Burner

WARNING

- **This procedure is written with the assumption the burner has a flame monitoring control system installed and operating. A proper purge cycle must be part of the system and purge timing should not be bypassed.**

1. Drive the gas control valve to low fire.

NOTE: All ThermAir burners are limited to ignition at inputs below 40% of maximum unless the control circuit in Design Guide 114 is followed.

2. Make sure the combustion air blower is running.
3. Open all manual gas valves feeding the burner.
4. Initiate the ignition sequence through the flame monitoring control system.
5. Verify that the burner has ignited.

   If the burner does not ignite:

   a. Try to ignite again to purge the air out of the gas piping.

   b. If the burner does not ignite after one or two additional ignition attempts, see the Maintenance & Troubleshooting Guide.

Step 4: Set High Fire Gas

1. If the burner has and is ignited, set the main gas pressure regulator for 7" w.c. outlet pressure.
2. Drive the main gas control valve to high fire (full open).
3. Verify air flow with the burner firing, repeat Step 2 “Verify Air Flow”.
4. Make sure that pressure taps B and D are open.
5. Connect the manometer to taps B and D.
6. Measure the gas differential pressure.
7. Use the gas curve from the appropriate ThermAir datasheet for the gas being used to find the differential gas pressure needed at high fire.

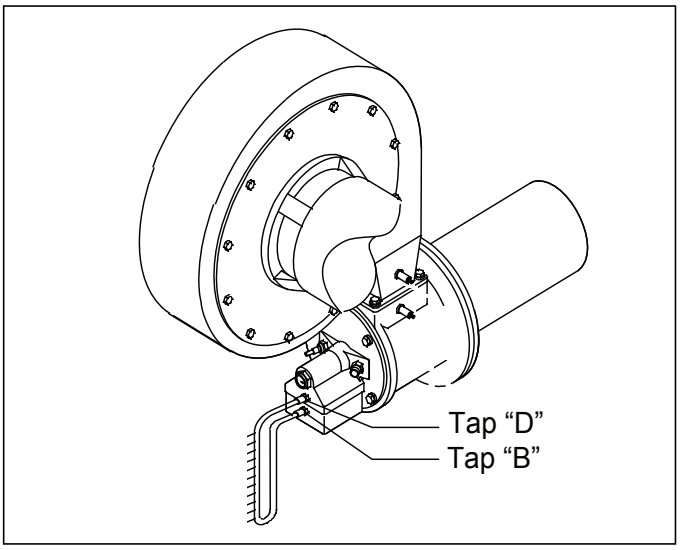


Figure 4.9

NOTE: Select the appropriate gas orifice differential pressure based upon the desired amount of excess air in the burner.

8. Adjust the adjusting screw on the main gas pressure regulator to achieve the desired gas flow.
9. Once the chamber conditions stabilize, (i.e. pressure and temperature), repeat Steps 3 through 8.
10. Remove the manometer.
11. Close the pressure taps.

Step 5: Set Low Fire Gas

1. Drive the main gas control valve to low fire.
2. Adjust the control valve linkage to provide the desired low fire gas flow.

NOTE: It is very difficult to measure the very low gas pressures experienced at low fire, and it may be necessary to rely on visual inspection of the flame. This is especially true when gas turndowns in excess of 10 to 1 are being used. The main intent is to provide a stable flame with good flame signal that will not cause the chamber temperature to overshoot.

Step 6: Verify Gas Settings

Make sure that all settings are still the same after cycling the system several times between high and low fire.

Step 7: Stop Procedure

CAUTION

- **Do not turn the combustion air blower off until the chamber temperature is below 250° (121°C). This will prevent hot gases from back flowing into the burner and blower causing damage to the burner.**

1. Stop the burner through the burner control system.
2. Run the combustion air blower until the chamber temperature drops below 250° (121°C).
3. Shut off the combustion air blower.
4. Close all manual gas valves to the burner.

Maintenance and Troubleshooting

5

This section is divided into two parts. The first part describes the maintenance procedures, and the second part helps you to identify problems that may occur and gives advice on how to solve these problems.

Preventative maintenance is the key to a reliable, safe and efficient system. The following are suggested guidelines for periodic maintenance. Burners in severe environments or operational conditions should be checked more frequently.

NOTE: The monthly and yearly lists are an average interval. If your environment is dirty, then the intervals may be shorter. Check with local authorities having jurisdiction on their recommended maintenance schedules.

