

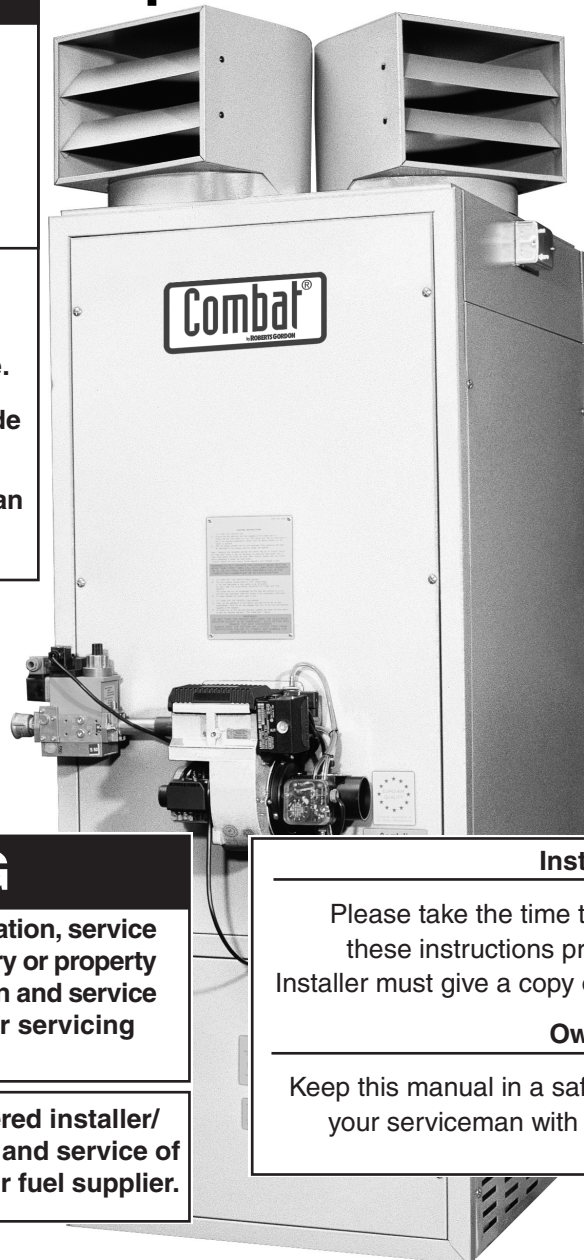
Combat®

Cabinet Heaters

Installation, Commissioning, Operation & Service Manual

**OIL-FIRED:
Model POP-ECA
015 to 0100**

**GAS-FIRED:
Model PGP-ECA
015 to 0100**



FOR YOUR SAFETY

If you smell gas:

1. Open windows.
2. **DO NOT** try to light any appliance.
3. **DO NOT** use electrical switches.
4. **DO NOT** use any telephone in your building.
5. Leave the building.
6. Immediately call your local gas supplier after leaving the building. Follow the gas supplier's instructions.
7. If you cannot reach your gas supplier, call the Fire Department.

⚠ WARNING



Fire Hazard

Do not store or use petrol or other flammable vapours and liquids in the vicinity of this or any other appliance.

Some objects will catch fire or explode when placed close to heater.

Failure to follow these instructions can result in death, injury or property damage.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can result in death, injury or property damage. Read the installation, operation and service manual thoroughly before installing or servicing this equipment.

Installation must be done by a registered installer/contractor qualified in the installation and service of gas/oil-fired heating equipment or your fuel supplier.

Installer

Please take the time to read and understand these instructions prior to any installation. Installer must give a copy of this manual to the owner.

Owner

Keep this manual in a safe place in order to provide your serviceman with necessary information.



Quality in Any Language™

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P/N X523 Rev G 10/08

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Product Approval

ROBERTS GORDON® appliances have been tested and CE certified as complying with the essential requirements of the Gas Appliance Directive, the Low Voltage Directive, the Electromagnetic Compatibility Directive and the Machinery Directive for use with natural gas and LPG when installed, commissioned and maintained in accordance with these instructions.

These instructions refer to gas appliances designed to operate in the European Union.

Appliances designed for other countries (Non-European Union) are available on request.

Oil-fired versions are constructed to the same basic design criteria to burn fuel oil as specified below, but no similar testing is available for these products at the time of writing. Oil-fired appliances should be operated in accordance with local rules and laws.

Oil heaters are supplied as standard for use with Gas Oil, also known as 35-second Oil, Red Diesel, Class D or Class A2. They are also available to order for Kerosine, also known as 28-second Oil or Class C2.

These appliances must be installed in accordance with the local and national codes in force and used only in a sufficiently ventilated space, as specified in these instructions. Before installation, check that the local gas distribution systems, nature of gas and pressure, and adjustment of the appliance are compatible.

SECTION 1: HEATER SAFETY



Your Safety Is Important to Us!
This symbol is used throughout the manual to notify you of possible fire, electrical or burn hazards. Please pay special attention when reading and following the warnings in these sections.

Installation, Service and Annual Inspection of heater must be done by a registered installer/contractor qualified in the installation and service of gas/oil-fired heating equipment.

Read this manual carefully before installation, operation, or service of this equipment. Burner manufacturers manual is also provided to give detailed instructions on the operation of the burner. The settings for use of the burner with the heater are shown in these instructions.

This heater is designed for heating non-residential indoor spaces. Do not install in residential spaces. These instructions, the layout drawing, local codes and ordinances, and applicable standards that apply to gas piping, electrical wiring, venting, etc., must be thoroughly understood before proceeding with the installation.

SECTION 2: INSTALLER RESPONSIBILITY

- To install the heater, as well as the fuel and electrical supplies, in accordance with applicable specifications and codes. Roberts-Gordon recommends the installer contact a local building inspector, Fire Officer or insurance company for guidance.
- To use the information given in this manual together with the local and national codes to perform the installation.
- To install the heater in accordance with the Clearances to Combustibles of this heater.
- To furnish all needed materials not furnished as standard equipment.
- To plan location of supports, flues and air intakes.
- To provide access to burners for servicing.
- To provide the owner with a copy of this installation, commissioning, operation and service manual.
- To never use heater as support for ladder or other access equipment and never hang or suspend anything from heater.
- To ensure that there is sufficient ventilation in the area to comply with the requirements of all relevant local and national codes.

2.1 Clearances to Combustibles

In all situations, clearances to combustibles must be maintained. Caution must be used when running the heater near combustible materials such as wood, paper, rubber, etc. A wall tag is on the back cover of this manual as a permanent reminder of the safety instructions and the importance of the required

clearances to combustibles. Affix the tag on a wall near the heater.

2.2 Corrosive Chemicals

CAUTION

Do not use heater in an area containing corrosive chemicals.

Corrosive chemicals will damage the burner and heat exchanger parts.

Failure to follow these instructions can result in property damage.

Roberts-Gordon cannot be responsible for ensuring that all appropriate safety measures are undertaken prior to installation; this is entirely the responsibility of the installer. It is essential that the contractor, the sub-contractor or the owner identifies the presence of combustible materials, corrosive chemicals or halogenated hydrocarbons* anywhere on the premises.

* **Halogenated Hydrocarbons** are a family of chemical compounds characterized by the presence of halogen elements (fluorine, chlorine, bromine, etc.). These compounds are frequently used in refrigerants, cleaning agents, solvents, etc. If these compounds enter the air supply of the burner, the lifespan of the heater components will be greatly reduced. Warranty will be invalid if the heater is exposed to halogenated hydrocarbons.

2.3 National Standards and Applicable Codes

All appliances must be installed in accordance with the latest revision of applicable standards and local and national codes. This refers also to the electric, gas and venting installation. NOTE: Additional standards for installations in Public Garages, Aircraft Hangars, etc. may be applicable.

The main relevant regulations for installation within the UK are:

- Gas safety (installation and use) regulations, 1984 and amendments - 1996.
- BS6230 - Specification for the installation of gas fired forced convection air heaters for commercial and industrial space heating of rated input exceeding 60kW. (This standard also applies to oil-fired heaters, except for the fuel supply).
- BS6230 - Parts 2 & 3, fire precautions in the design and construction of buildings.
- BS6891 - Low pressure installation pipes.
- BS5410 - Codes of practice for oil firing. Part 2 installation of 44 kW and above output capacity for space heaters, hot water and steam supply purposes.
- Institute of Gas Engineers document IGE/UP/2.
- Building regulations.
- IEE regulations.
- Health and safety at work acts.
- Requirements of local authority, fire officer and insurance company.

