



0063

This appliance is for use with natural or propane gas. Read these instructions thoroughly before commencing installation.

# AMBI-RAD Model T Gas-Fired Duct Furnace

Installation Form GB/WA/030/1099

APPLIES TO: Installation, Commissioning, and Service

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**WARNING: Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. All work must be carried out by competent persons, i.e. a registered CORGI installer.**

**PLEASE READ THESE INSTRUCTIONS THOROUGHLY BEFORE COMMENCING WORK.**

### HAZARD INTENSITY LEVELS

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

**WARNING: The electrical isolator should only be used in an emergency and should not be used for closing down the main burner, as it switches off the fan prematurely and may damage the heat exchanger, invalidating the warranty.**

## 1.0 INTRODUCTION

### 1.1 Basic Information

The instructions in this manual apply to Model T Series warm air heaters. Model T Series heaters are designed for use with the installer's air supply system. Units are suitable for inserting into ductwork or may be directly coupled to an air supply fan. **UNITS SHOULD BE USED FOR INDOOR INSTALLATIONS ONLY.**

Models T Series heaters are 80% thermal efficient. A permanent electricity supply of 230 volts, 50 Hz, single phase is required.

Model T heaters are approved for:

**Type B<sub>II</sub>** - Gravity Vent, Open Flue

**Category II<sub>2H3P</sub>** - use with G20 natural gas or G31 propane gas

Each unit is fitted with a permanent pilot. A thermoelectric flame supervision device monitors the pilot flame to prevent an explosive condition occurring.

### 1.2 Warranty

**Warranty is void if ...**

- Heater is installed in atmospheres containing flammable vapours or atmospheres containing chlorinated or halogenated hydrocarbons or atmospheres containing any silicone, aluminum oxide, etc. that adheres to spark ignition flame sensing probes.
- The installation is not in accordance with these instructions.

## 2.0 TECHNICAL DATA

### 2.1 Specifications

**2.1.1 TABLE 1 - Model T SPECIFICATIONS**

Size	Heat Input		Heat Output		Maximum Gas Rate ① for G20 Natural Gas	Maximum Gas Rate ② for G31 Propane Gas
	kw	BTUH	kw	BTUH	m <sup>3</sup> /hr	m <sup>3</sup> /hr
75	22.0	75,000	17.3	60,000	2.05	0.83
100	29.3	100,000	23.1	79,000	2.73	1.11
125	36.6	125,000	28.9	98,750	3.41	1.39
150	43.9	150,000	35.1	120,000	4.10	1.67
175	51.3	175,000	40.5	138,250	4.78	1.95
200	58.6	200,000	46.9	160,000	5.46	2.23
225	65.9	225,000	52.1	177,750	6.15	2.50
250	73.2	250,000	58.6	200,000	6.83	2.78
300	87.9	300,000	69.4	237,000	8.20	3.34
350	102.5	350,000	81.0	276,500	8.57	3.90
355	102.5	350,000	81.0	276,500	8.57	3.90
400	117.1	400,000	92.5	316,000	10.95	4.45

① Gas flow rate is based on a gas with a gross C.V. of 39.9 MJ/m<sup>3</sup> (1030 BTUH) and includes a pilot flow rate of 351 watts (1200 BTUH).

② Gas flow rate is based on a gas with a gross C.V. of 101.6 MJ/m<sup>3</sup> (2500 BTUH) and includes a pilot flow rate of 351 watts (1200 BTUH).

### 2.2 Burner Injector Size and Pressure

#### Natural Gas

**2.2.1 TABLE 2 - G20 (Natural) GAS INJECTOR SIZE, BURNER PRESSURE, AND INLET PRESSURE**

Size	Injector Quantity	Injector Size	Injector Marking	Burner Pressure		Minimum Inlet Pressure	Maximum Inlet Pressure	Gas Rate Per Burner
		mm		mbar	in. w.g.	mbar	mbar	M <sup>3</sup> /Hr
75	4	2.10	45	8.5	3.4	12.5	30	0.52
100	4	2.35	42	8.5	3.4	12.5	30	0.69
125	5	2.35	42	8.5	3.4	12.5	30	0.69
150	7	2.20	44	9.0	3.6	14.0	30	0.59
175	7	2.35	42	8.5	3.4	16.0	30	0.69
200	9	2.25	43	8.5	3.4	12.5	30	0.61
225	9	2.35	42	8.5	3.4	12.5	30	0.69
250	12	2.20	44	8.5	3.4	15.0	30	0.57
300	12	2.35	42	8.5	3.4	15.0	30	0.69
350	14	2.35	42	8.5	3.4	17.0	30	0.69
355	16	2.35	42	7.0	2.8	17.0	30	0.60
400	16	2.35	42	8.5	3.4	17.5*	30	0.69

\*When fitted with optional modulating burner control, Model 400 requires minimum inlet pressure of 19 mbar of natural gas.

#### Propane Gas

**2.2.2 TABLE 3 - G31 (Propane) GAS INJECTOR SIZE, BURNER PRESSURE AND INLET PRESSURE**

Size	Injector Quantity	Injector Size	Injector Marking	Burner Pressure		Minimum Inlet Pressure	Maximum Inlet Pressure	Gas Rate per Burner
		mm		mbar	in. w.g.	mbar	mbar	M <sup>3</sup> /Hr
75	4	1.20	1.20	21.5	8.6	27	35	0.21
100	4	1.45	1.45	21.5	8.6	27	35	0.28
125	5	1.45	1.45	21.5	8.6	27	35	0.28
150	7	1.35	1.35	21.5	8.6	27	35	0.24
175	7	1.45	1.45	21.5	8.6	28	35	0.28
200	9	1.40	54	21.5	8.6	28	35	0.25
225	9	1.45	1.45	21.5	8.6	28	35	0.28
250	12	1.35	1.35	21.5	8.6	30	35	0.23
300	12	1.45	1.45	21.5	8.6	30	35	0.28
350	14	1.45	1.45	21.5	8.6	30	35	0.28
355	16	1.35	1.35	21.5	8.6	30	35	0.24
400	16	1.45	1.45	21.5	8.6	30	35	0.28

## 2.3 DIMENSIONS

Figure 2

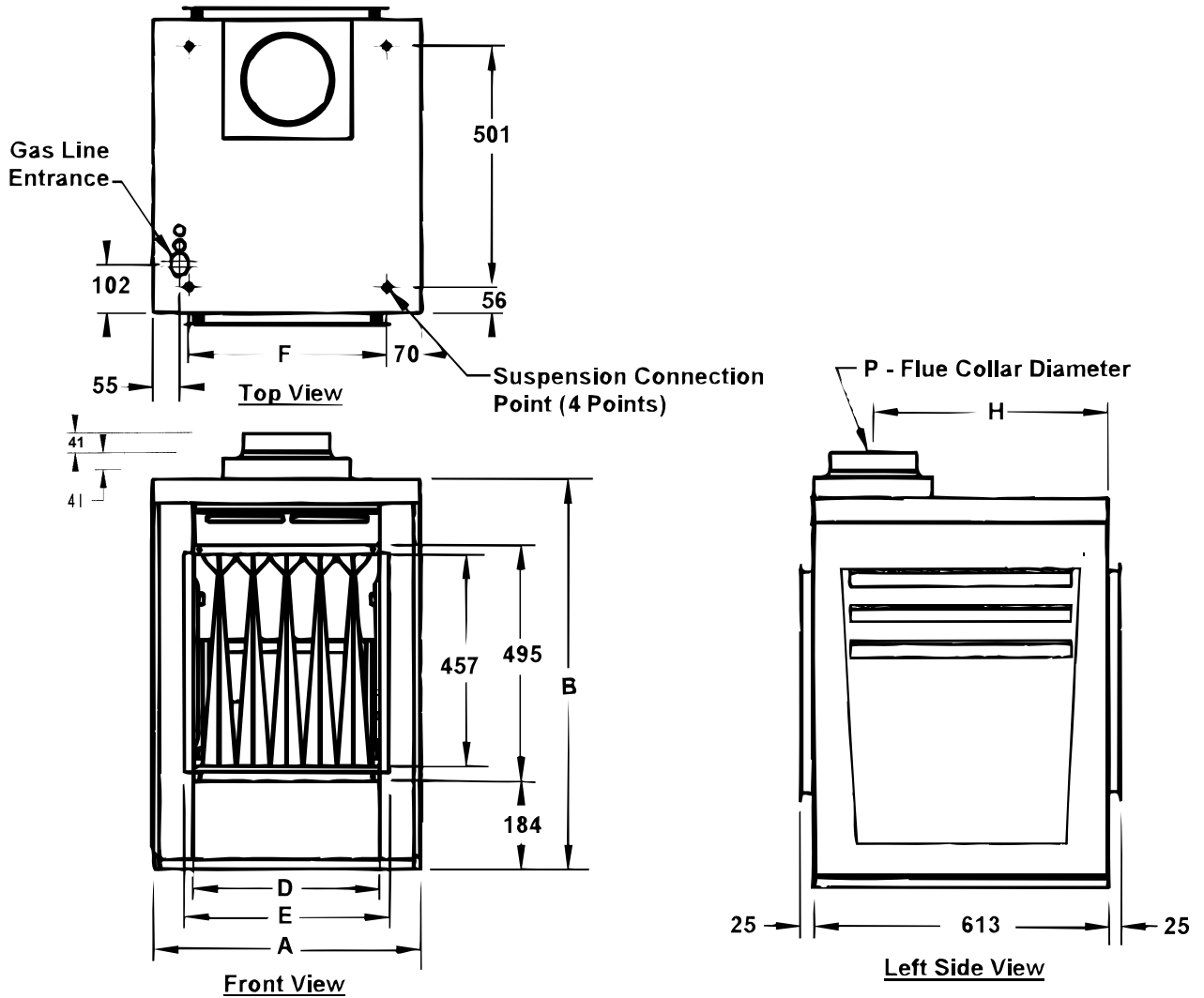


TABLE 4

Model	A	B	D	E	F	H	P
T	mm	mm	mm	mm	mm	mm	mm
75	489	819	317	355	348	489	125
100	489	819	317	355	348	489	150
125	559	819	387	425	418	489	175
150	699	819	527	565	558	489	200
175	699	819	527	565	558	489	200
200	838	895	667	705	698	438	200
225	838	895	667	705	698	438	200
250	1048	895	876	914	908	438	200
300	1048	895	876	914	908	438	250
350	1187	895	1016	1054	1048	438	250
355	1327	895	1156	1194	1187	438	250
400	1327	895	1156	1194	1187	438	250

## 3.0 GENERAL REQUIREMENTS

### 3.1 Related Documents

It is important that all gas appliances are installed by competent persons, i.e. a registered CORGI installer, in accordance with the relevant requirements of the following regulations.

Failure to install appliances correctly could lead to prosecution. It is in your own interest and that of safety to ensure compliance with the law.

**WARNING: Air heaters should not be installed in corrosive atmospheres, i.e., near plating or degreasing plants or in areas where there is a fire risk. Consult BS6230 for further information on hazardous areas.**

### 3.2 Heater Location

The location chosen for the heater must permit the provision of a satisfactory combustion air and flue system. The location must also provide required clearances and adequate space for servicing.

Top	Sides		Bottom		Rear
	Control	Other	To Combustibles	To Non-Combustibles	(Measuring from cabinet)
152	See Note	152	152	0	750

NOTE: Service Clearance for Control Side is the width of the unit plus 152 mm in order to remove the drawer-type burner rack.

**CAUTION: Avoid installing a unit in an extremely draughty area. Extreme draughts can shorten the life of the heat exchanger and/or cause safety problems.**

### 3.3 Flue System

Each heater must be fitted with an adequately sized flue (See Table 6). Stainless steel flue pipe is recommended.

Model Size	Nominal Flue Diameter (mm)	Minimum Flue Height (m)
75	125	2
100	150	2
125	175	2
150	200	2
175	200	2
200	200	2
225	200	2
250	200	2.5
300	250	2
350	250	2.5
355	250	2.5
400	250	2.5

**WARNING: The flue must be installed in accordance with BS5440 Part 1 1990 for all models up to and including Size 200 or BS6230 1991 for all Models Size 250 and over.**

**Failure to provide proper flueing could result in death, serious injury and/or property damage. The unit must be installed with a flue to the outside of the building. Safe operation of any natural draught gas burning equipment requires a properly operating flue system, correct provision for combustion air, and regular maintenance and inspection.**

The unit heater is fitted with an integral draught diverter. Do not use an external draught diverter, barometric damper and/or restrictive damper.

When condensation is possible within the flue, double wall flue pipe is recommended. When double wall flue pipe is used, it should be a type complying with British Standards. Double wall flue pipe requires the use of a special flue socket adapter. Where condensation is unavoidable, provision should be made for condensation to flow freely to a point at which it can be released, preferably into a gully. The condensation pipe from the flue to the disposal point should be of non-corrodible material, not less than 19 mm (3/4 in.) diameter.

The flue must terminate outside the building in a freely exposed position so as to prevent products of combustion from entering any opening in a building.