⚠ CAUTION

- **Turn off power to burner and controls before proceeding with burner inspection.**

Monthly Checklist

1. Inspect the flame sensing device for good condition and cleanliness.
2. Check for proper air/gas pressures (refer to the ThermAir datasheets, series 114).
3. Test all the system alarms for proper response signals.
4. Check and clean igniter electrodes.
5. Check valve motors and control valves for free, smooth action and adjustment.
6. Check for proper operation of ventilating equipment.
7. Test the interlock sequence on all safety equipment. Manually force each interlock to intentionally fail while at the same time noting if related equipment closes and stops as specified by the manufacturer. Test the flame safeguard by manually shutting off the gas to the burner.
8. Test the manual gas shut off cocks for proper operation.
9. Clean and/or replace the combustion air blower filter.
10. Inspect and clean the combustion air blower rotor.

Yearly Checklist

1. Test (leak test) safety shut-off valves for tightness of closure.
2. Test pressure switch settings by checking the switch movements against pressure settings and comparing these with the actual impulse pressure.
3. Visually check ignition cable and connectors.
4. Inspect impulse piping for leaks.
5. Clean and inspect all burners
6. Remove and clean the orifice plate ❺, see Figure 5.1.
7. Be sure the following components are not damaged or distorted:
   - the burner nozzle
   - the igniter
   - the flame sensors
   - the combustion tube or block

The nozzle and combustion tube can be inspected without removing the burner from the chamber wall or entering the chamber. See Figure 5.1. Perform the following:

a. Shut the burner off and manually close the main gas shut off cocks.

b. Allow the chamber temperature to close down to 250°F (121°C).

c. Disconnect the gas piping at a union or the gas inlet flange ❶ provided on the burner.

d. Remove the rear cover bolts ❷.

e. Remove the rear cover ❸ from the burner housing ❹.

f. To re-assemble, follow this sequence in the reverse order.