SECTION 3: CRITICAL CONSIDERATIONS

3.1 Basic Information

Cabinet heaters are supplied with burners suitable for on/off operation as standard. As an option, oil-fired burners are available with two-stage operation and gas-fired burners are available with full modulation.

3.2 Location and Suspension

All models:

- Are designed to be installed indoors within the heated space. Special versions are available for installation outdoors.
- Are designed for floor standing vertical installation.
- Must be installed in a manner which allows all the upper panels and either of the lower side panels to be removed to provide access to all serviceable components.
- Must be placed on a firm, level, non-combustible surface that can support its weight. See *Page 5, Section 4.1* for weight details.

Horizontal models:

- Special versions supplied with steel channels to support the heater are available and may be mounted horizontally. When installed horizontally, the heater will normally lie on its left side when viewed from the burner. The same clearances and comments on panels must be used, except for the side the heater lies on.

3.3 Minimum Required Installation Clearances

Clearances around the heater and flue must be as indicated on *Page 4, Figure 1* and *Page 13, Figure 4 through Figure 5* to ensure access for servicing, and correct operation.

3.4 Clearances to Combustibles

Clearances must be as indicated on *Page 4, Figure 1*. If no clearances to combustibles are indicated, then installation clearances apply.

3.5 Ventilation

It is important to ensure adequate air circulation around the heater to supply air for combustion, ventilation and distribution in accordance with local and national codes.

3.6 Fuel Supply

It is important that the fuel supply pipe is sized correctly to provide the inlet pressure as stated on the heater data plate. The fuel supply pipe and electrical connections must not support any of the heater's weight.

3.7 Electrical Supply

A permanent 230 V, 50 Hz, 1 Ø is required on models 15 to 30 and 400 V, 50 Hz, 3 Ø and neutral required on models 40 to 100 (special version PGP and POP 040 and 050 models are available as belt drive). The heater also requires suitable energy controls in accordance with *Section 9*. ON/OFF control, temperature control, time control, and frost protection are available as a remote control, which needs to be site wired for proper operation of the heater. Alternatively, any remote energy controls may be used which must be wired in accordance with *Section 9.3 through Section 9.10*.

3.8 Flue

Choose heater siting to allow for the proper location of the flue. Each heater must be fitted with an individual and correctly sized sealed flue system (See *Page 13, Section 6*).

⚠ WARNING



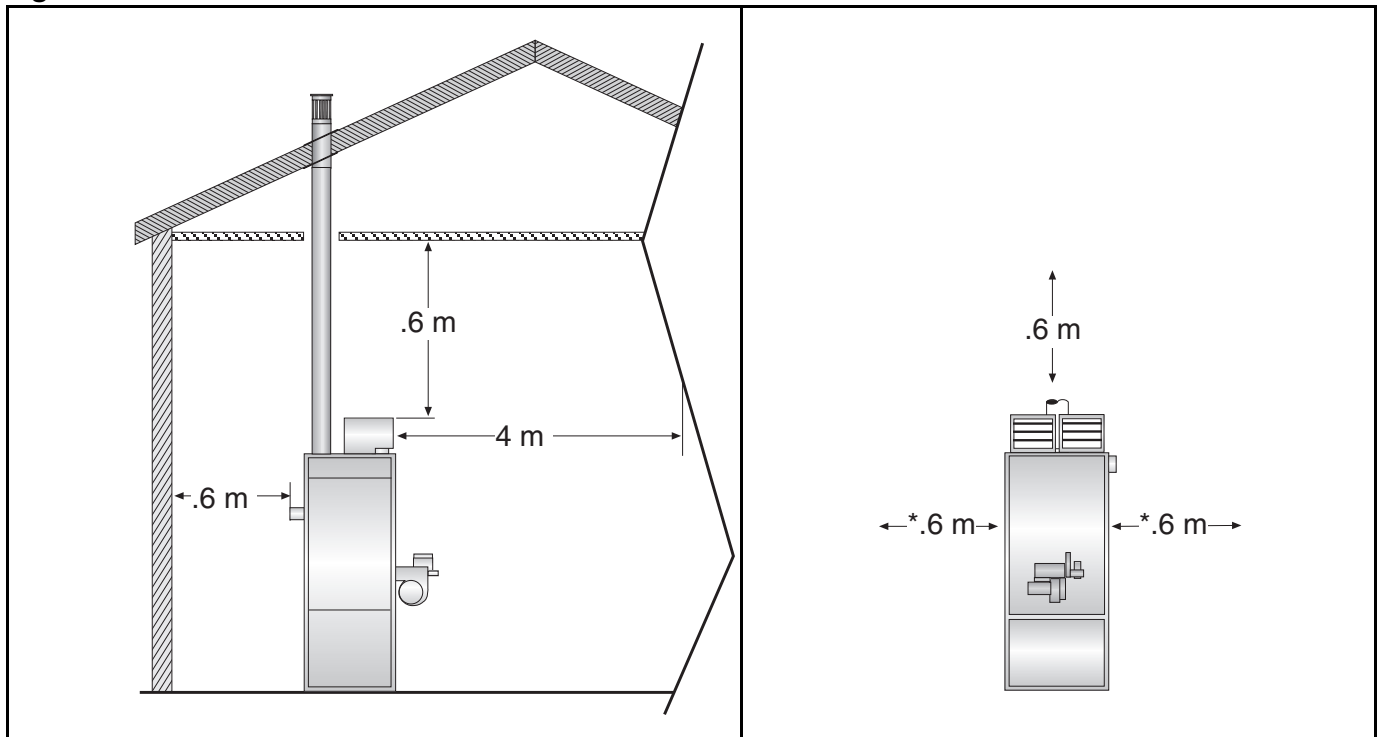
Fire Hazard

Some objects will catch fire or explode when placed close to heater.

Keep all flammable objects, liquids and vapours the required distance away from the heater.

Failure to follow these instructions can result in death, injury or property damage.

Figure 1: Installation Clearances and Clearances to Combustibles



The flue pipe must have clearance from combustibles by 5 cm.

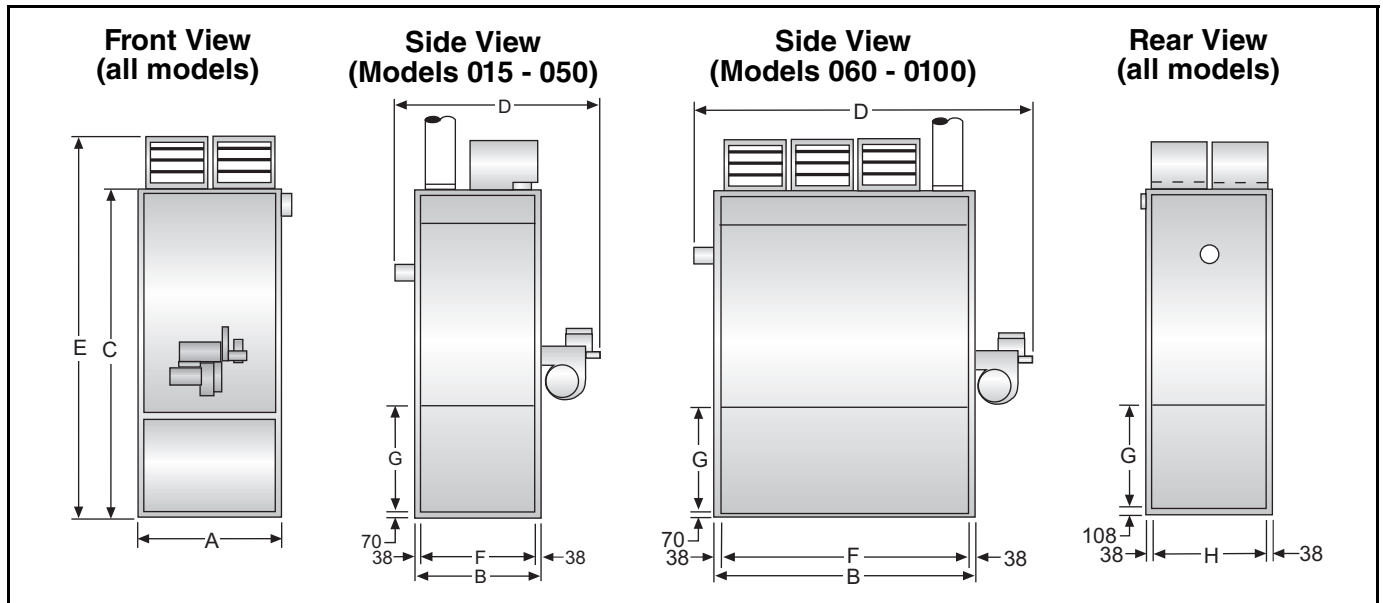
If installed where individuals can come in contact with the pressure relief door or other hot components, adequate guarding must be provided.