If the flue passes through a wall or ceiling of combustible material, it must be enclosed by a sleeve of non-combustible material and separated from the sleeve by at least 25 mm (1 inch) air gap. The temperature of any combustible material near the flue or heater must not exceed 65°C when the heater is in operation. The flue must also be at least 50 mm (2 in.) from any other combustible material.

The joint between the female flue socket of the heater and the flue must be sealed. If double wall flue piping is used, the appropriate adapter must be fitted.

### 3.4 Gas Supply Pressure

These heaters are designed to operate on either G20 natural gas or G31 propane gas. Refer to Tables 2 and 3 or the data plate for minimum and maximum supply pressure. Before installation, check that the local distribution conditions, nature of gas and pressure, and adjustment of the appliance are compatible.

The gas meter and service must be checked by the gas supplier to ensure that it is adequate to deal with the total connected load of the completed installation.

The installation must comply with British Standard 6891, and the complete installation including the meter must be purged and tested for soundness as described in the above standard and in British Gas Document IGE/UP/1.

### 3.5 Air Distribution System

These heaters are designed for connection to the positive pressure side of a centrifugal blower and to air distribution ductwork. The air throughput must be within the range stated on the heater data plate. The air distribution must be even over the entire heat exchanger. To determine temperature rise, measure inlet and outlet air temperatures at points not affected by heat radiating from the heat exchanger.

Table 7 shows the approved temperature rise range (11°-42°C) with the required air volume and the internal pressure drop through each size of unit. Maximum approved total static pressure is 5 mbar.

**Table 7 - Pressure Drop Table**

Size	75		100		125		150		175		200		225		250		300		350		400	
	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar	Air Volume m³/hr	P.D. mbar
11	4715	1.50	6286	2.70	7866	2.80	9438	2.13	11010	2.78	12581	2.55	14153	3.10	15724	2.25	18876	3.10	22019	3.10	25171	3.10
17	3140	0.67	4188	1.20	5241	1.25	6286	0.95	7340	1.25	8385	0.30	9438	1.38	10483	1.00	12581	1.38	14679	1.38	16778	1.38
22	2357	0.38	3143	0.68	3933	0.70	4715	0.53	5505	0.70	6286	0.63	7076	0.78	7866	0.55	9438	0.78	11010	0.78	12581	0.78
28	1886	0.24	2515	0.43	3143	0.45	3772	0.35	4400	0.45	5029	0.40	5658	0.50	6286	0.35	7544	0.50	8809	0.50	10067	0.50
33	1567	0.19	2090	0.33	2616	2.83	3143	0.28	3670	0.35	4188	0.30	4715	0.38	5241	0.28	6286	0.38	7340	0.38	8385	0.38
39	1344	0.14	1792	0.25	2243	0.28	2693	0.25	3143	0.33	3593	0.25	4044	0.28	4494	0.23	5386	0.28	6286	0.28	7187	0.28
42	1255	0.13	1674	0.23	2090	0.25	2515	0.23	2931	0.28	3356	0.23	3772	0.25	4188	0.20	5029	0.25	5870	0.25	6711	0.25

### 3.6 Electrical Supply

Wiring external to the air heater must be installed in accordance with the regulations and be carried out by a qualified electrician.

A constant 230V, 50 Hz single phase supply is required. All heaters and controls must be correctly earthed. An isolator with a contact separation of at least 3 mm on all poles should be installed adjacent to the heater.

When a number of heaters are to be wired as part of a single installation, each heater must be provided with a separate isolator.

Electrical supply entrance is on the rear of the heater. The final connection to the heater should be to the appliance terminal block in the heater electrical box. See the connection diagrams in Paragraph 9.1.

Supply cable size should be 1.0 mm. Fit the cord anchor supplied with the heater. The length of the conductors between the cord anchorage and the terminals must be such that the current-carrying conductors become taut before the earthing conductor, if the cable or cord slips out of the cord anchorage.

## 4.0 INSTALLATION

### 4.1 Uncrating and Preparation

Prior to despatch, the unit was operated and tested at the factory. If the heater has incurred any damage in shipment, file a claim with AMBI-RAD within 48 hours.

Check the data plate for the gas specifications and electrical characteristics of the heater to be sure that they are compatible with the gas and electric supplies at the installation site. Read this booklet and become familiar with the installation requirements of your particular heater. Before beginning, make preparations for necessary supplies, tools, and manpower.

### 4.2 Fitting the Heater

Before fitting the heater, check the supporting structure to be used to verify that it has sufficient load-carrying capacity to support the weight of the unit and the ancillary equipment. See weights in Table 8.

Model T	Size							
	75	100	125	150	200	250	350	355
kg								

Where the location of the air heater is such that it might suffer external mechanical damage, i.e., from overhead cranes, fork lift trucks, it must be suitably protected.

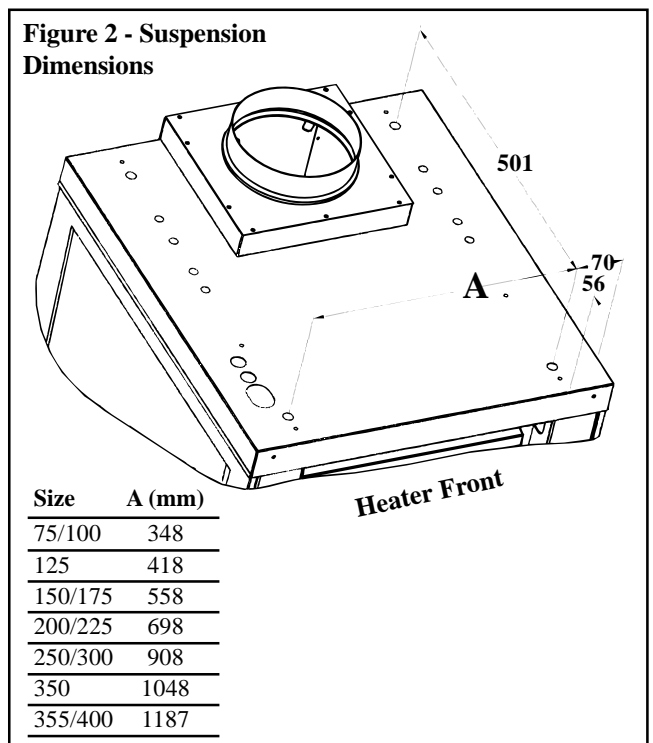
Material used to support any heater whether suspended or base mounted should be corrosion resistant and of sufficient strength. The gas supply pipe and electrical connections should not support any of the weight of the heater.

**WARNING: Units must be level for proper operation. Do not place or add additional weight to the heater.**

#### 4.2.1 Suspending the Heater

Heaters are equipped with four suspension points to receive an M10 eyebolt or threaded rod. See dimensions in Figure 2.

**WARNING: Suspend the heater only from the suspension points. Do not suspend from the heater side or top panel.**



#### 4.2.2 Mounting the Heater

These heaters may be base mounted on a non-combustible support. Always ensure the heater is adequately secured.

### 4.3 Fitting the Flue System

The flue pipe system attaches directly to the flue socket provided on the heater. The socket is sized to accept standard metric sheetmetal flue pipe. When double wall flue pipe is used, a suitable adapter is required. It is recommended that a split socket is fitted so that if necessary the heater may be removed for servicing.

## 4.0 INSTALLATION (cont'd)

### 4.3 Fitting the Flue System (cont'd)

Any joints should be secured using three pop rivets or sheradized sheet metal screws at each joint. The joints of the flue must be sound. The flue pipe should be supported so that the heater does not carry any of the flue weight. Flues must be fitted with an approved flue terminal.

### 4.4 Gas Connection

Fit the heater with the piping arrangement shown in Figure 3.

NOTE: When removed, the side access panel is designed to hang from the bottom of the heater. Place the extended top edge of the side panel over the lip on the bottom panel of the heater. The side panel will "hang" suspended from the bottom panel until ready to be re-installed on the heater.

Heaters suspended by flexible support material or drop rods should be connected to the gas service using a flexible connector. Sufficient slack must be provided in the flexible connector to allow for normal movement of the heater. Use a flexible connector of suitable size to reduce pressure drop and the possibility of flow noise.

**Warning: Do not use the gas supply connection to balance heater or support any weight of the heater.**

### 4.5 Electrical Connections

All electrical connections should be made in the heater terminal box. Screw-type terminals are provided. Connections should be in accordance with terminal markings and the wiring diagram affixed to the heater or shown in Section 9.

The minimum control scheme must have a room thermostat, and in all cases, **it is essential that the main input to terminals L and N remains alive at all times to ensure the correct operation of the blower.** It is essential that the main air supply fan runs on after each heater operation either via a time delay relay (150 seconds minimum) or by wiring via the heaters integral fan control thermostat and suitable contactor.

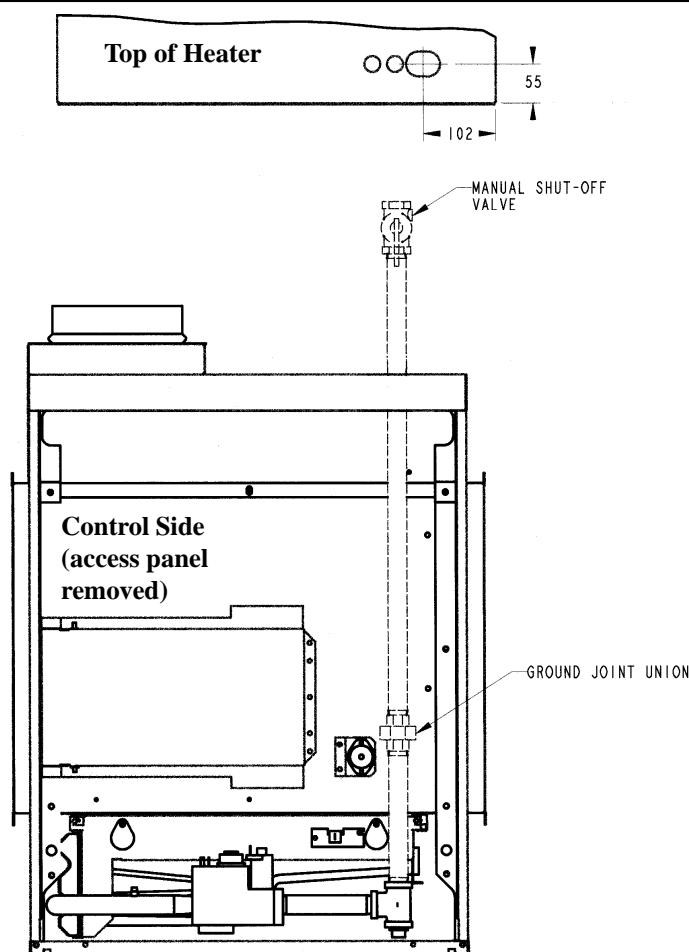
Units fitted with automatic spark ignition may have a remote reset facility by wiring to the terminal strip in the electrical box as indicated on the wiring diagram. **CAUTION: The cause for activating the lockout control should be identified and corrected before resetting. If the first reset is not successful, wait 15 seconds before pushing the reset button.**

### 4.6 Temperature Control Device

The siting of the temperature control thermostat or panel is particularly important. It should not be fitted on an outside wall. Avoid locating the temperature control device in draughty areas or where it may be directly exposed to heat from the sun or other heat sources. The thermostat or panel should be mounted on an internal wall or column about 1.5 m above the floor. A temperature control device capable of switching 230 volts should be fitted for on/off or high/low operation. Do not attempt to control more than one heater from a single temperature control unless correctly wired relays are fitted. If correctly fitted with relays, a thermostat or panel can be used to control several heaters. Follow the thermostat manufacturer's instructions when fitting a thermostat.

Figure 3 - Recommended Gas Supply Piping Arrangement

Dotted lines indicate site provided piping and connections.