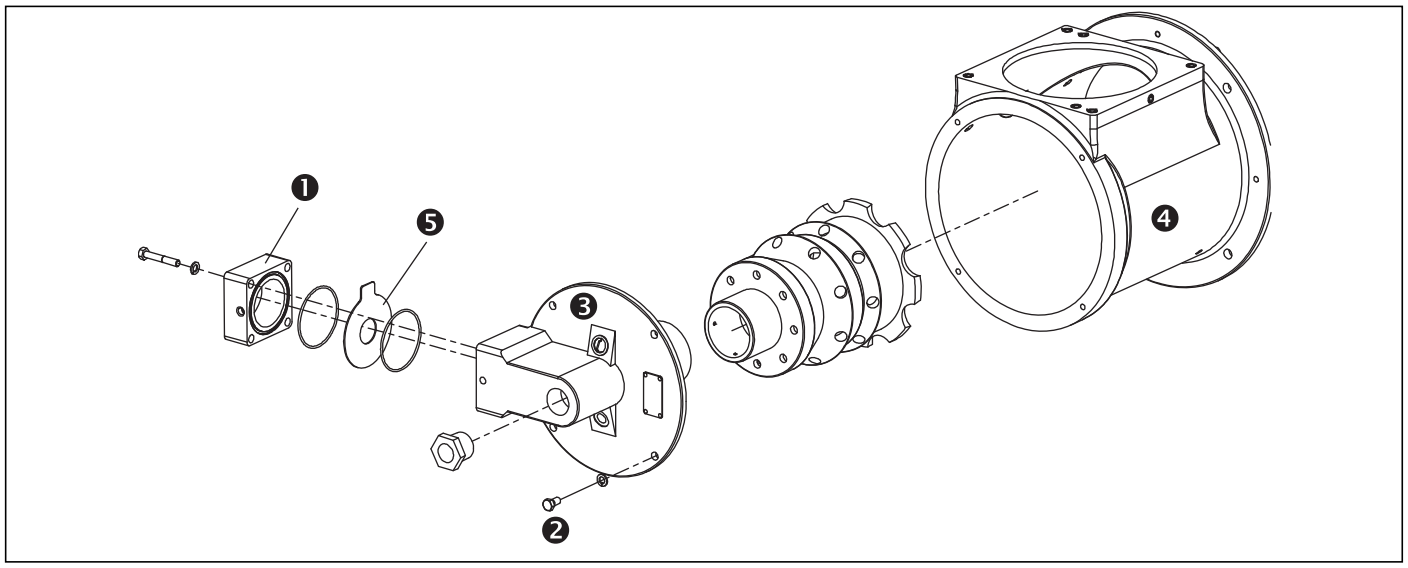


Figure 1.1

Troubleshooting Guide

Problem	Possible Cause	Solution
Start-up sequence runs but burner does not light.	No ignition. Attempting to ignite at inputs greater than 40%.	Reduce start point gas flow. Verify control circuit.
	No ignition. Weak or non-existent spark.	Verify ignition transformer is 6000 to 8000 volt transformer (not half-wave).
	No ignition. There is no power to the ignition transformer.	Restore the power to the ignition transformer.
	No ignition. Open circuit between the ignition transformer and the igniter.	Repair or replace the wiring to the igniter.
	No ignition. The igniter needs cleaning.	Clean the igniter.
	No ignition. The igniter is not correctly grounded to the burner.	Clean the threads on the igniter and the burner. **NOTE:** do not apply grease to the threads of the igniter.
	No ignition. Igniter insulator is broken. Igniter is grounding out.	Inspect the igniter. Replace if broken.
	Not enough gas. The gas flow into the burner is too low.	Check the start-up settings. Adjust low fire gas setting if necessary.
	Not enough gas. If equipped with ratio regulator, loading line may not be attached.	Reconnect loading line and verify loading pressure.
	Not enough gas. The bypass valve is not open far enough.	Adjust bypass gas flow.
	Not enough gas. Start gas solenoid valve does not open.	Check the solenoid valve coil for proper operation. Replace it if necessary.

Problem	Possible Cause	Solution
Start-up sequence runs but burner does not light (continued).	Not enough gas. Gas valve does not open.	Check the wiring to the automatic gas shut-off valve. Check the output from the flame safeguard. Open manual gas cock.
	No flame signal. Broken flamerod or dirty UV scanner lens.	Inspect and clean sensor. Replace if necessary.
	No flame signal. Flamerod grounding out. (For sizes TA0025-TA0100)	Verify that the flamerod is installed correctly and is the correct length.
	Too much gas. Wrong or missing burner fuel orifice.	Check ThermAir datasheets, series 114 for fuel orifice and the given fuel.
The low fire flame is weak or unstable.	Not enough gas flowing to the burner.	Adjust the gas control valve to increase the gas flow.
	Not enough air.	Check for proper blower rotation. Check air filter for blockage.
The burner goes out when it cycles to high fire.	Too much gas to the burner.	Verify gas orifice size for your fuel using datasheet, series 114. Verify chamber pressure for proper air flow effect. Check the start-up settings. Measure the gas pressures and adjust them where necessary. Check for valve train pressure loss.
	Loading line to the ratio regulator (if installed) is leaking.	Repair the leak in the loading line.
The burner is erratic and does not respond to adjustment.	Internal damage to the burner. Some parts inside the burner are loose, dirty, or burned out.	Contact Eclipse for further information.
The burner is unstable or produces soot or smoke.	The air/gas ratio is out of adjustment.	Measure all the gas pressures and air pressures. Compare these pressures to the documented initial start-up settings and adjust them where necessary.
The burner cannot achieve full capacity	Air filter is blocked. (When equipped with ratio regulator.)	Clean or replace the air filter.
	Gas pressure going into the burner is too low.	Adjust the gas pressure.
	Combustion chamber pressure is too high.	Contact Eclipse for further information

Problem	Possible Cause	Solution
Cannot initiate a start sequence.	Air pressure switch has not made contact.	Check air pressure switch adjustment. Check air filter. Check blower rotation. Check outlet pressure from blower.
	High gas pressure switch has activated.	Check incoming gas pressure. Adjust gas pressure if necessary. Check pressure switch setting and operation.
	Low gas pressure switch has activated.	Check incoming gas pressure. Adjust gas pressure if necessary. Check pressure switch setting and operation.
	Malfunction of the flame safeguard system (i.e. shorted-out flame sensor or electrical noise in the sensor line).	Have a qualified electrician troubleshoot and correct the problem.
	No power to the control unit.	Have a qualified electrician troubleshoot and correct the problem.
	Main power is off.	Be sure the main power to the system is switched to the “on” position.

Appendix

Conversion Factors

Metric to English

From	To	Multiply By
actual cubic meter/h (am^3/h)	actual cubic foot/h (acfh)	35.31
normal cubic meter/h (Nm^3/h)	standard cubic foot /h (scfh)	38.04
degrees Celsius (°C)	degrees Fahrenheit (°F)	(°C x 9/5) + 32
kilogram (kg)	pound (lb)	2.205
kilowatt (kW)	Btu/h	3415
meter (m)	foot (ft)	3.281
millibar (mbar)	inches water column ("w.c.)	0.402
millibar (mbar)	pounds/sq in (psi)	14.5×10^{-3}
millimeter (mm)	inch (in)	3.94×10^{-2}
MJ/Nm^3	Btu/ft^3 (standard)	26.86