All distances are minimum clearance requirements for service access, air flow and safety.

*A service clearance of 1m is required on one side to allow for fan replacement.

SECTION 4: SPECIFICATIONS

4.1 PGP & POP Internal Heaters



Dimension Data - PGP & POP Internal Heaters

		Model	015/020	030	040	050	060/070/080	0100
A	Width	mm (in)	724 29	724 29	857 34	1016 40	1016 40	1016 40
B	Depth, Cabinet Only	mm (in)	857 34	857 34	857 34	1016 40	1676 66	1994 79
C	Height, Cabinet Only	mm (in)	1740 69	1740 69	1930 76	1930 76	1930 76	1930 76
D	Depth, Overall	mm (in)	1267 50	1267 50	1337 53	1496 59	2156 85	2496 98
E	Height, Including Heads	mm (in)	1988 78	2058 81	2235 88	2235 88	2235 88	2235 88
F	Left/Right Air Inlet Spigot - Depth	mm (in)	781 31	781 31	781 31	940 37	1600 63	1918 76
G	Left/Right Air Inlet Spigot - Height	mm (in)	457 18	457 18	560 22	560 22	560 22	559 22
H	Rear Air Inlet Spigot - Depth	mm (in)	648 26	648 26	781 31	781 31	NA	NA
J	Rear Air Inlet Spigot - Height	mm (in)	361 14	361 14	446 18	446 18	NA	NA
	Flue Diameter*	mm (in)	178 7	178 7	178 7	178 7	229 9	229 9
	Weight	kg	200	200	245	270	440	530

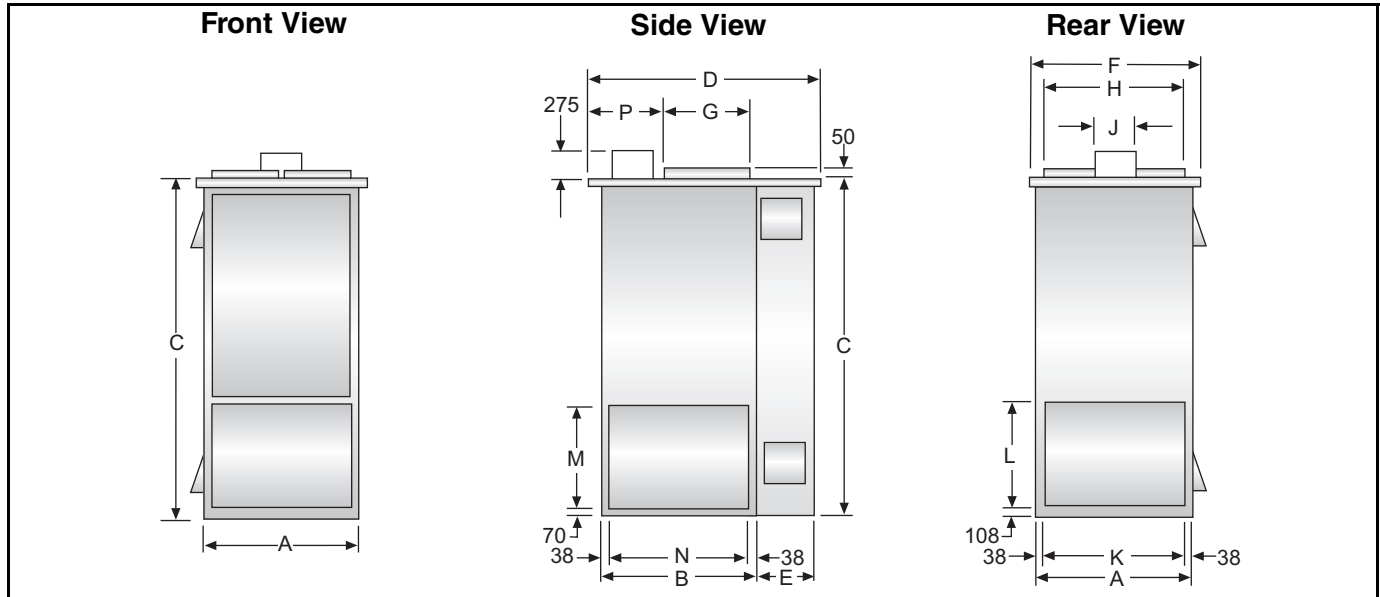
NOTES: Horizontal cabinet heaters are designed to lie on their left side as standard.

For vertical models, add 54 mm (2 in) to the right side of the cabinet for the fan/limit thermostat.

For horizontal models, add 54 mm (2 in) to the top of the cabinet for the fan/limit thermostat.

*All heaters must be connected to a suitable flue constructed of single wall stainless steel.

4.2 PGP & POP External Heaters



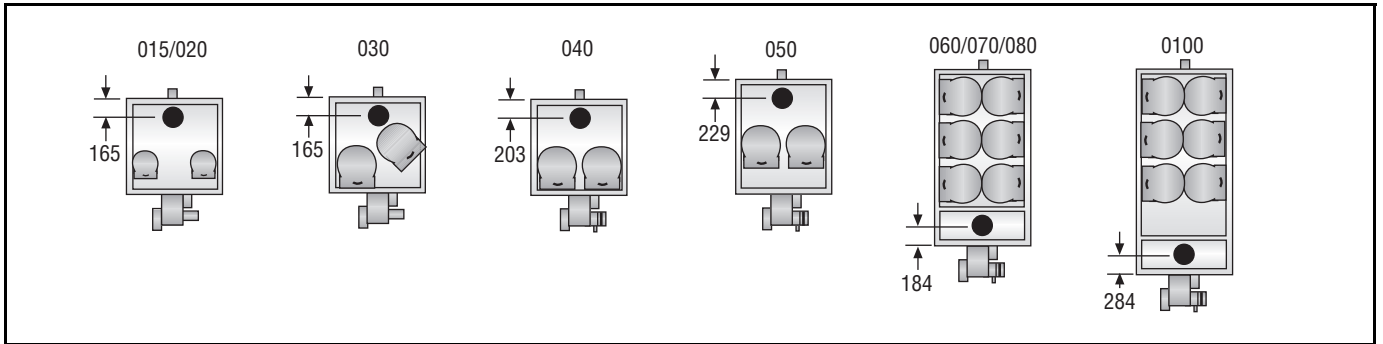
Dimension Data - PGP & POP External Heaters

		Model	015/020/030	040	050	060/070/080	0100
A	Width	mm (in)	724 29	857 34	857 34	1016 40	1016 40
B	Depth, Cabinet Only	mm (in)	857 34	857 34	1016 40	1676 66	1994 79
C	Height, Cabinet Only	mm (in)	1740 69	1930 76	1930 76	1930 76	1930 76
D	Depth Overall	mm (in)	1396 55	1498 59	1657 65	2483 98	2800 110
E	External Heater Housing	mm (in)	373 15	474 19	474 19	639 25	639 25
F	Width Overall	mm (in)	840 33	973 38	973 38	1132 45	1132 45
G	Air Outlet Spigot - Depth	mm (in)	476 19	476 19	610 24	1238 49	1524 60
H	Air Outlet Spigot - Width	mm (in)	648 26	781 31	781 31	940 37	940 37
J	Flue Diameter	mm (in)	178 7	178 7	178 7	229 9	229 9
K	Rear Return/Fresh Air Inlet - Width	mm (in)	648 26	781 31	781 31	NA	NA
L	Rear Return/Fresh Air Inlet - Height	mm (in)	178 7	178 7	178 7	229 9	229 9
M	Left/Right Return Fresh Air Inlet - Height	mm (in)	457 18	560 22	560 22	560 22	560 22
N	Left/Right Return Fresh Air Inlet - Width	mm (in)	781 31	781 31	940 37	1600 63	1918 76
P	Rear of Heater to Air Outlet Spigot*	mm (in)	401 16	401 16	426 17	96 4	96 4

NOTE: *For Models 060-0100, the circular flue spigot is at the front of the heater, with the rectangular air outlet spigot at the rear. COMBAT® external cabinet heaters are designed to be sited externally, with heat ducted into the building. These models are fitted with a special metal rain drip cover, and all cabinet joints are silicone sealed to ensure that the heaters are weatherproof.