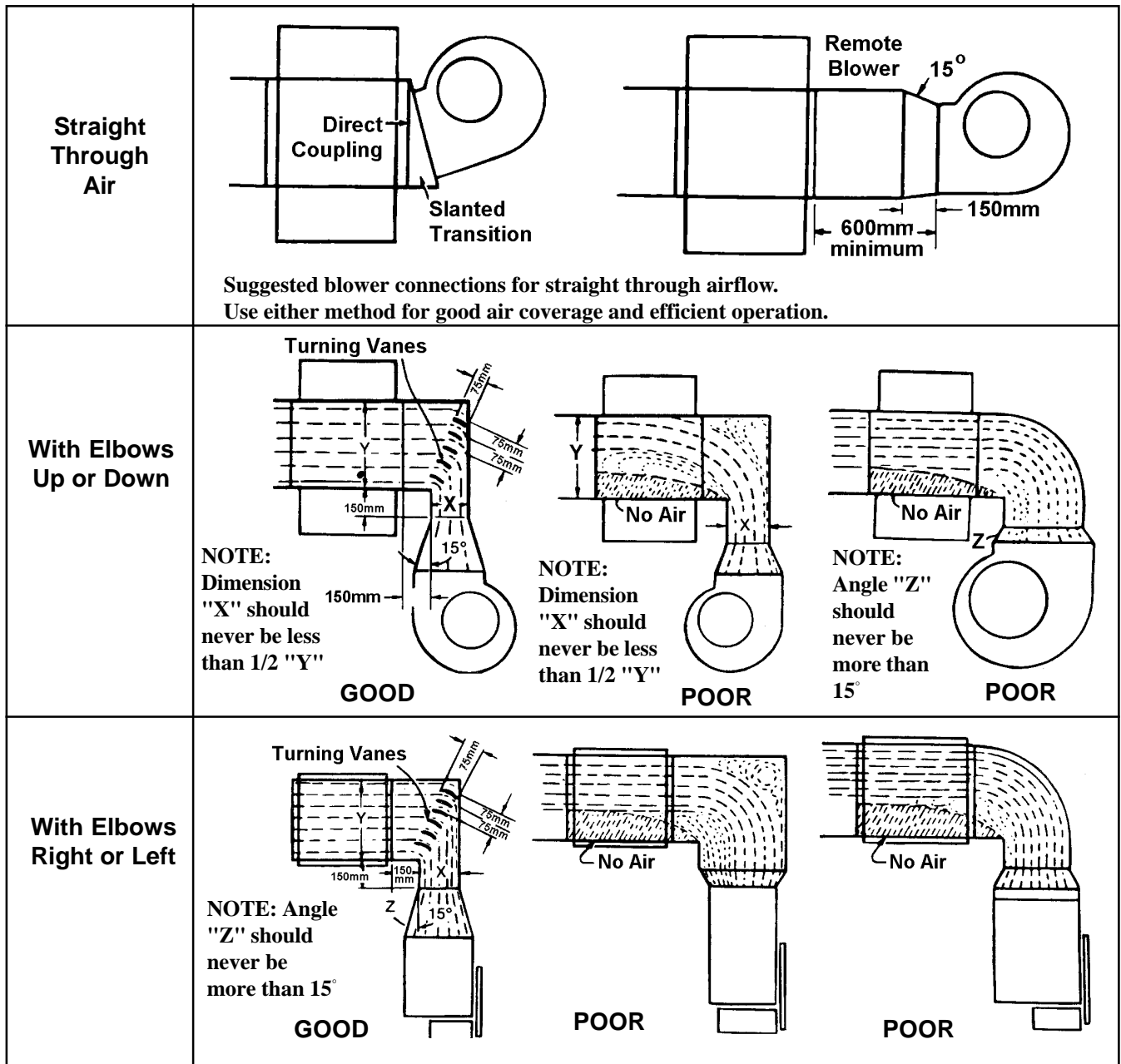


# 5.0 AIR DISTRIBUTION SYSTEM

## 5.1 Blower Connection

Proper arrangement of blower and furnace with respect to angle of approach of the duct connection and the arrangement of the discharge opening of the blower are shown. Blowers should be bottom horizontal discharge when coupled to the furnace. When a top horizontal blower is connected to the furnace, be sure that sufficient length of duct is provided to permit even flow of air at the end of the duct. Alternatively, insert baffles between the blower and the heater to assure an even flow of air across the heat exchanger. **Install the heater on the positive pressure side of the air-circulating blower.**

Figure 4 - Blower Connections



## 5.2 Fitting Outlet Ductwork

Low heat capacity materials should be used for the construction of warm air delivery and should be insulated when passing through unheated spaces. Joints and seams of all outlet air ducts and fittings must be securely fastened and made airtight.

All ducting must be securely supported in such a way that there is no undue strain. The heater should not be used to provide any support for the ductwork.

**NOTE: Always attach ductwork to flanges; do not attach ductwork to heater cabinet.**

TABLE 9 - Outlet Duct Connection Size

Heater Size	Width	Height
	mm	mm
75 - 100	317	462
125	387	462
150 - 175	527	462
200 - 225	667	462
250 - 300	876	462
350	1016	462
355 & 400	1156	462

## 6.0 COMMISSIONING AND TESTING

The commissioning and testing should only be carried out by a competent person. This section should be read completely and fully understood. A commissioning service is available from AMBI-RAD.

### 6.1 Electrical Check

After completion of the installation and before switching on the electrical supply, a preliminary check must be performed by a qualified electrician. Check the following:

- ❑ Check that all site wiring is connected in accordance with the appropriate circuit diagram in Section 9.
- ❑ Ascertain that the correct fuse and cable size are fitted.
- ❑ Check that the earthing of the heater has been carried out by conducting an earth continuity test. Connect a test meter, one lead to the appliance earth point and the other lead to the main incoming earth at the isolator. A resistance reading of 0.1 ohm or less must be indicated. If a higher reading is obtained, check earth connections for being clean and tight. If problem still exists, seek expert advice.
- ❑ Carry out a polarity test. Connect one lead of a suitable AC voltmeter to earth and connect the other lead to the live supply terminal at the heater. Turn on power to the heater and check for proper voltage.  
The same result should be obtained by connecting the test leads from live to neutral.  
Connect the voltmeter test leads to N and E. A reading of between 0-15 volts at maximum should be obtained. If these tests do not conform to the above, there is a fault which must be rectified before progressing further with the commission.
- ❑ Check that a suitable thermostat or control panel has been fitted.
- ❑ Ensure that an isolation switch has been fitted.

### 6.2 Gas Connection

The whole of the gas installation, including the meter, should be inspected, tested for soundness, and purged in accordance with BS6891 and British Gas Document IGE/UP/1.

### 6.3 Suspension and Support

Check to ensure that the heater is adequately suspended or supported and that no other parts have been fitted that are not properly supported or secured. For safe heater operation, check that the heater is level in all directions.

### 6.4 Lighting the Heater (Read and understand all steps before lighting.)

The heater is fitted with either a permanent pilot which requires lighting or an automatic spark ignition system. Determine the type of pilot and follow the appropriate instructions.

#### 6.4.1 Lighting a Heater with a Permanent Pilot

- ❑ Ensure that the electrical supply to the heater is turned "On"
- ❑ Set the temperature controller to lowest setting. If a clock control and a summer/winter switch have been fitted, ensure that they are set to "ON" and winter.
- ❑ Turn on the main gas supply to the heater.
- ❑ Remove the access panel on the control side of the heater. (While servicing the heater, the side access panel is designed to "hang" from the bottom panel of the heater. Place the extended top edge of the side panel over the lip on the bottom panel of the heater. The side panel will "hang" suspended from the bottom panel until ready to be re-installed on the heater.)

With the panel removed, the pilot lighting hole is in view (on the right side of the burner rack).

**WARNING: If for any reason the pilot light goes out, allow three minutes before relighting.**

- ❑ Locate the multifunctional control valve and identify the control knob. While lighting the pilot, depress the control knob. Once the pilot is established continue to depress the knob for 20 seconds and then release slowly.
- ❑ Re-attach the access panel.
- ❑ Adjust the temperature control setting to above the ambient temperature. The main burners will light (the main burners can be seen through the viewing port).

#### 6.4.2 Turning "OFF" a Heater with a Permanent Pilot

To turn off both the pilot and the main burner, rotate the knob on the multifunctional valve in a clockwise direction. **WAIT THREE MINUTES BEFORE RELIGHTING THE HEATER.**

#### 6.4.3 Turning "ON" a Heater with Spark Ignition

The ignition spark ignites the gas creating a pilot flame. The flame is detected by the flame rod. If a pilot flame is not detected within 50 seconds, the ignition controller locks out and must be manually reset. The reset button is on the heater (or a site-provided, remote button may be fitted).

- ❑ Ensure that the electrical supply and the gas supply to the heater are turned "ON"
- ❑ If fitted with a clock control, set to "ON".
- ❑ Adjust the temperature control to the required operating temperature. The heater will operate automatically.

**NOTES:** If heater will not "start" on initial start up, the ignition controller may be in lockout position. Depress the reset button. Several attempts at lighting the pilot may be required to remove the air from the multifunctional valve.

#### 6.4.4 Turning "OFF" a Heater with Spark Ignition

To turn "OFF" the heater for a short period, adjust the temperature control to its lowest temperature or "OFF". The blower will continue to run to cool the heat exchanger before turning off automatically.

To turn "OFF" the heater for a long period, adjust the temperature control to its lowest temperature or "OFF". When the blower has stopped, turn "OFF" the gas and the electricity supplies.

### 6.5 Heater Pipework

The soundness of the heater's pipework has been checked at the factory. However, during shipment or installation, connections may be loosened. Check the soundness of the pipework using a leak-detecting fluid such as a soap and water solution. If any leaks are found, they must be rectified immediately.

**WARNING: Never use a naked flame for checking the soundness of any gas connections.**

### 6.6 Adjustments

#### 6.6.1 Burner Gas Adjustment

The gas pressure is set for the required heat input before the heater leaves the factory, and normally the gas pressure will not require re-setting. To check gas pressure, the following procedure should be carried out.

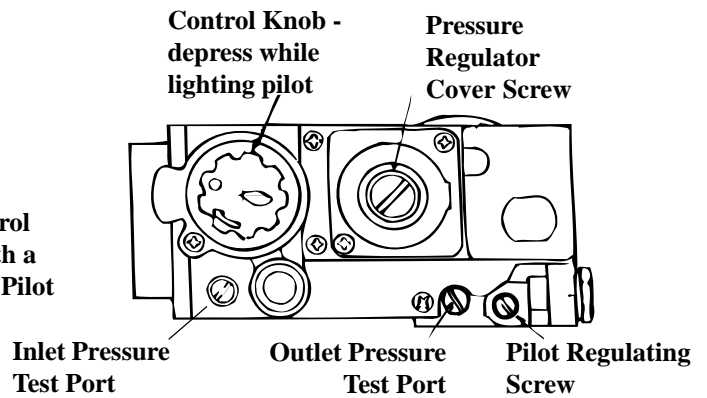
- 1) Ascertain from Section 1, Technical Data (Table 2 or 3), the correct burner pressure for the heater.
- 2) Turn the temperature control to its lowest setting.
- 3) Remove the screw from the outlet pressure test point of the gas valve (See Figure 5, page 9). Connect a manometer to the test point.
- 4) Adjust the temperature control to a setting above ambient temperature.



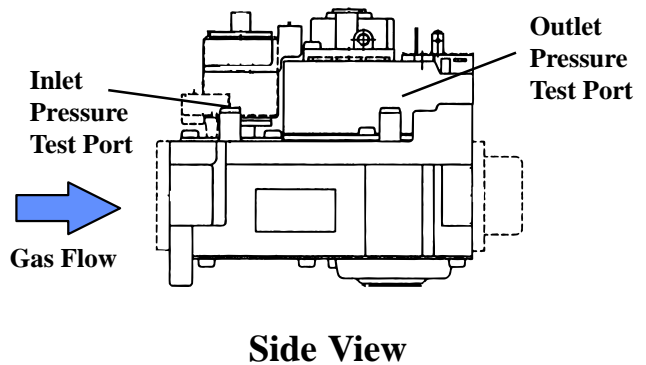
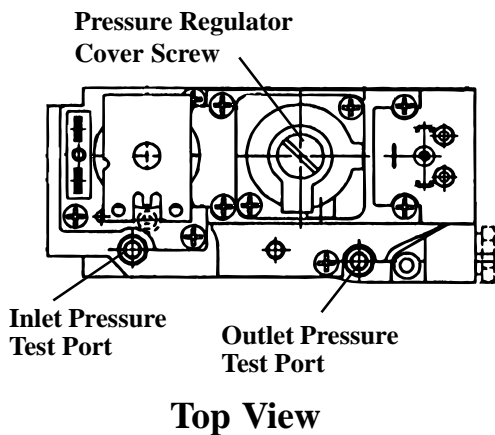
**Figure 5 - Multifunctional Control Valves**

(NOTE: When measuring gas pressure, do not remove screw. Loosen enough to allow gas pressure to register.)

**Multifunctional Control Valve on a Heater with a Standard Permanent Pilot**



**Multifunctional Control Valve on a Heater with Optional Spark Ignition**



- 5) Observe the gas pressure on the manometer and compare to required burner pressure.
- 6) If necessary, adjust the burner gas pressure. Remove the cover screws. Turn the regulator screw anti-clockwise to decrease the pressure or clockwise to increase the pressure.
- 7) Set the temperature control to lowest setting to turn off the main burners. Replace the pressure test point screw and cover screw (if removed) and with the main burner turned on, test for gas soundness using a leak-detection fluid such as a soap and water solution.

Reset temperature control to required operating temperature.

### 6.6.2 Pilot Flame Adjustment - Permanent Pilot

The pilot regulating screw is contained in the multifunctional control valve. The pilot regulating screw is factory set for the maximum pilot rate. If the G20 natural gas inlet pressure to the heater exceeds 25 mbar (10 inches W.G.), the pilot rate should be reduced.

#### Pilot Flame Adjustment Instructions

- 1) Remove the cover screw (see Figure 5).
- 2) To adjust the pilot flame, turn the adjusting screw clockwise to reduce the flow.
- 3) Replace the cover screw after pilot adjustment is completed.