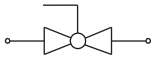
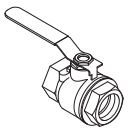
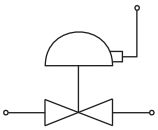
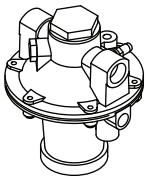
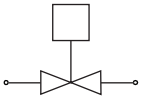
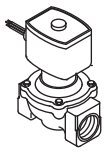
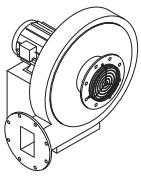
Metric to Metric

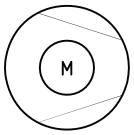
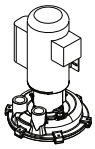
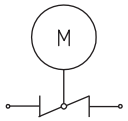
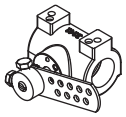
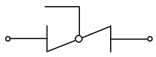
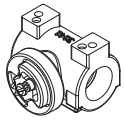
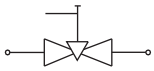
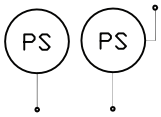
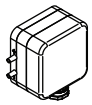
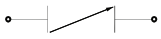
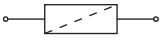
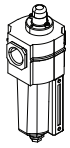
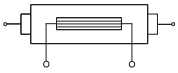
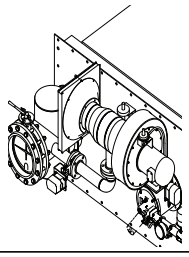
From	To	Multiply By
kiloPascals (kPa)	millibar (mbar)	10
meter (m)	millimeter (mm)	1000
millibar (mbar)	kiloPascals (kPa)	0.1
millimeter (mm)	meter (m)	0.001

English to Metric

From	To	Multiply By
actual cubic foot/h (acfh)	actual cubic meter/h (am^3/h)	2.832×10^{-2}
standard cubic foot /h (scfh)	normal cubic meter/h (Nm^3/h)	2.629×10^{-2}
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32) x 5/9
pound (lb)	kilogram (kg)	0.454
Btu/h	kilowatt (kW)	0.293×10^{-3}
foot (ft)	meter (m)	0.3048
inches water column ("w.c.)	millibar (mbar)	2.489
pounds/sq in (psi)	millibar (mbar)	68.95
inch (in)	millimeter (mm)	25.4
Btu/ft^3 (standard)	MJ/Nm^3	37.2×10^{-3}

System Schematics

Symbol	Appearance	Name	Remarks	Bulletin/ Info Guide
		Gas Cock	Gas cocks are used to manually shut off the gas supply.	710
		Ratio Regulator	A ratio regulator is used to control the air/gas ratio. The ratio regulator is a sealed unit that adjusts the gas pressure in ratio with the air pressure. To do this, it measures the air pressure with a pressure sensing line, the impulse line. This impulse line is connected between the top of the ratio regulator and the burner body.	
Main Gas Shut-Off Valve Train		Main Gas Shut-Off Valve Train	Eclipse strongly endorses NFPA as a minimum.	790/791
Pilot Gas Shut-Off Valve Train		Pilot Gas Valve Train	Eclipse strongly endorses NFPA as a minimum.	790/791
		Automatic Shut-Off Valve	Shut-off valves are used to automatically shut off the gas supply on a gas system or a burner.	760
		Orifice Meter	Orifice meters are used to measure flow.	930
		Combustion Air Blower	The combustion air blower provides the combustion air to the burner(s).	610

Symbol	Appearance	Name	Remarks	Bulletin/ Info Guide
		Hermetic Booster	Booster is used to increase gas pressure.	620
		Automatic Butterfly Valve	Automatic butterfly valves are typically used to set the output of the system.	720
		Manual Butterfly Valve	Manual butterfly valves are used to balance the air or gas flow at each burner.	720
		Adjustable Limiting Orifice	Adjustable limiting orifices are used for fine adjustment of gas flow.	728/730
		Pressure Switch	A switch activated by rise or fall in pressure. A manual reset version requires pushing a button to transfer the contacts when the pressure set point is satisfied.	840
		Pressure Gauge	A device to indicate pressure.	940
		Check Valve	A check valve permits flow only in one direction and is used to prevent back flow of gas.	780
		Strainer	A strainer traps sediment to prevent blockage of sensitive components downstream.	
		Flexible Connector	Flexible connectors isolate components from vibration, mechanical, and thermal stresses.	
		Heat Exchanger	Heat exchangers transfer heat from one medium to another.	500
		Pressure Taps	Pressure taps measure static pressure.	

Notes

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