4.3 Air Outlet and Flue Arrangements

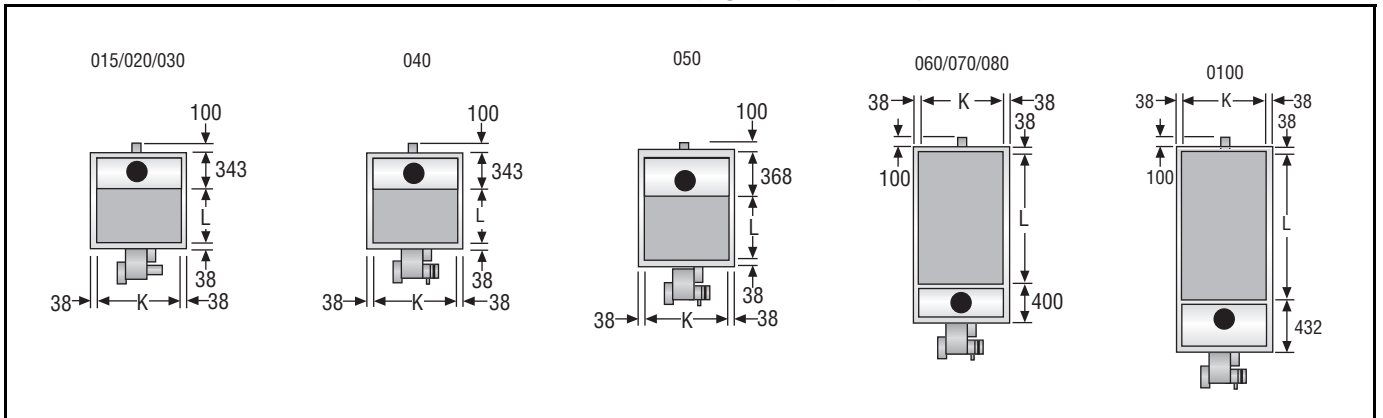
4.3.1 Vertical and Horizontal Heaters - Free Blowing (top view)



NOTE: Models 015-020 are fitted with 229 mm (9") diameter discharge heads as standard.

Models 030-0100 are fitted with 356 mm (14") diameter discharge heads as standard.

4.3.2 Vertical and Horizontal Heaters - Air Outlet Spigots (top view)



Outlet Spigot Dimensions

		Model	015/020/030	040	050	060/070/080	0100
K	Spigot width	mm (in)	648 26	781 31	781 31	940 37	940 37
L	Spigot Depth	mm (in)	476 19	476 19	610 24	1238 49	1524 60

4.4 General Technical Data Table (all models)

Appliance Category II _{2H/L 3B/P}

Model		015	020	030	040	050	060	070	080	0100	
Electrical Supply*		230 V / 50 Hz / 1 Ø					400 V / 50 Hz / 3 Ø				
Main Fan Motor Type		Direct Drive					Belt Drive				
Motor Size	(kW)	0.75			2.2		1.5		2.2		4.0
Motor Pulley	(PCD)	NA					2 A x 80 mm	2 A x 95 mm		2 A x 106 mm	
Fan Pulley	(PCD)	NA					2 A x 180 mm	2 A x 180 mm	2 A x 180 mm	2 A x 180 mm	
Start Current	(Amps)	24	24	28	21	21	10.2	30	30	35	
Run Current	(Amps)	5.3	5.3	6.3	6.2	6.2	3.5	5.1	5.1	9.6	
Airflow	(m³/h)	3398	3398	5097	6796	8495	11044	12443	12443	17330	
Free Blowing	(ft³/min)	2000	2000	3000	4000	5000	6500	7500	7500	10200	

NOTE: *Models 40 & 50 are available with 230 V 1 Ø electrical supply as an extra cost option.
A permanent uninterrupted electrical supply is required for all models.

When reading the following data tables, ensure that you are using the correct table for the burner and gas valve installed. The data tables include a burner reference letter that can be found on the heater data plate. Refer to the burner manufacturer's instructions and the specific instructions supplement where applicable. The burner settings shown in the instructions must be used for burner settings.

4.5 Technical Data - Ecoflam ON/OFF Burners (all models - burner reference "C")

Model		015	020	030	040	050	060	070	080	0100	
Gross Heat Input	(kW) (Btu/h) x (1000)	55.5 189.4	73.3 250.1	93.2 318.0	129.9 443.2	162.0 552.7	208.0 709.7	242.0 825.7	275.2 939.0	348.5 1189.1	
Net Heat Input	(kW) (Btu/h) x (1000)	50.0 170.6	66.0 225.2	84.0 286.6	117.0 399.2	146.0 498.2	187.4 639.4	218.0 743.8	248.0 846.2	314.0 1071.4	
Heat Output	(kW) (Btu/h) x (1000)	47.4 161.7	61.2 208.8	78.4 267.5	110.2 376.0	134.5 458.9	177.7 606.3	205.3 700.5	230.4 786.1	293.4 1001.1	
Pressure Switch Setting	(mbar)	1.5		4.5	4.0	6.5	5.0	6.5	7.5	7.0	
Flue Static Pressure	(mbar)	-0.05	-0.05	-0.09	-0.30	-0.05	-0.25	-0.17	0.10	0.45	
Gas Connection	(in)	3/4"					1 1/4"				
Natural Gas (G20) Data - Inlet Pressure 20 mbar (7.8 in WG) Min 17 mbar (6.8 in WG) Max 25 mbar (10 in WG)											
Main Burner Gas Pressure	mbar	4.0	2.7	4.2	4.8	7.7	5.2	7.1	9.5	10.0	
Start Gas Pressure	mbar	NA	NA	NA	1.8	2.8	0.9	1.1	1.7	3.4	
Gas Rate	(m³/h) (ft³/h)	5.3 187	7.0 247	8.9 314	12.4 438	15.4 546	19.8 701	23.1 816	26.2 928	33.2 1175	
Start Gas Orifice	(mm dia)				5.0	6.0	7.0	7.0	7.0		
Burner Type		AZUR 60	BLU 120	BLU 120	BLU 170	BLU 250R	BLU 250	BLU 250	BLU 250S	BLU 350	
Burner Head		S	S	S	S	S	S	S	S	S	
Burner Head Setting	(mm)	0	10	11	15	14	24	24	24	21	
Air Setting		2.6	4.2	6	2.2	3.5	2.9	3.6	1.4	1.6	
Valve Type Main Gas		MBDLE 405			MBDLE 407	MBDLE 410				MBDLE 412	
Valve Type Start Gas		NA					S.I.T. 0 832 051				
LPG Gas Propane (G31) Data - Inlet Pressure 37 mbar (14.6 in WG) Min 25 mbar (10 in WG) Max 45 mbar (18 in WG)											
Main Burner Gas Pressure	mbar	4.2	3.3	4.6	4.8	7.5	5.8	7.8	12.0	7.6	
Start Gas Pressure	mbar	NA	NA	NA	1.6	2.5	0.8	1.0	1.5	3.1	
Gas Rate	(m³/h) (kg/h)	2.1 3.9	2.8 5.1	3.5 6.5	4.9 9.1	6.1 11.3	7.8 14.5	9.1 16.9	10.4 19.2	13.1 24.3	
Start Gas Orifice	(mm dia)				5.0	6.0	7.0	7.0	7.0		
Main Gas Orifice	(mm dia)	8.5	10.0	10.0	14.5	14.5	14.5	14.5	14.5		
Burner Type		AZUR 60 AH	BLU 120 AH	BLU 120 AH	BLU 170 AH	BLU 250R AH	BLU 250 AH	BLU 250 AH	BLU 250S AH	BLU 350 AH	
Burner Head		S	S	S	S	S	S	S	S	LPG	
Burner Head Setting	(mm)	0	10	13	15	14	24	24	24	20	
Air Setting		3.0	4.8	6.6	2.6	4.5	3.1	4.2	1.6	1.8	
Valve Type Main Gas		MBDLE 405			MBDLE 407	MBDLE 410				MBDLE 412	
Valve Type Start Gas		NA					S.I.T. 0 832 051				