## 6.7 Air Distribution System

### 6.7.1 General Requirements

The system should be checked to ensure that the installation work has been carried out in accordance with the design requirements.

### 6.7.2 Ducted Heaters

Airflow and temperature rise must be within the limits on the unit rating plate.

## 6.8 Heater Controls

### 6.8.1 Standard Heater Controls

Check heater operation after all adjustments have been carried out. Set the temperature control to above ambient temperature. The main burner will light. The main air supply fan should be wired for "constant fan" operation or via the integral fan thermostat control in the heater through a suitable contactor. If wired via the integral fan control thermostat, then the fan motor should be energised approximately 30 seconds after the burner lights.

Continue to operate the heater for several minutes to ensure the limit switch does not activate. The limit switch is a manually reset switch which must be cooled to room temperature before being reset. The reset button is accessible by opening the heater control panel. If for any reason, the limit switch trips, the cause must be determined. See Fault Finding Chart, Section 10.3.

Turn the temperature control to its lowest setting. The main burners should extinguish while the fan or blower continues to cool the heat exchanger. When the heat exchanger is sufficiently cooled (usually within five minutes), the fan control will de-energize the fan or blower motor.

The circuit diagram on the heater indicates the type of gas control.

### 6.8.2 Heater with Optional Two-Stage Gas Control

Checks and operation sequence are the same as in Section 6.8.1, except that the heater is controlled by a two-stage temperature controller and a two-stage valve (50% and 100%). Depending on the temperature controller setting, the gas valve fires the burner at either 50% or 100%.

### 6.8.3 Heater Controls with Optional Electronic Modulation Gas Control

Checks and operation sequence are the same as in Section 6.8.1, except that the gas valve is electrically controlled to modulate between 50% to 100% firing rate depending on the temperature requirement.

## 6.0 COMMISSIONING AND TESTING (cont'd)

### 6.9 Handing Over

Upon the satisfactory completion of commissioning and testing, hand the instructions to the user or purchaser. Advise the user/purchaser how to safely use and operate the heater, including all associated equipment and controls. Ensure that the user/purchaser understands how to start the heater and how to turn it off.

Suggest that the instructions be placed close to the heater for future reference. Instruct the user/purchaser not to place the instructions adjacent to a hot surface or in a place where they may restrict air flow.

Advise the user/purchaser that for safe and efficient operation, the heater must be serviced at least annually. A complete after sales service is available from AMBI-RAD.

## 7.0 SERVICING INSTRUCTIONS

**WARNING: Only competent and qualified engineers should carry out servicing and fault finding on this equipment. Complete after-sale service is available from AMBI-RAD.**

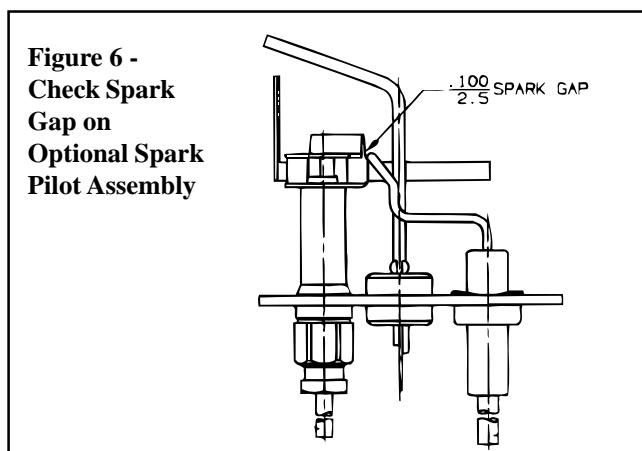
This heater will operate with a minimum of maintenance. To ensure long life, satisfactory performance and continued safety, a heater that is operated under normal conditions should be inspected and cleaned annually. Heaters that are operated in areas where an unusual amount of dust or impurities are present in the air, require more frequent maintenance.

### 7.1 Servicing Requirements/Procedure

The following procedures should be carried out at least annually:

1. Remove the Burner Assembly as in Section 8.1.
  - a) Check the condition of the pilot burner and clean off any deposits which may have formed. Clean the inside of the burner hood with an emery cloth. Clean the pilot injector with solvent and compressed air. **CAUTION: Wearing eye protection is recommended.**

Check the condition of the thermocouple or flame rod and clean with an emery cloth. Remove all deposits. If signs of erosion are visible, renew the thermocouple or flame rod. On pilots with a flame rod (spark ignition), check the spark gap (2.5 mm).



- b) Clean any deposits from the main burner, paying particular attention to lint or fluff, etc., which may have formed around the injectors in the venturi of the burner. Clean using compressed air and a soft brush. **CAUTION: Wearing eye protection is recommended.**
- c) Clean any deposits from the burner tray.

2. The heat exchanger should remain clean unless some problem has developed with combustion. Examine the heat exchanger internally and externally for any sign of deterioration.
3. Ensure that any purpose provided air vents for ventilation and combustion are free from obstruction.
4. The flue system should be checked for soundness. Reseal/replace any parts that do not appear sound.
5. Check the wiring for any signs of damage. Replace wiring with an equivalent specification.
6. Check operation of the fan control and the fan control time delay relay.
7. When service is complete, carry out commissioning procedure, Section 6.0-6.8.

## 8.0 REMOVAL AND REPLACEMENT OF PARTS

**WARNING: To comply with legislation, only certificated spares may be fitted to heaters supplied after 1/1/96. A full spares service is provided by AMBI-RAD. Only a competent and qualified engineer should carry out servicing on this equipment.**

**Before maintenance is carried out, ensure that both gas and electrical supplies are turned off and the appliance is cold.**

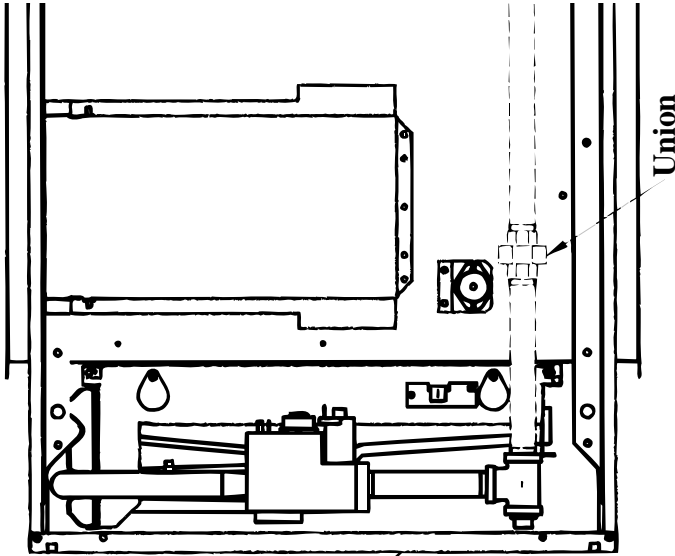
**After maintenance work, the heater MUST be fully commissioned (See Section 6).**

### 8.1 Main Burner Removal

#### Instructions for Burner rack Removal

1. Remove the control access panel from the heater. (The side panel is designed to "hang" from the bottom panel of the heater. Place the edge over the lip on the side of the bottom panel of the heater, carefully allowing the side panel to "hang".)
2. If equipped with spark ignition, open the electrical box cover and disconnect the ignitor lead from the ignition controller. Disconnect the flame sensor lead (wire from the ignition controller to the probe) from the auxiliary flame probe.
3. Mark and disconnect electric valve leads.
4. Uncouple the union in the gas supply line upstream from the valve.
5. Remove the two screws holding the bottom of the burner rack assembly. Slide the "drawer-type" burner rack out of the heater.

**Figure 7 - Control Side with Access Panel Removed for Removal of Burner Rack**



The access panel will "hang" over the edge of the bottom panel.

**Instructions to remove the individual burners from the burner rack assembly :**

1. With the burner assembly upside down, remove the screws (located at the rear) that secure the retaining bracket.
2. Lift the front of the burner upwards slightly and pull it back, removing the individual burner (a slight tap with a wooden mallet is sufficient to dislodge it).
3. Clean individual burners using air pressure or soft brush Use an air nozzle to blow out scale and dust accumulation from the burner ports. **CAUTION: Wearing eye protection is recommended.** Alternately blow through burner ports and venturi. Use fine wire to dislodge any stubborn particles. Do not use anything that might change the port size.



**Figure 8 - Individual Burner Removed from the Burner Rack**

**Instructions to Re-Assemble**

1. Reverse the Steps to Disassemble and Remove the burner rack.
2. When lighting, always follow the lighting instructions on the heater. After any service work, the heater must be fully commissioned. See Section 6.0-6.8.

**NOTE: Use only factory-authorized replacement parts. Heaters supplied after 1/1/96 must use certificated spares to comply with legislation.**

A complete spares service is available from AMBI-RAD.

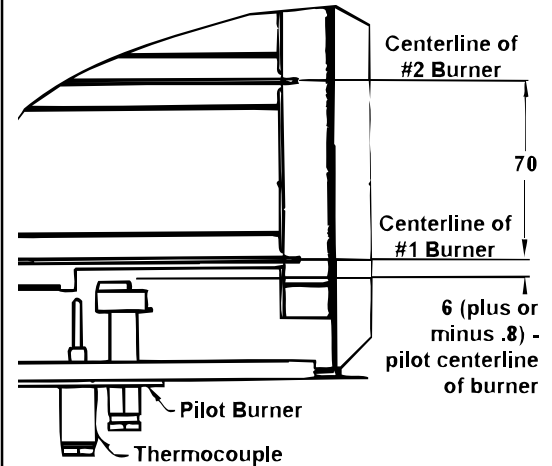
**8.2 Pilot Burner Injector**

1. If connected, disconnect the pilot tubing from the pilot burner.
2. Fit a new pilot burner injector.
3. Re-assemble in reverse order.

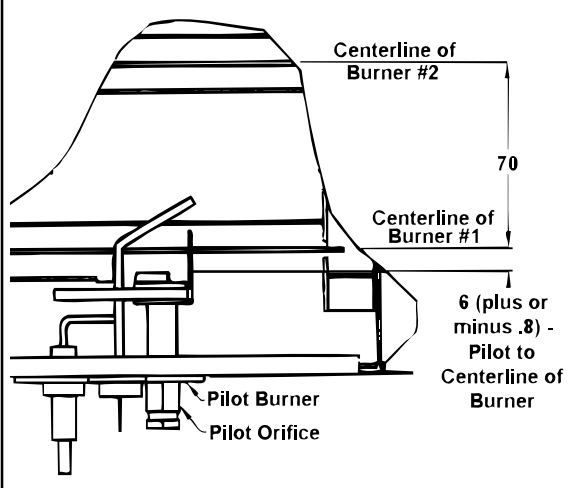
**8.3 Pilot Burner Assembly**

1. To remove the pilot assembly, remove its two fixing screws.
2. Refit the new pilot burner by re-assembling in reverse order.
3. Check relationship of the pilot burner with the adjacent main burner. Refer to Figures 11 and 12.

**Figure 9 - Relationship of Permanent Pilot Assembly and Main Burner**



**Figure 10 - Relationship of Spark Pilot Assembly and Main Burner**



**8.4 Optional Spark Pilot Ignition System**

The ignition controller of the intermittent electronic ignition pilot system is located in the electrical box. There are no field-replaceable components in the ignition controller. Check the lead wires for insulation deterioration and good connections. Proper operation of the electronic spark ignition system requires a minimum flame signal of 0.7 micro amps as measured by a micro amp meter.

**CAUTION: Due to high voltage on pilot spark wire and pilot electrode, do not touch when energized.**

**8.5 Main Burner Injectors**

1. Remove the burner rack (See Paragraph 8.1).
2. Remove the manifold bracket screws and manifold.
3. Unscrew the main burner injectors.
4. Re-fit new injectors.
5. Re-assemble in reverse order.

## 8.0 REMOVAL AND REPLACEMENT OF PARTS (cont'd)

### 8.6 Multifunctional Control Valve

1. Ensure the electrical supply is isolated.
2. Remove the pilot supply tube and the spark tension lead.
3. Remove the terminal cover and disconnect the electricity connections.
4. Disconnect the union between the multifunctional control valve and the gas service cock. Remove the valve.
5. Re-fit the replacement valve making all the required connections. If the connection includes an O-ring, fit a new O-ring.
6. Carry out a complete commissioning procedure. Refer to Sections 6.0 to 6.8.

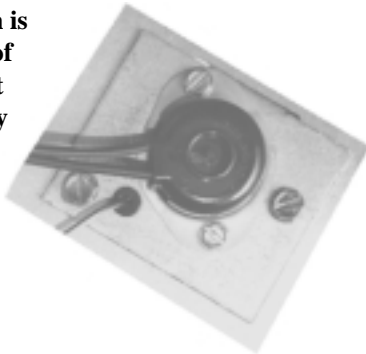
### 8.7 Limit and High Temperature Limit Controls

The heater is fitted with a limit control and a high temperature limit control.