NOTE: For adjustment of head setting, see Ecoflam Instructions

4.6 Technical Data - Ecoflam Modulating Burners (all models - burner reference "H")

Model		015	020	030	040	050	060	070	080	0100
Maximum Gross Heat Input	(kW) (Btu/h) x (1000)	55.5 189.4	73.3 250.1	93.2 318.0	129.9 443.2	162.0 552.7	208.0 709.7	242.0 825.7	275.2 939.0	348.5 1189.1
Maximum Net Heat Input	(kW) (Btu/h) x (1000)	50.0 170.6	66.0 225.2	84.0 286.6	117.0 399.2	146.0 498.2	187.4 639.4	218.0 743.8	248.0 846.2	314.0 1071.4
Minimum Gross Heat Input	(kW) (Btu/h) x (1000)	38.9 132.7	51.3 175.0	65.2 222.5	90.9 310.2	113.4 386.9	145.6 496.8	169.4 578.0	192.6 657.2	244.0 832.5
Minimum Net Heat Input	(kW) (Btu/h) x (1000)	35.0 119.4	46.2 157.6	58.8 200.6	81.9 279.5	102.2 348.7	131.2 447.7	152.6 520.7	173.6 592.3	219.8 750.0
Maximum Heat Output	(kW) (Btu/h) x (1000)	47.4 161.7	61.2 208.8	78.4 267.5	110.2 376.0	134.5 458.9	177.7 606.3	205.3 700.5	230.4 694.0	293.4 1001.1
Minimum Heat Output	(kW) (Btu/h) x (1000)	33 113	43 147	55 188	77 263	94 321	124 423	144 491	161 549	205 699
Pressure Switch Setting	(mbar)	1.5			1.0	1.5			2.0	2.5
Flue Static Pressure	(mbar)	-0.05	-0.05	-0.09	-0.30	-0.05	-0.25	-0.17	0.10	0.45
Gas Connection	(in)	3/4"				1 1/4"				
Natural Gas (G20) Data - Inlet Pressure 20 mbar (7.8 in WG) Min 17 mbar (6.8 in WG) Max 25 mbar (10 in WG)										
Main Burner Gas Pressure	(mbar)	4.9	2.4	3.3	4.1	6.7	5.2	6.7	8.0	8.6
Min. Burner Gas Pressure	(mbar)	3.2	2.8	2.4	2.3	3.7	2.5	3.4	4.3	5.4
Start Gas Pressure	(mbar)	NA	NA	NA	1.1	1.8	0.6	0.7	0.9	1.0
Maximum Gas Rate	(m ³ /h) (ft ³ /h)	5.3 187	7.0 247	8.9 314	12.4 438	15.4 544	19.8 699	23.1 816	26.2 925	33.2 1172
Minimum Gas Rate	(m ³ /h) (ft ³ /h)	3.8 134	5.0 177	6.3 222	8.8 311	11.0 388	14.2 501	16.5 583	18.7 660	23.7 837
Start Gas Orifice	(mm dia)	NA	NA	NA	7.0					
Burner Type		AZUR 60	BLU 120	BLU 120	BLU 170	BLU 250R	BLU 250	BLU 250	BLU 250	BLU 350
Burner Head		S	S	S	S	S	S	S	S	S
Burner Head Setting	(mm)	0.0	8.0	10.0	15.0	14	T.O.			
Low Flame Air Orange Cam	**	20°	13°	22°	18°			22°	25°	
High Flame Air Red Cam	**	33°	40°	80°	30°	32°	30°	35°	55°	60°
Gas Valve Setting		0-1, 5	0-1	0-1, 4						
Valve Type Main Gas		MBDL E 407				MBDL E 412				
Valve Type Start Gas		NA				S.I.T. 0 832 051				
LPG Gas Propane (G31) Data - Inlet Pressure 37 mbar (14.6 in WG) Min 25 mbar (10 in WG) Max 45 mbar (18 in WG)										
Main Burner Gas Pressure	(mbar)	4.3	5.7	4.7	3.1	5.9	5.3	7.2	9.0	6.4
Min. Burner Gas Pressure	(mbar)	2.3	2.9	1.4	1.6	2.0	2.3	2.5	3.2	2.0
Start Gas Pressure	(mbar)	NA	NA	NA	1.1	1.7	0.6	0.7	0.7	1.5
Maximum Gas Rate	(m ³ /h) (kg/h)	2.09 3.87	2.76 5.11	3.51 6.49	4.89 9.05	6.10 11.29	7.83 14.49	9.11 16.86	10.36 19.18	13.12 24.29
Minimum Gas Rate	(m ³ /h) (kg/h)	1.46 2.71	1.93 3.58	2.46 4.55	3.42 6.34	4.27 7.90	5.48 10.15	6.38 11.80	7.25 13.42	9.18 17.00
Start Gas Orifice	(mm dia)	NA	NA	NA	7.0					
Main Gas Orifice	(mm dia)	8.5	10.0		14.5					NA
Burner Type		AZUR 60	BLU 120	BLU 120	BLU 170	BLU 250R	BLU 250	BLU 250	BLU 250	BLU 350
Burner Head		S	S	S	S	S	S	S	S	S
Burner Head Setting	(mm)	0.0	8.0	10.0	15.0	14	T.O.			
Low Flame Air Orange Cam	**	20°	13°	22°	18°			22°	25°	
High Flame Air Red Cam	**	33°	40°	80°	30°	32°	30°	35°	55°	60°
Gas Valve Setting		0-1, 4	0, 3-0, 9	0-1, 1			0-1, 4		0-1, 5	0-0, 85
Valve Type Main Gas		MBDL E 407				MBDL E 412				
Valve Type Start Gas		NA				S.I.T. 0 832 051				

NOTE: The air setting is a guide only. The final setting is subject to combustion testing.

When setting the minimum firing rate, a check must be made following the setting of the burner combustion. The check is made by running the heater on low fire for a minimum of 15 minutes at the full transport air rate and at typical ambient conditions. During the test, check that the flue gas temperature does not fall below 125° C. Should the flue gas temperature fall below 100° C, then the low fire gas setting must be increased to a value that will achieve 125° C flue gas temperature; otherwise condensation may form in the heat exchanger and flue, causing rapid corrosion and short operational life.

NOTE: For adjustment of head setting, see Ecoflam Instructions.

4.7 Technical Data - Ecoflam Oil-Fired Burners (burner reference "G")

Model		015	020	030	040	050	060	070	080	0100
Gross Heat Input	(kW) (Btu/h) x (1000)	55.5 189.4	73.3 250.1	93.2 318.0	129.9 443.2	162.0 552.7	208.0 709.7	242.0 825.7	275.2 939.0	348.5 1189.1
Heat Output	(kW) (Btu/h) x (1000)	47.4 161.8	61.2 208.9	78.4 267.4	110.2 375.9	134.5 458.8	177.7 606.5	205.3 700.3	230.4 786.2	293.4 1001.0
Burner Type		Minor 8		Minor 12	Minor 20		Minor 30			Major 30
Oil Pump Connections	(in)	3/8								

Light Fuel Oil (Gas Oil) Data

Nozzle Size	*US (gal/h)	1.00	1.50	1.75	2.50	3.50	4.00	5.00	5.00	7.00
Angle & Type		60S					60A			
Make		Danfoss					Delavan			
Head Setting	(mm)	8	0	14	(full back)					(fixed)
Air Setting	(number)	4.2	8.5	5.5	3	4	3.7	4	6.2	1.8
Burner Fuel Pressure	(Bar) (lbf/in ²)	12.1 175	10.3 150	12.4 180	11.7 170	10.0 145	11.0 160	10.0 145	13.0 188	11.0 160
Fuel Consumption	(L/h) *UK (gal/h)	5.17 1.14	6.82 1.50	8.68 1.91	12.09 2.66	15.08 3.32	19.36 4.26	22.53 4.96	25.62 5.63	32.44 7.14
Maximum Oil Pressure to Pump Inlet	(Bar) (lbf/in ²)	.21 3								

Kerosene Data

Nozzle Size	*US (gal/h)	1.25	1.75	2.50	3.00	4.00	5.00	6.00	6.50	8.50
Angle & Type		60S								60B
Make		Danfoss								
Head Setting	(mm)	8	0	14	(full back)					(fixed)
Air Setting	(number)	4	6.6	6	3	4	3.7	4.5	6	1.4
Burner Fuel Pressure	(Bar) (lbf/in ²)	8.6 125	9.7 140	8.3 120	9.7 140	8.3 120	9.0 130	8.3 120	9.3 135	8.3 120
Fuel Consumption	(L/h) *UK (gal/h)	5.47 1.20	7.23 1.59	9.19 2.02	12.81 2.82	15.98 3.51	20.52 4.51	23.87 5.25	27.14 5.97	34.37 7.56

NOTE: For adjustment of head setting, see Ecoflam Instructions.

* Nozzle sizes are quoted in US gal/h. Fuel consumption is quoted in imperial gal/h.

SECTION 5: HEATER INSTALLATION

5.1 General

Heaters are designed for floor standing vertical installation. Special versions supplied with steel channels to support the heater are available and may be mounted horizontally. When installed horizontally, the heater will normally lie on its left side when viewed from the burner. The heater

should be placed on a firm, level, non-combustible surface that can support its weight. See *Page 5, Section 4.1* for weight details.

5.2 Handling

All cabinet heaters are supplied secured to a wooden pallet and shrink wrapped. Use the pallet to support the heater during handling and installation.