The limit control switch fitted on the side of the heater (Refer to Figures 11 and 12) has a sensor capillary tube that passes twice across the heat exchanger discharge opening. The switch is a manual reset type which interrupts the circuit to the heater operating controls. Before replacing, be certain that the limit control sensor capillary tube has cooled sufficiently. If it has been determined that the limit control needs replacing, use only a factory-authorised replacement.

The high temperature limit control is a redundant safety device calibrated to open at a much higher temperature than the limit control. The high temperature limit control is a manual reset type. A high temperature limit control interruption indicates a major failure caused by a malfunction of the primary safety controls or miswiring. The cause must be determined and corrected; both the fan control and the limit control must be replaced; and the entire heater must be inspected for damage to wiring and controls.

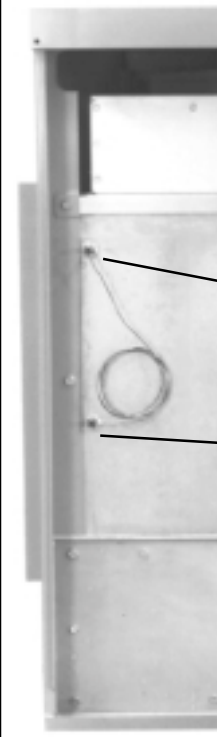
**Figure 11 - The "Lower Temperature" Limit Control Reset Switch is on the Control Side of the Heater. This limit switch has a capillary tubing sensor that passes twice across the heat exchanger discharge. When activated, the switch "turns off" the gas controls.**



#### 8.7.1 Instructions for Replacement of Limit Switch Control

1. Remove the heater side panel on the non-control side of the heater and the access panel on the control side of the heater. The limit switch reset button is visible; see Figure 11.
3. Disconnect the limit switch wires from the gas valve.
4. The one-piece capillary tube passes twice across the outlet of the heat exchanger. To replace: **a)** from the non-control side of the heater (See Figure 12), pull the upper portion of the "copper-coloured" capillary tube out of stainless steel tube. **b)** From the control side, withdraw the full length of capillary tubing.
5. Remove the limit switch control from the bracket by removing the two retaining screws.

**Figure 16 - Non-Control Side of the Heater with Cabinet Panel Removed showing the Limit Control Capillary Tubing**



#### When Removing Tubing:

On this side, pull the "copper coloured" capillary tubing from the upper row of stainless steel tubing so that the full length can be pulled through the lower row of tubing and removed from the control side of the heater.

**(1) To remove, pull out here.**

**(2) Uncoil and pull through to the other side.**

#### When Installing New Tubing:

Be sure tubing passes twice across the full width of the heat exchanger. "Coil" excess capillary tubing (on non-control side) as illustrated.

6. Replace the limit control switch and re-assemble in reverse order, ensuring that the capillary tube extends two times across the full width of the heat exchanger.
7. Carry out a complete commissioning procedure. Refer to Section 6.0 to 6.8.

#### 8.7.2 High Temperature Limit Switch Location

The high temperature limit control is located in the electrical box above the fan temperature control. If the high temperature limit switch activates, the primary limit switch and fan control must be replaced. The high limit switch may be reset.

### 8.8 Fan Temperature Control

The fan temperature control senses the temperature of the heat exchanger. The fan temperature control has a fixed setting and may not be site adjusted. If it is determined that the fan temperature control needs replacing, use only a factory-authorised replacement part. (See Section 8.0.)

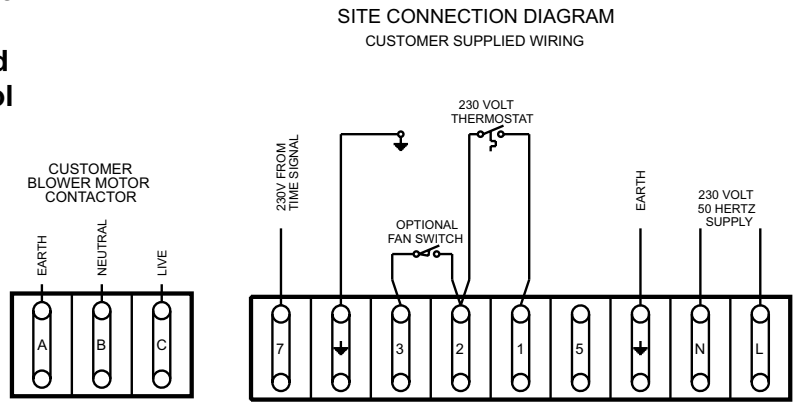
The fan control is located in the electrical box.

As with all service procedures, carry out a complete commissioning procedure after replacement of the fan control. Refer to Sections 6.0 to 6.8.

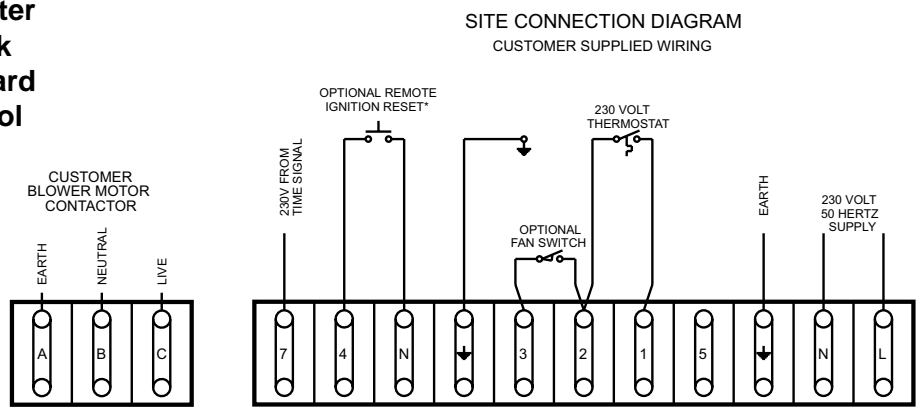
# 9.0 CIRCUIT DIAGRAMS

## 9.1 Site Wiring

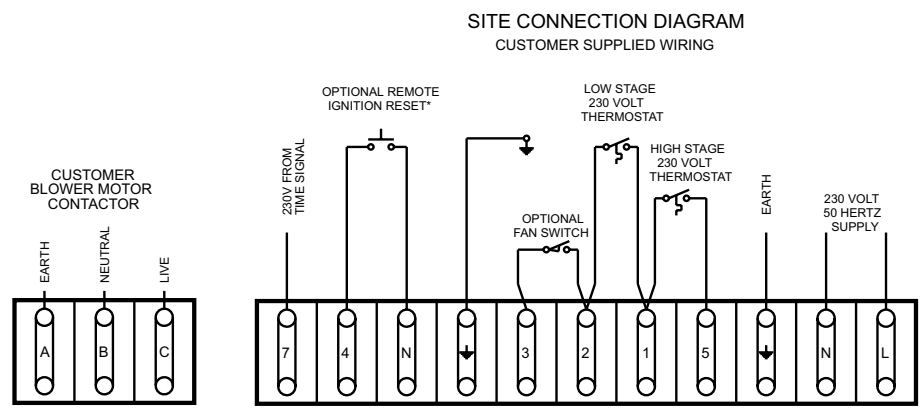
### 9.1.1 Site Wiring for Heater with Standard Permanent Pilot and Single Stage Control



### 9.1.2 Site Wiring for Heater with Optional Spark Ignition and Standard Single Stage Control



### 9.1.3 Site Wiring for a Heater with Optional Spark Ignition and Optional Two-Stage Control



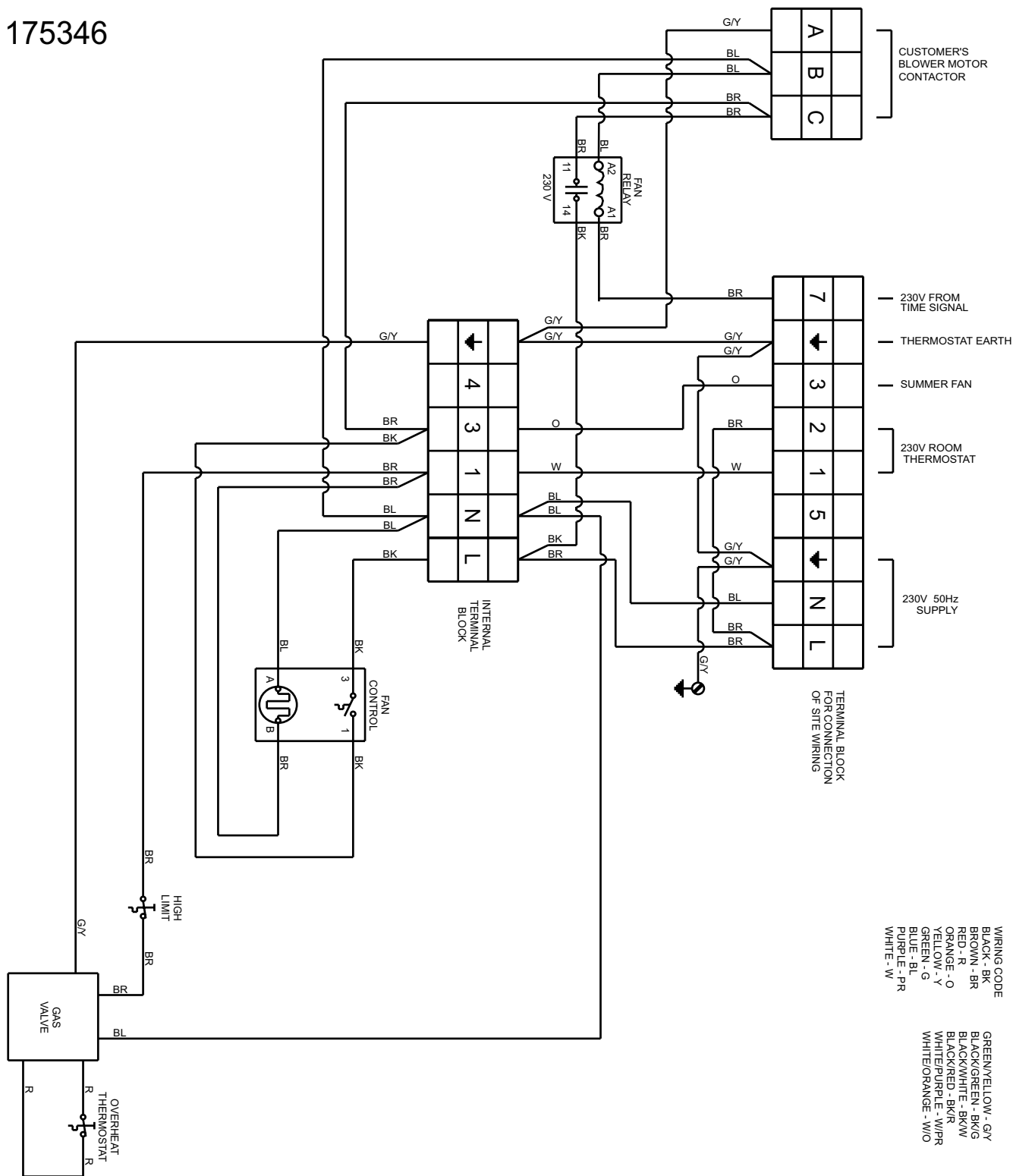
# 9.0 CIRCUIT DIAGRAMS (cont'd)

## 9.2 Heater Circuit Diagram

### 9.2.1 Model T with Permanent Pilot and Single-Stage Gas Valve

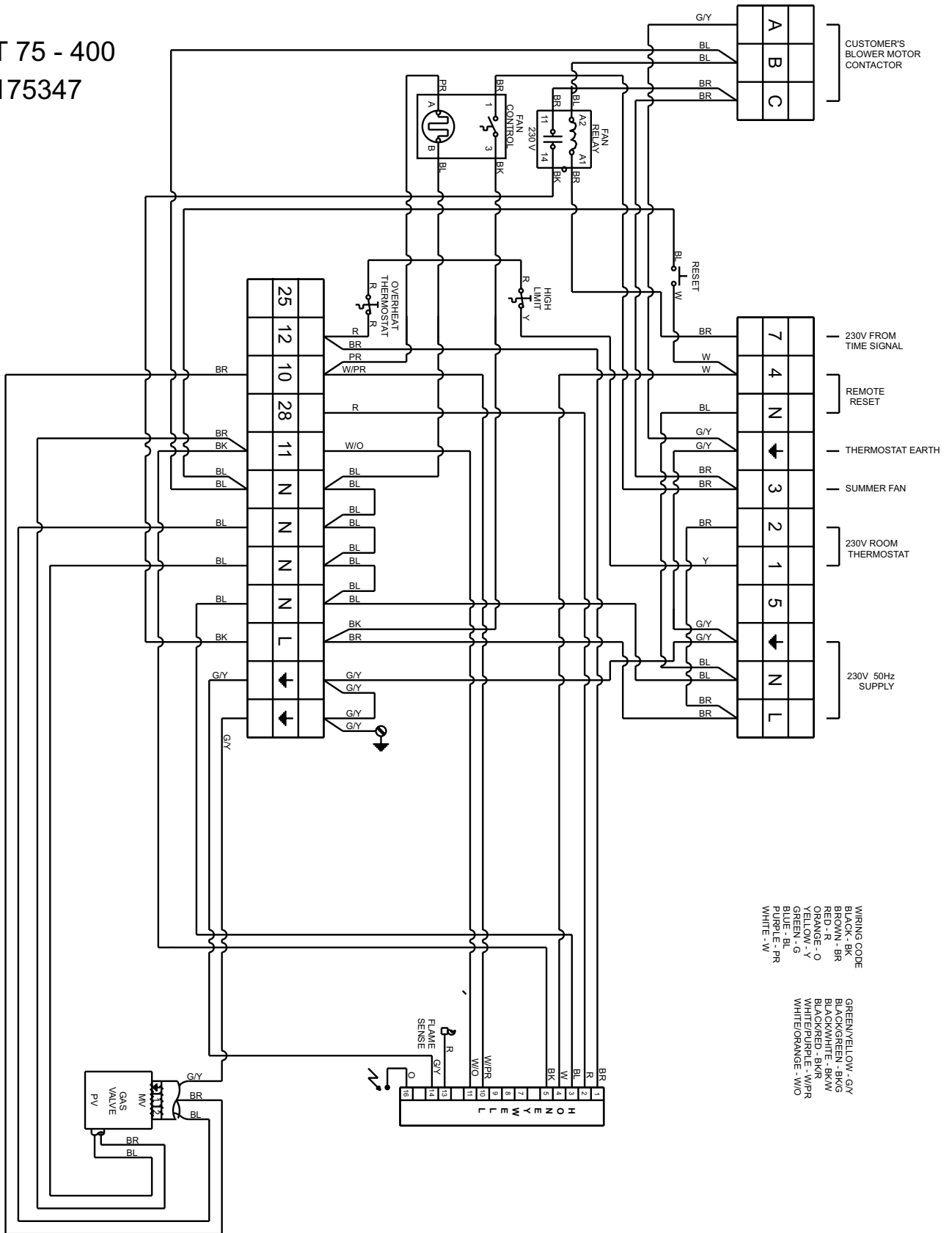
T 75 - 400

175346



### 9.2.2 Model T with Optional Spark Ignition and Single-Stage Gas Valve

T 75 - 400  
175347

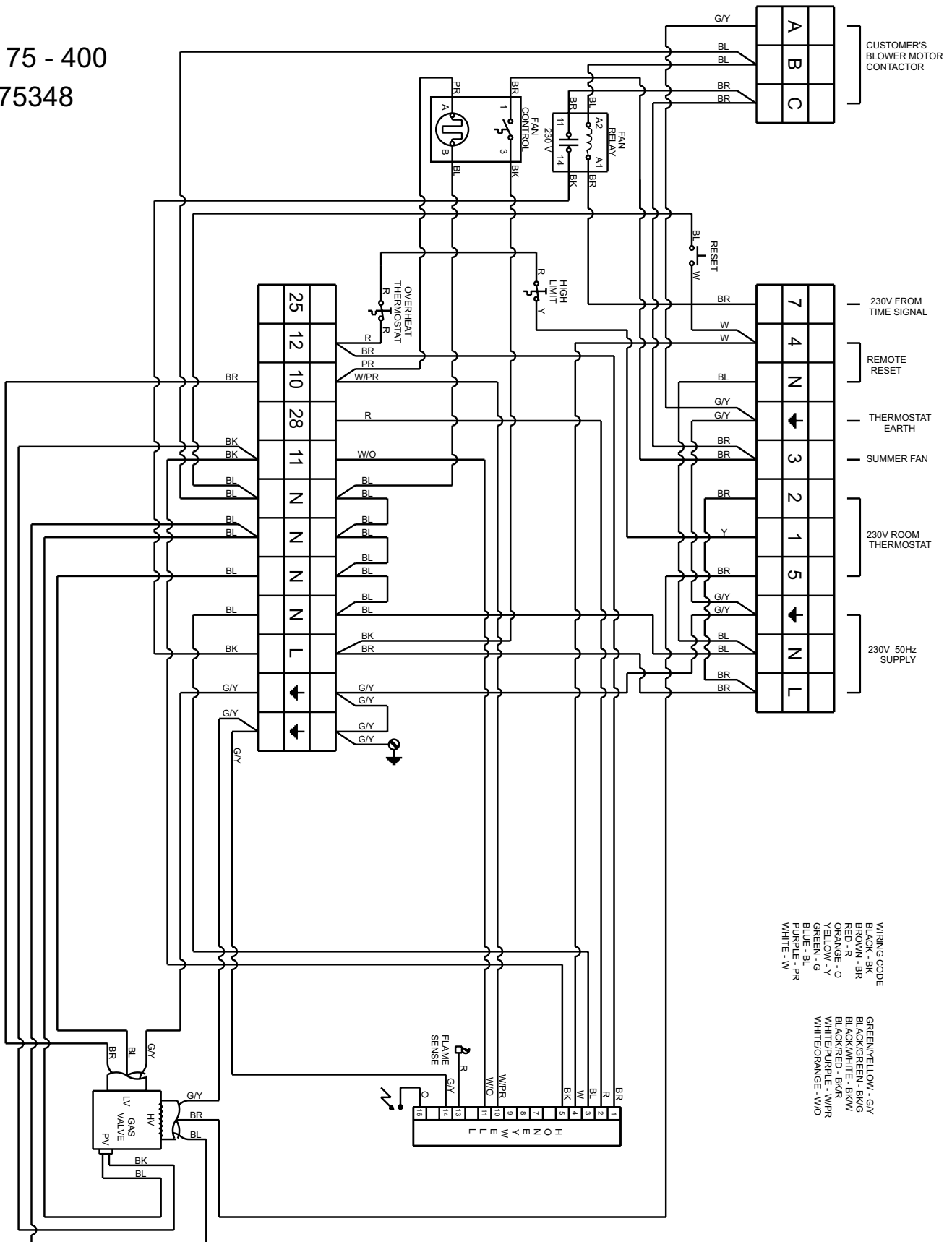


# 9.0 CIRCUIT DIAGRAMS (cont'd)

## 9.2 Heater Circuit Diagram

### 9.2.3 Model T with Optional Spark Ignition and Optional Two-Stage Gas Valve

T 75 - 400  
175348



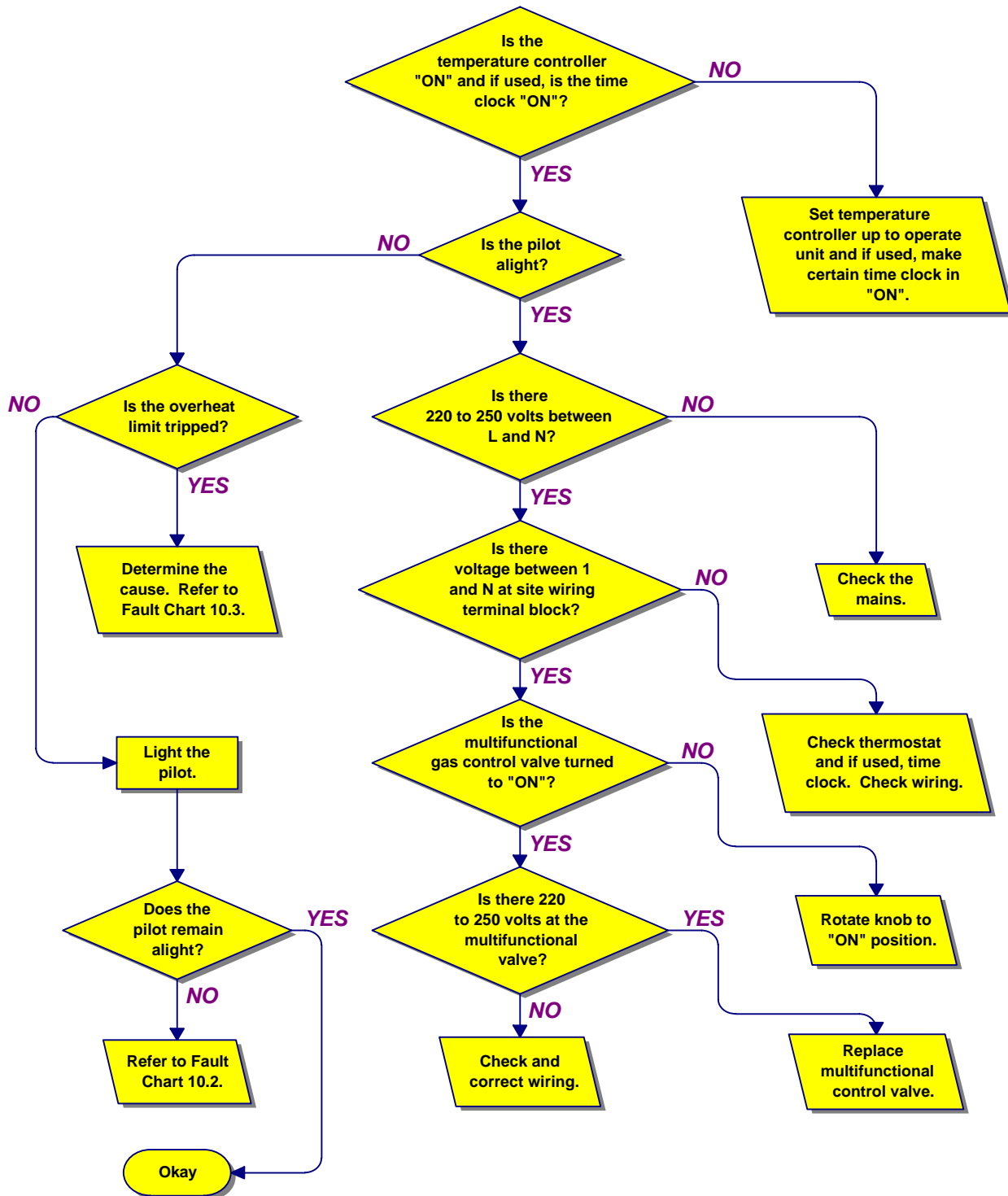


# 10.0 FAULT FINDING CHARTS

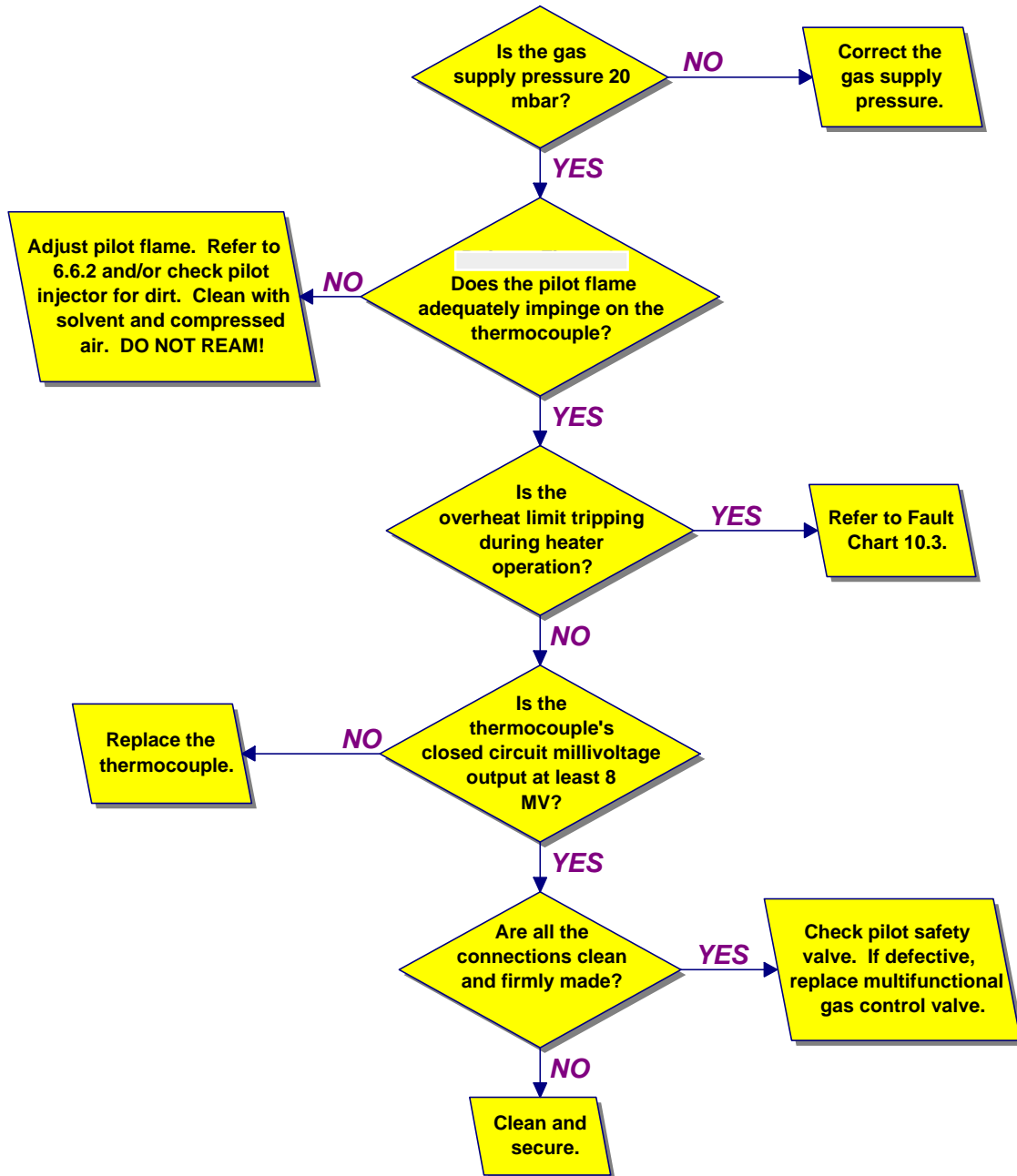
## 10.1 Main Fault Finding Chart

Applies to Model T with a Standard Permanent Pilot