Figure 2: Typical Installation of a Gas Fired Cabinet Heater

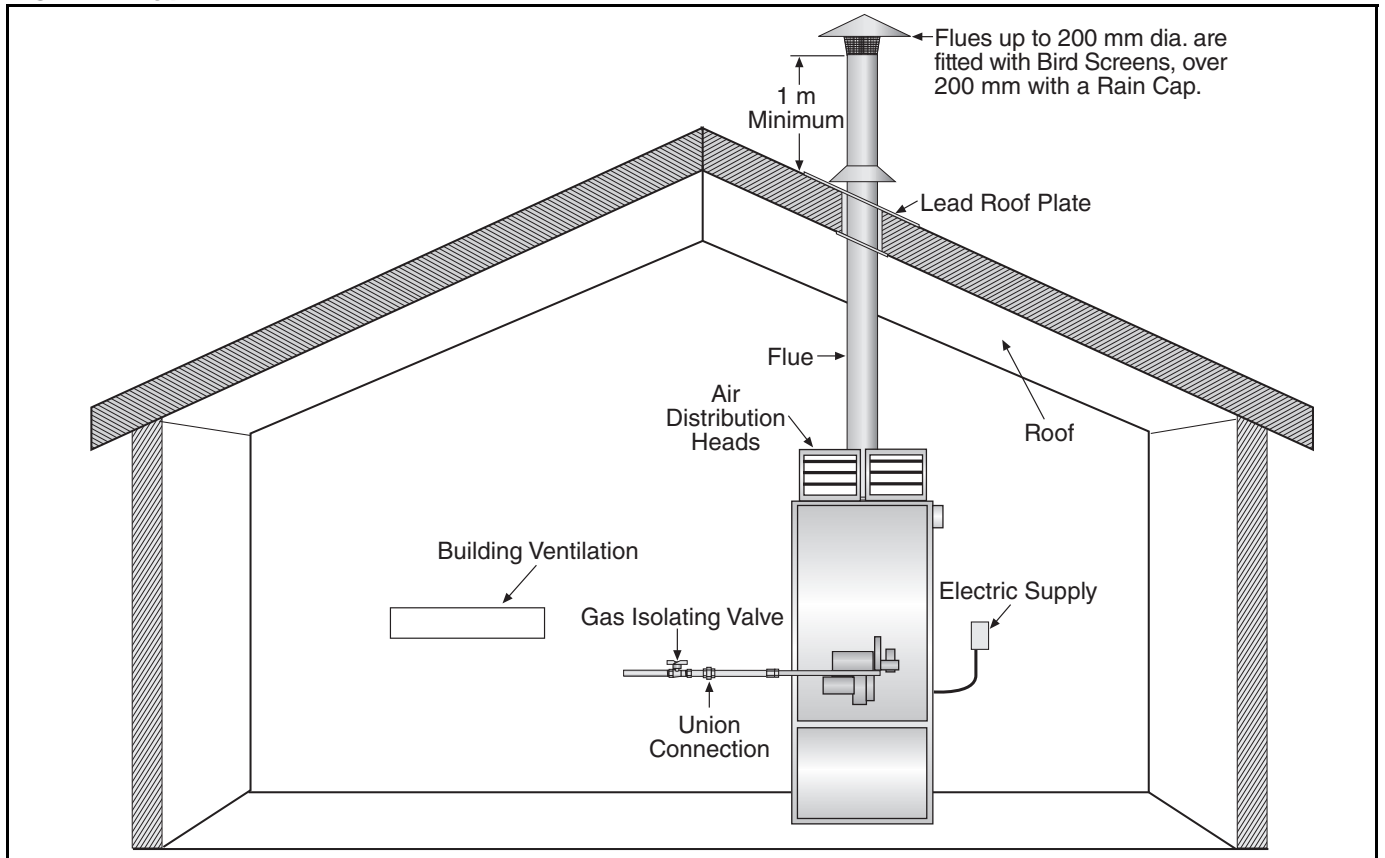
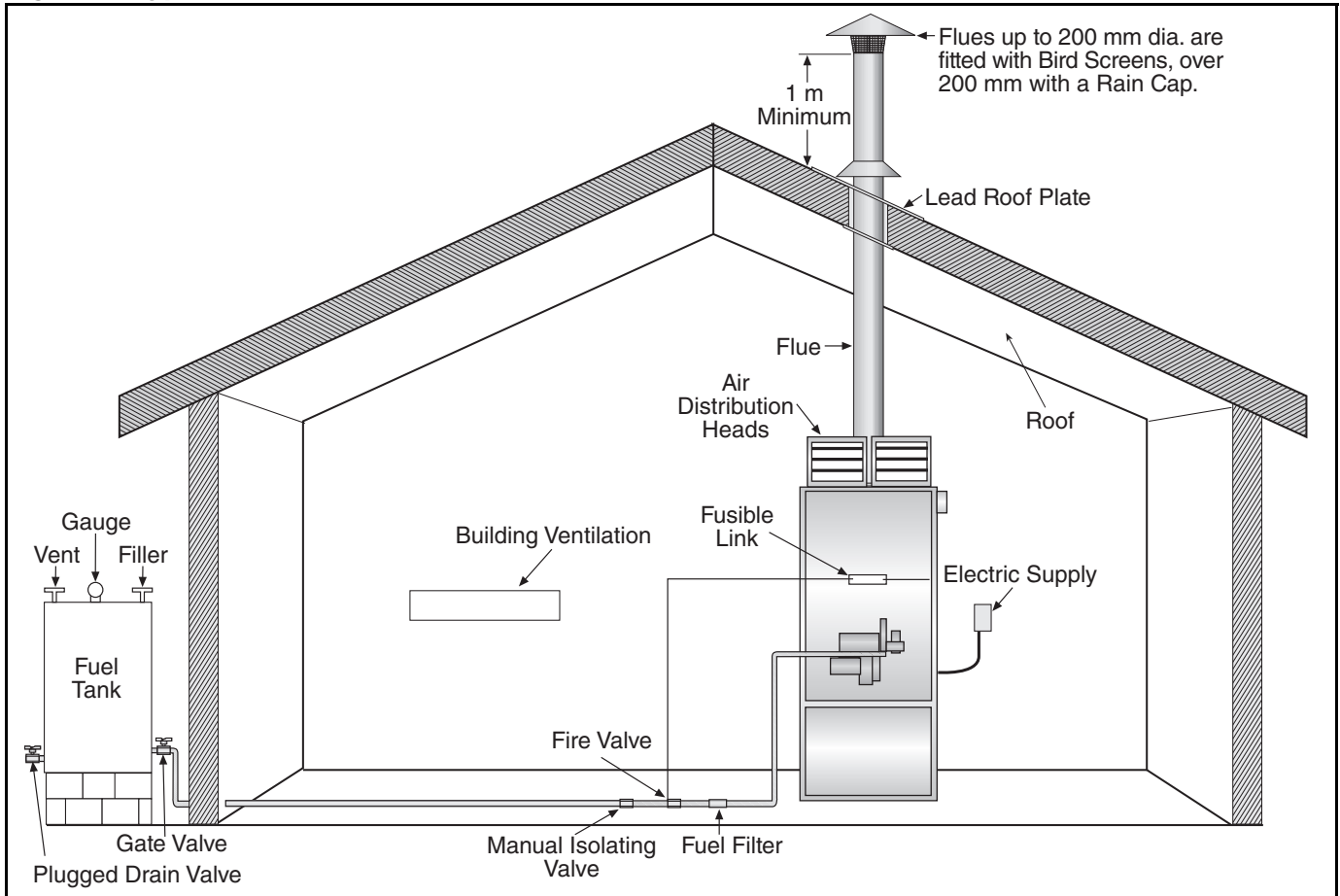


Figure 3: Typical Installation of a Oil-Fired Cabinet Heater



SECTION 6: FLUE INSTALLATION

6.1 Flue Installation

! WARNING



Fire Hazard

Some objects will catch fire or explode when placed close to heater.

Keep all flammable objects, liquids and vapours the required distance away from the heater.

Failure to follow these instructions can result in death, injury or property damage.

Flues must be correctly sized for the model. See Page 5, Section 4.1. Flues should be assembled as on Page 13, Figure 4 and Figure 5 and Page 14,

Figure 6 through Page 14, Figure 9. The joints between the flue and the roof or wall must be properly sealed. If the flue passes through a wall or ceiling of combustible material it must be enclosed by a sleeve of non-combustible material and be separated from the sleeve by at least a 25 mm air gap.

Flues must be adequately supported so that the heater does not bear the weight of the flue.

For straight and offset flue termination See Page 13, Figure 4 and Figure 5.

90° bends and horizontal pipe must not be used in flues except for the immediate connection to horizontally mounted heaters (1 m max). 135° bends are used to offset the flue as in Figure 5. If condensation is likely to occur in the flue, then provision should be made for drainage.

Figure 4: Flue Termination

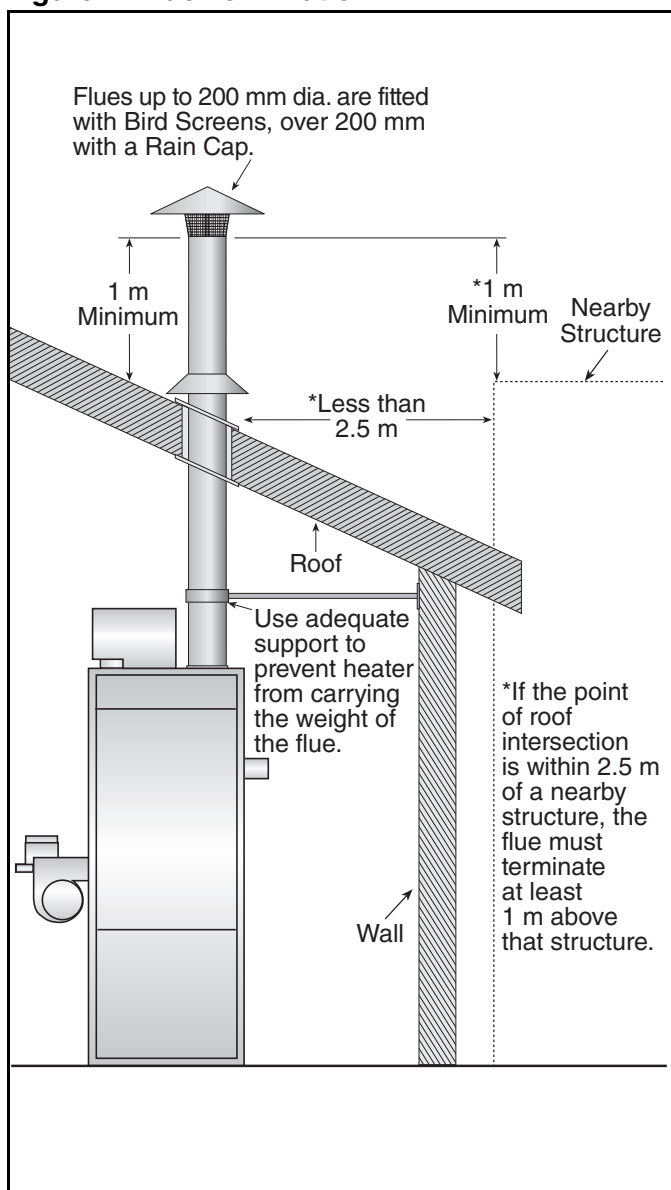


Figure 5: Offset Flues with 135° bends

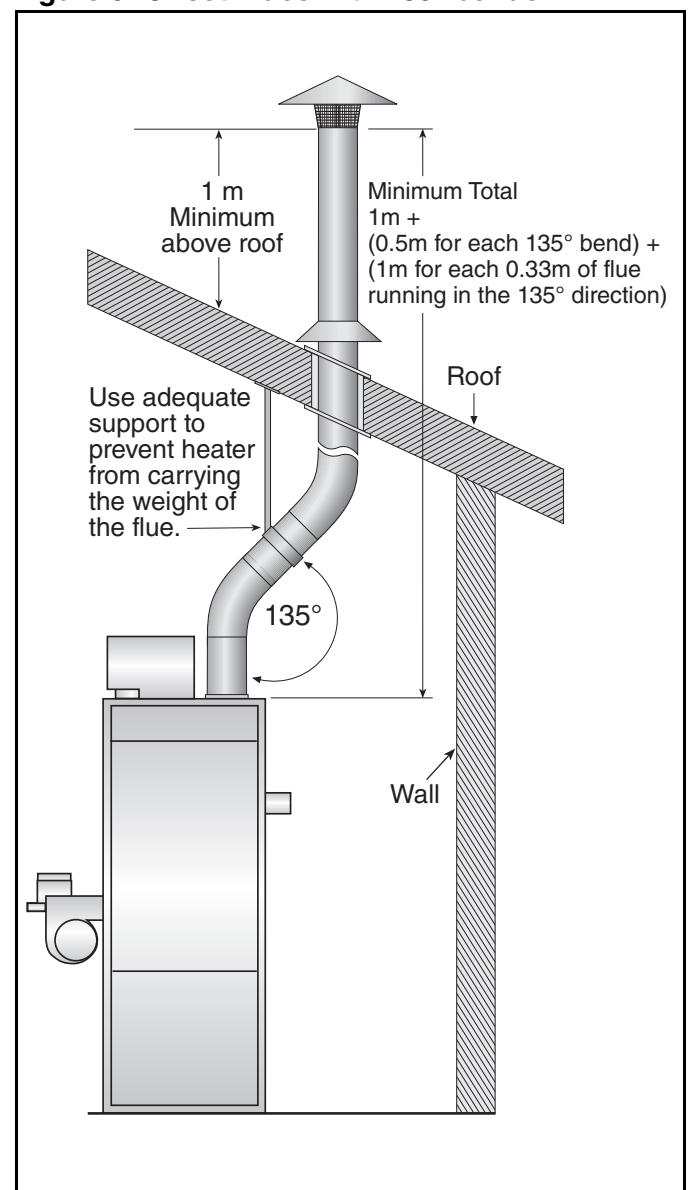


Figure 6: Guy Wire

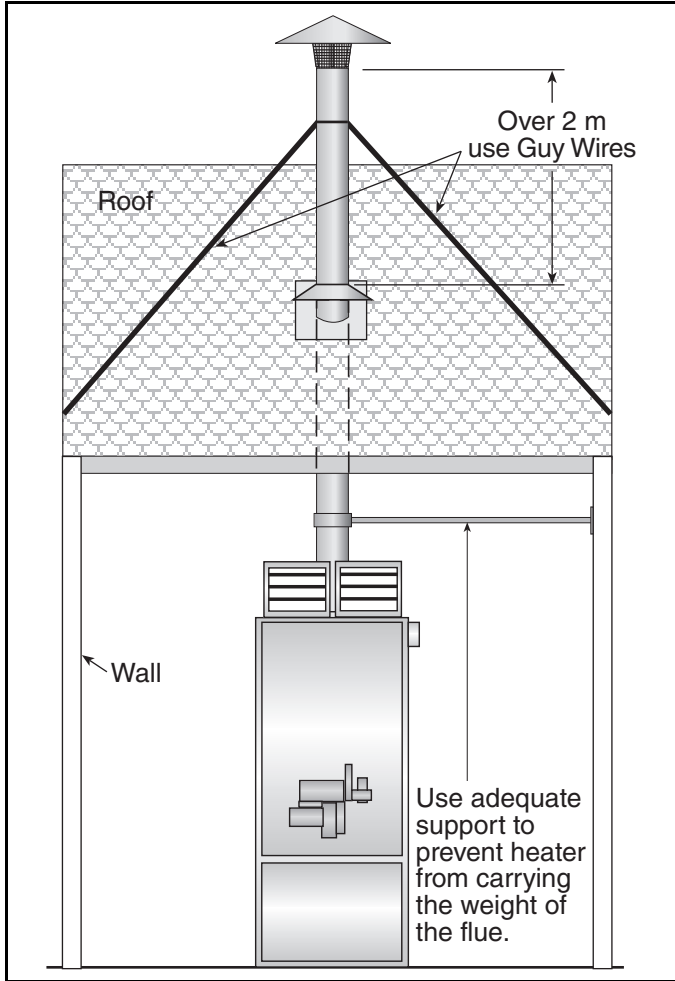


Figure 8: Flue and Roof Detail

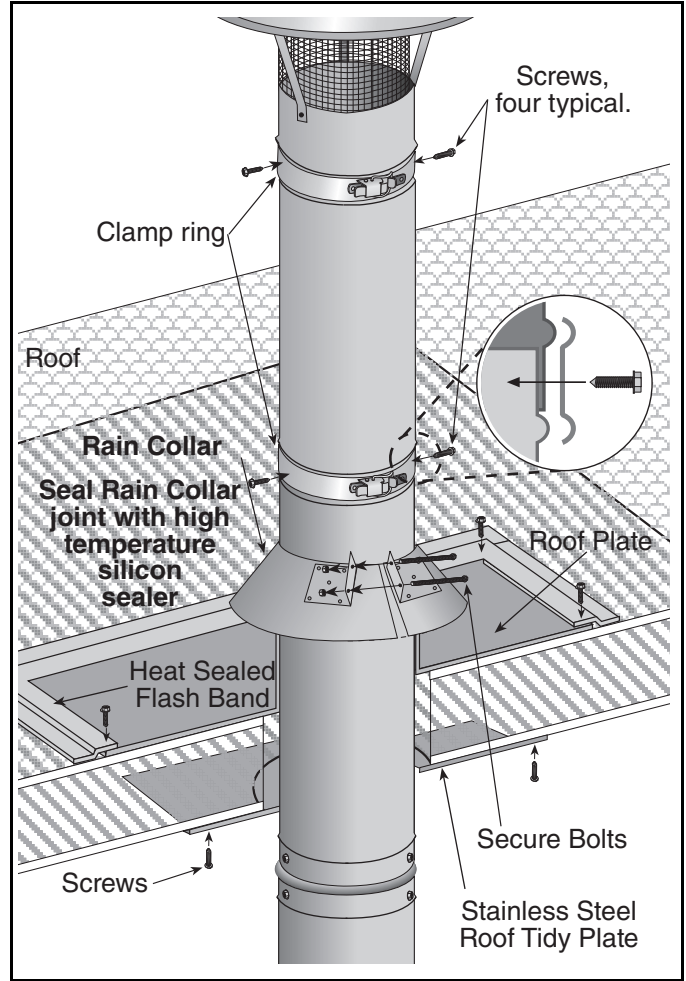


Figure 7: Socket Direction

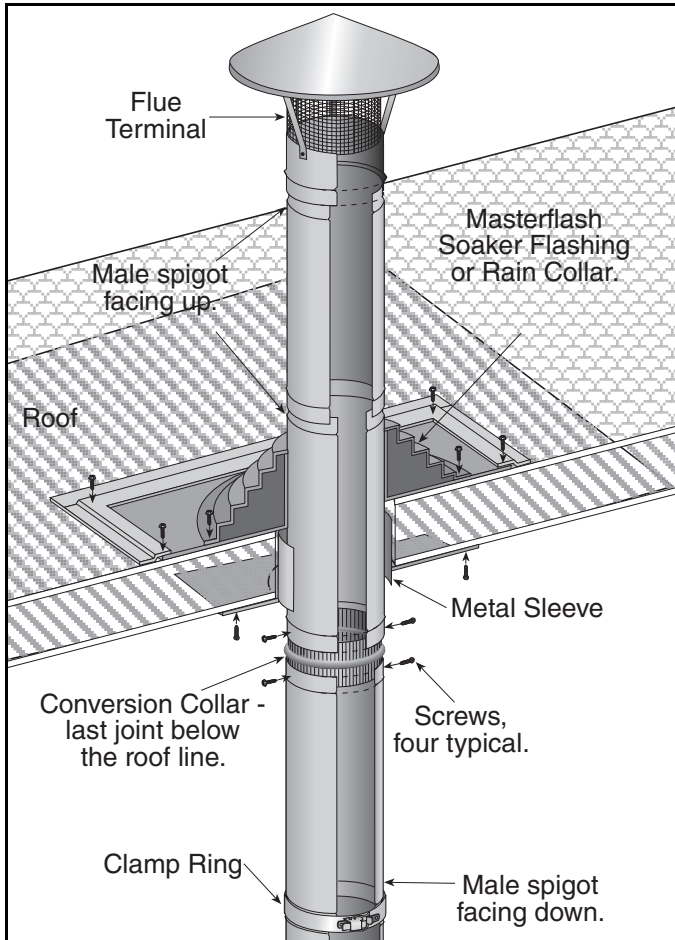
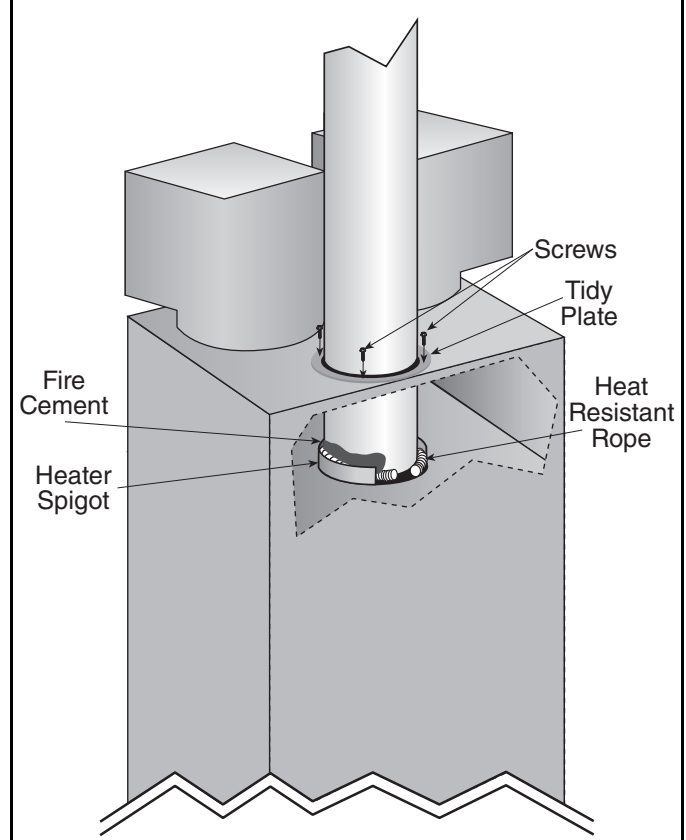


Figure 9: Flue and Heater Spigot Joint Detail

If it is necessary to cut any section of flue, the cut is made at the bottom of the lowest section where it connects to the heater.



SECTION 7: AIR SUPPLY

7.1 Air Supply

It is important to ensure adequate air supply at all times for both combustion and heating requirements in accordance with BS 6230 for UK installations and the latest revisions of applicable standards and local and national codes.

7.2 Isolated Equipment Rooms

Ventilation must prevent the temperature of isolated equipment room from exceeding 32°C as well as prevent any negative air pressure within the room. Any isolated equipment room containing air heaters will require permanent air vents direct to outside air in compliance with local codes.

Where natural ventilation is used, suitable permanent openings at low and high levels, communicating directly with the outside air, must be provided.

Where mechanical ventilation is used, extract rate must be 5% - 10% less than the inlet rate. The mechanical ventilation must be interlocked with the burner on the heater.

7.2.1 Heaters Installed Within the Heated Space

Where the volume of the heated space is greater than 4.7 m³ per kilowatt of total rated heat input and the air change rate is at least 0.5/h, additional high and low level ventilation will not be required.

For a building having an air change rate less than 0.5/h, ventilation will be necessary in accordance with local and national codes.

7.3 Building Ventilation