**WARNING:** All fault finding should only be carried out by a competent service engineer.

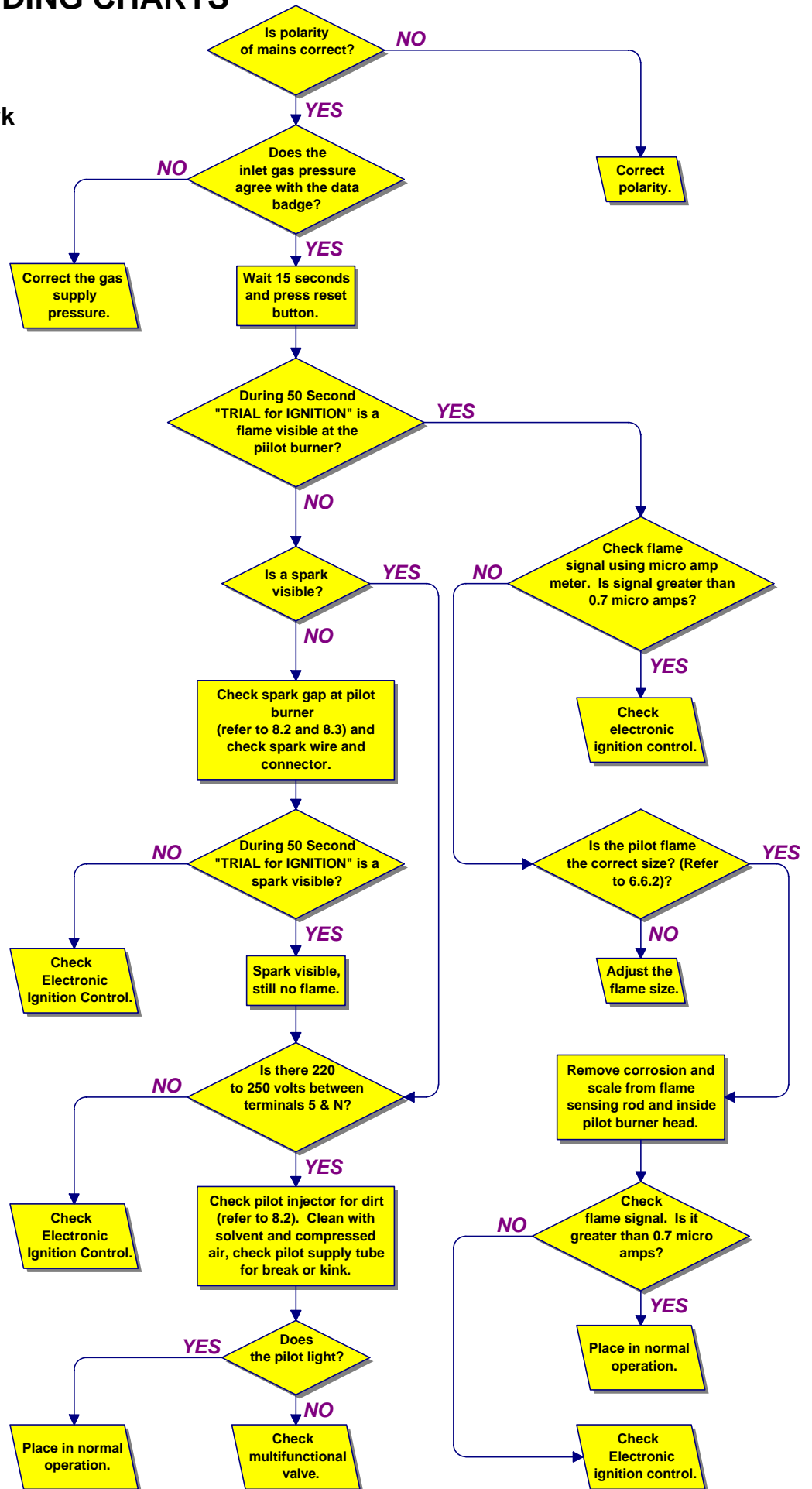


## 10.2 .1 Permanent Pilot Does not Remain Alight



# 10.0 FAULT FINDING CHARTS (cont'd)

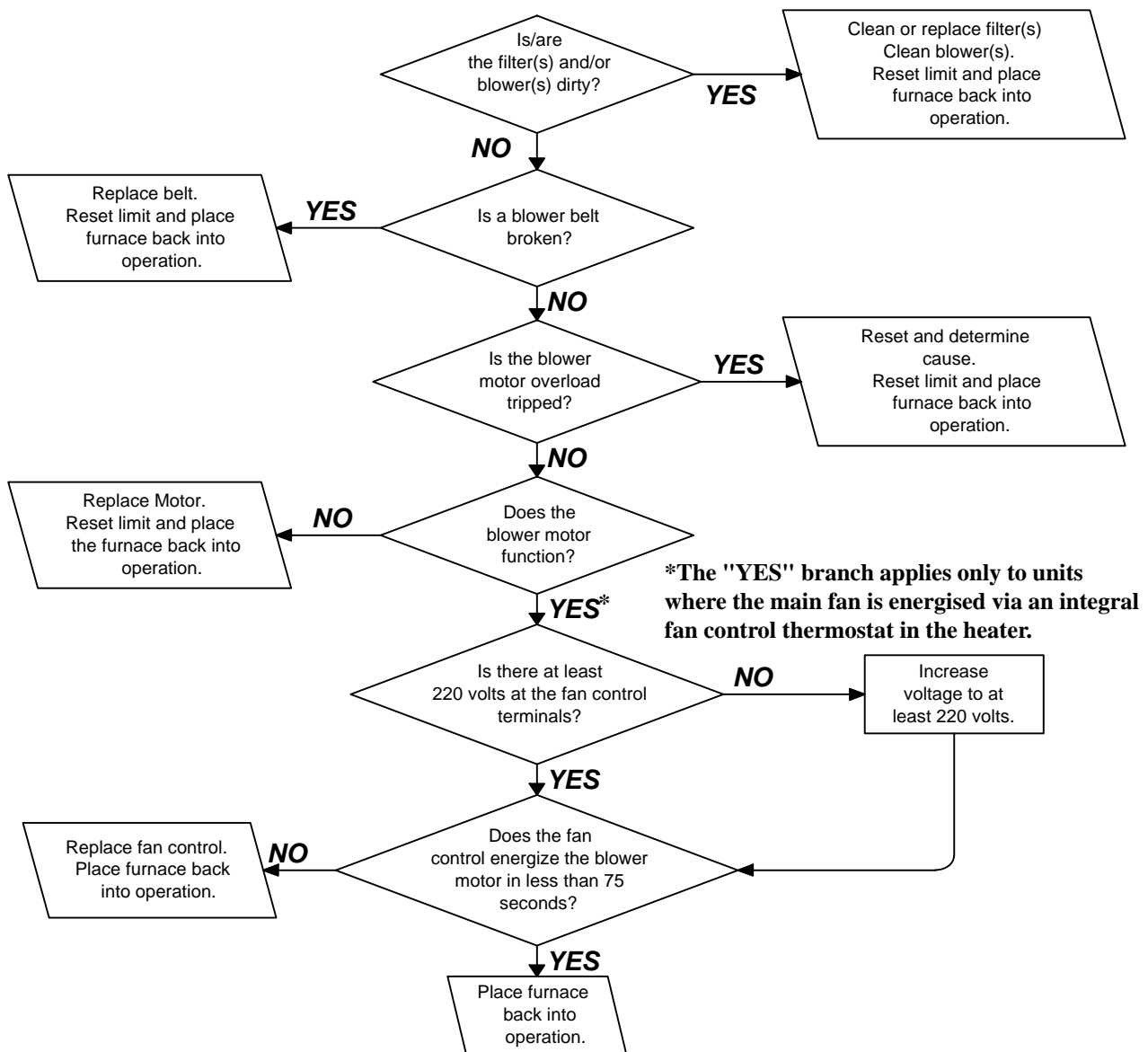
## 10.2.2 Heater with Optional Spark Ignition -- Ignition Controller Repeatedly Locks Out



### 10.3 Limit Control Fault Finding Chart (Limit Control Trips)

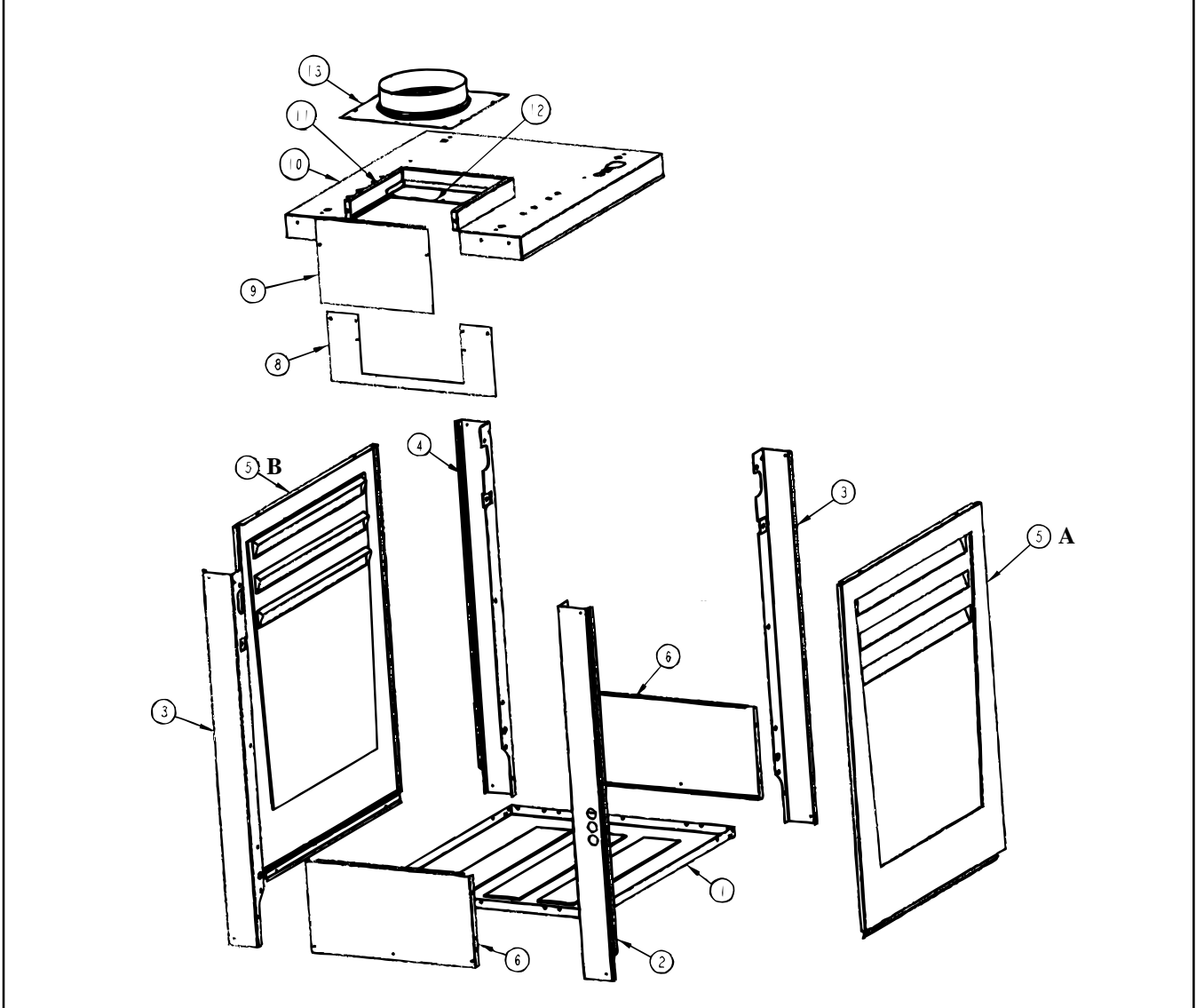
**NOTE:** Interruption of the main electrical supply to the air supply fan when the heater is in operation may cause the limit control to trip. Check that the supply is not being interrupted incorrectly by (a) Incorrect wiring of the time clock; (b) Fire alarm systems, etc.; or (c) Isolation of main feed to the building.

**Fault finding chart assumes that the furnace has been in service and operating correctly.**



# 11.0 EXPLODED DIAGRAMS

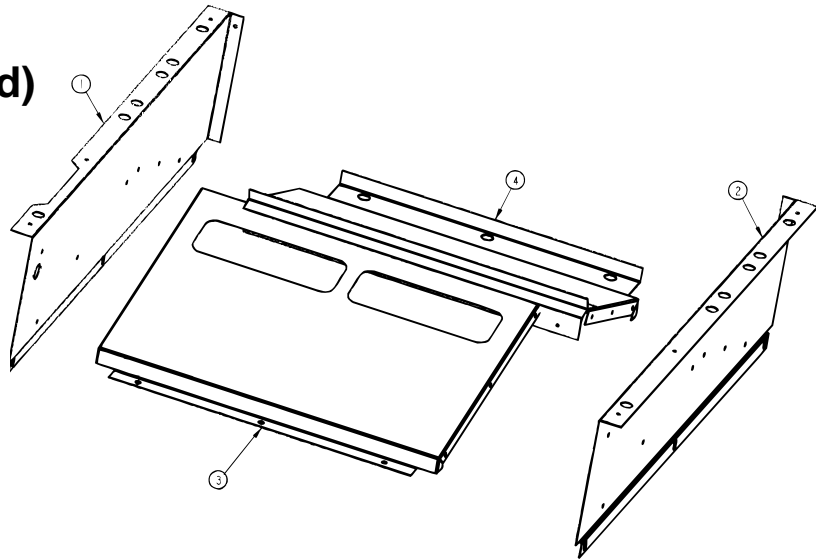
## 11.1 Standard Heater Cabinet Parts



Item No.	Description	Qty	75	100	125	150	175	200	225	250	300	350	355	400	
1	Bottom Pan	Aluminized	1	15244	15244	15248	14618	14618	14624	14624	14625	14625	15249	14632	14632
		Stainless Steel	1	--	15978	26167	15979	15979	15980	15980	15981	15981	26168	15982	15982
2	Rear Corner Leg w/Wire Access Holes	1	11004	11004	11004	11004	11004	11006	11006	11006	11006	11006	11006	11006	
3	Right Front/Left Rear Corner Leg	2	10310	10310	10310	10310	10310	10312	10312	10312	10312	10312	10312	10312	
4	Left Front Corner Leg	1	10309	10309	10309	10309	10309	10311	10311	10311	10311	10311	10311	10311	
5A	Casing Side Panel - Control Side (with hanger flange)	1	144870	144870	144870	144870	144870	144871	144871	144871	144871	144871	144871	144871	
5B	Casing Side Panel - for side opposite controls	1	9853	9853	9853	9853	9853	9547	9547	9547	9547	9547	9547	9547	
6	Bottom Front and Rear Panel	2	9926	9926	9889	9850	9850	9810	9810	9771	9771	9735	9542	9542	
8	Top Back	1	9916	9916	9880	9840	9840	9801	9801	9762	9762	9729	9684	9684	
9	Flue Adapter Back Plate	1	132390	132390	132390	132390	132390	132391	132391	132391	132391	132391	132391	132391	
10	Casing Top Assembly	1	9912	9912	9876	9836	9836	9797	9797	9758	9758	9725	9534	9534	
11	Flue Collar Support	1	132392	132392	132392	132392	132392	132393	132393	132393	132393	132393	132393	132393	
12	Flue Collar Support Hold Down	1	132394	132394	132394	132394	132394	132395	132395	132395	132395	132395	132395	132395	
13	Flue Collar Assembly	1	148084	144634	144635	144636	144636	144637	144637	144637	144639	144639	144639	144639	

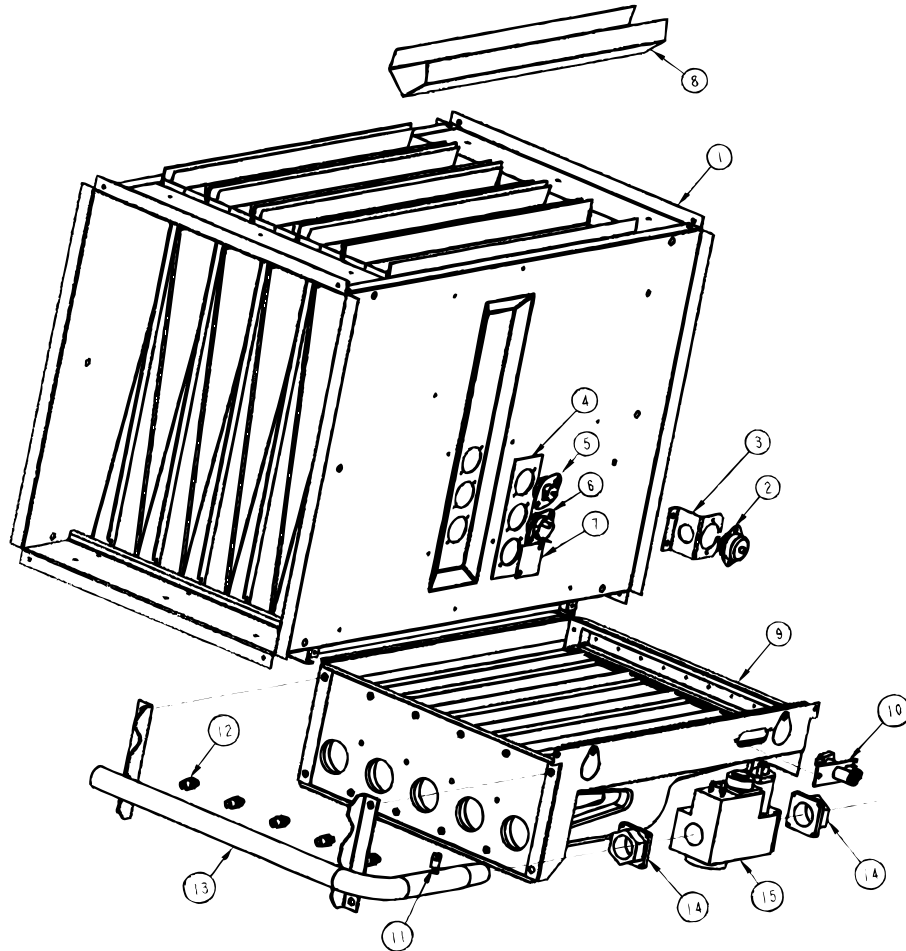
# 11.0 EXPLODED DIAGRAMS (cont'd)

## 11.2 Draft Hood/Inner Cabinet Parts



Item No.	Description	Qty	75	100	125	150	175	200	225	250	300	350	355	400
1	Draft Hood Left Side	1	85808	85808	85808	85808	85808	85808	85808	85808	85808	85808	85808	85808
2	Draft Hood Right Side	1	85807	85807	85807	85807	85807	85807	85807	85807	85807	85807	85807	85807
3	Draft Hood Rear Baffle	1	85778	85778	85782	85786	85786	85790	85790	85793	85793	85796	85799	85799
4	Draft Hood Front Baffle	1	85803	85803	85536	85804	85805	67699	17486	67701	17507	17525	17540	67044

## 11.3 Heat Exchanger and Burner Rack



Item No.	Description	Qty	75	100	125	150	175	200	225	250	300	350	355	400	
1	Heat Exchanger Assembly	Aluminized	1	145496	145496	145497	145498	145498	145499	145499	145500	145500	145501	145502	145502
		321 Stainless	1	145513	145513	145514	145515	145515	145516	145516	145517	145517	145518	145519	145519
		409 Stainless	1	145506	145506	145507	145508	145508	145509	145509	145510	145510	145511	145512	145512
2	Limit Control w/Capillary Tube	1	134808	134808	134808	134808	134808	134808	134808	134808	141749	141749	141749	141749	141749
3	Limit Control Bracket	1	141676	141676	141676	141676	141676	141676	141676	141676	141676	141676	141676	141676	141676
4	Control Gasket	1	17083	17083	17083	17083	17083	17083	17083	17083	17083	17083	17083	17083	17083
5	High Limit Switch	1	112752	112752	112752	112752	112752	112752	112752	112752	112752	112752	112752	112752	112752
6	Fan Control	1	141750	141750	141750	141750	141750	141750	141750	141750	141750	141750	141750	141750	141750
7	Patch Plate	1	9814	9814	9814	9814	9814	9814	9814	9814	9814	9814	9814	9814	9814
8	Tube Baffle		85727	85727	85727	85727	85727	85727	85727	85727	85727	85727	85727	85727	85727
		*	(4)	(5)	(5)	(7)	(7)	(9)	(9)	(12)	(12)	(14)	(16)	(16)	
9	Burner Rack Assembly	Aluminized	1	40573	40573	40574	40575	40575	40576	40576	40577	40577	40578	40579	40579
		409 Stainless	1	—	128642	128643	128644	128644	128645	128645	128646	128646	128647	128648	128648
10	Pilot Burner	1	144599	144599	144599	144599	144599	144599	144599	144599	144599	144599	144599	144599	144599
	Thermocouple	1	125835	125835	125835	125835	125835	125835	125835	125835	125835	125835	125835	125835	125835
11	Pipe Plug	1	142665	142665	142665	142665	142665	142666	142666	142666	142666	142666	142666	142666	142666
12	Main Orifices	Natural Gas	*	11792	11792	84437	11833	84437	11828	84437	11833	84437	84437	84437	84437
			(4)	(5)	(5)	(7)	(7)	(9)	(9)	(12)	(12)	(14)	(16)	(16)	
		Propane Gas	*	63003	61652	61652	97360	61652	146090	61652	97360	61652	61652	97360	61652
		(4)	(5)	(5)	(7)	(7)	(9)	(9)	(12)	(12)	(14)	(16)	(16)		
13	Manifold	1	141761	141761	141762	141763	141763	141764	141764	141765	141765	141766	141767	141767	
14	Flange	2	--	--	--	--	--	--	134809	133913	133913	133913	133913	133913	
	O-Ring	2	--	--	--	--	--	--	--	125842	125842	125842	125842	125842	
15	Gas Valve - Permanent Pilot	1	113766	113766	113766	113766	113766	113766	113766	113766	113766	113766	113766	113766	
	Gas Valve - Spark Pilot	1	134778	134778	134778	134778	134778	134779	134779	134779	134779	134779	134779	134779	
	Gas Conversion Kit - to propane	1	146469	146118	146119	146120	146121	146122	146123	146124	146125	146126	146127	146128	

\*Quantity in parenthesis

## 12.0 SHORT LIST OF PARTS

A "replacement parts tag" listing the most common replacement parts is affixed to the rear of the heater. Each tag is "custom made" for that particular size and style of heater.

Component	SIZE												
	75	100	125	150	175	200	225	250	300	350	355	400	
Permanent Pilot Burner Assembly including Injector	144599	144599	144599	144599	144599	144599	144599	144599	144599	144599	144599	144599	144599
Thermocouple	125835	125835	125835	125835	125835	125835	125835	125835	125835	125835	125835	125835	125835
Spark Ignition Pilot Burner Assembly including Injector	144900	144900	144900	144900	144900	144900	144900	144900	144900	144900	144900	144900	144900
Ignition Controller	145714	145714	145714	145714	145714	145714	145714	145714	145714	145714	145714	145714	145714
Fan Control	141750	141750	141750	141750	141750	141750	141750	141750	141750	141750	141750	141750	141750
Limit Control with Capillary	134808	134808	134808	134808	134808	134808	134808	134808	141749	141749	141749	141749	141749
High Limit Control	112752	112752	112752	112752	112752	112752	112752	112752	112752	112752	112752	112752	112752
Reset Switch	121925	121925	121925	121925	121925	121925	121925	121925	121925	121925	121925	121925	121925
Injector - Main (G20 Gas)	11792	11792	84437	11833	84437	11828	84437	11833	84437	84437	84437	84437	84437
	(4)	(4)	(5)	(7)	(7)	(9)	(9)	(12)	(12)	(14)	(16)	(16)	
Injector - Main (G31 Gas)	61652	61652	61652	97360	61652	11834	61652	97360	61652	61652	97360	61652	
	(4)	(4)	(5)	(7)	(7)	(9)	(9)	(12)	(12)	(14)	(16)	(16)	
Gas Control Valve - Standard Single Stage, Permanent Pilot	113766	113766	113766	113766	113766	113766	113766	113766	113766	113766	113766	113766	113766
Gas Control Valve - Optional Single Stage, Spark Ignition	134778	134778	134778	134778	134778	134779	134779	134779	134779	134779	134779	134779	134779
Gas Conversion Kits - Natural to G31 Propane Gas	146469	146118	146119	146120	146121	146122	146123	146124	146125	146126	146127	146128	

Sales & Service by:

# **AMBI-RAD<sup>®</sup>**

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