Where ventilation is required, air must be taken from an outside point where it is not likely to be contaminated or obstructed.

7.4 Distribution Ducting

Duct should be full size for at least twice the minor dimension before change of direction or reduction of area.

7.5 Return Air Ducting

In installations employing recirculation or fresh air ducting, this ducting shall comply with the following:



1. There shall be an unobstructed air path connected directly to the heater.
2. The return air or fresh air shall be connected by ducting directly to the air inlet on the heater.
3. Where automatic or manual dampers are provided for operational adjustment in these ducts, they shall be proved in the correct position during the operation of the burner.

The main fan requires a minimum free air return path of 1 m² per 197 kW of heater output or 0.33 m², whichever is greater.

NOTE: When heaters are installed in the horizontal mode and connected to distribution ducting and/or inlet ducting, then the natural convected air flow through the heater, before the main fan turns on may be disrupted.

To ensure correct operation of the fan under these circumstances, in all COMBAT® cabinet heaters designed for horizontal mounting, the main fan will operate in conjunction with the burner sequence by the use of a time delay or direct acting relay. It is strongly recommended that when any heater is connected to installation ducting, a similar approach to the fan control is used. Any such control must be in parallel with the fan thermostat so that the fan "run on" feature is still able to operate (See Page 22, Section 9.5).

SECTION 8: FUEL PIPING



Fire Hazard
<p>Connect gas supply according to Figure 10.</p> <p>Gas can leak if not installed properly.</p> <p>Failure to follow these instructions can result in death, injury or property damage.</p>

8.1 Connections

Connect the heater to the gas supply, ensuring that the final connections are as follows:

- Gas supply pipe is run in medium or heavy gauge tubing in compliance with local and national codes.
- The gas supply pipe is adequately sized to carry the total volume of gas for the complete installation.
- An isolating valve and union connection should be used and fitted into the supply adjacent to the heater.

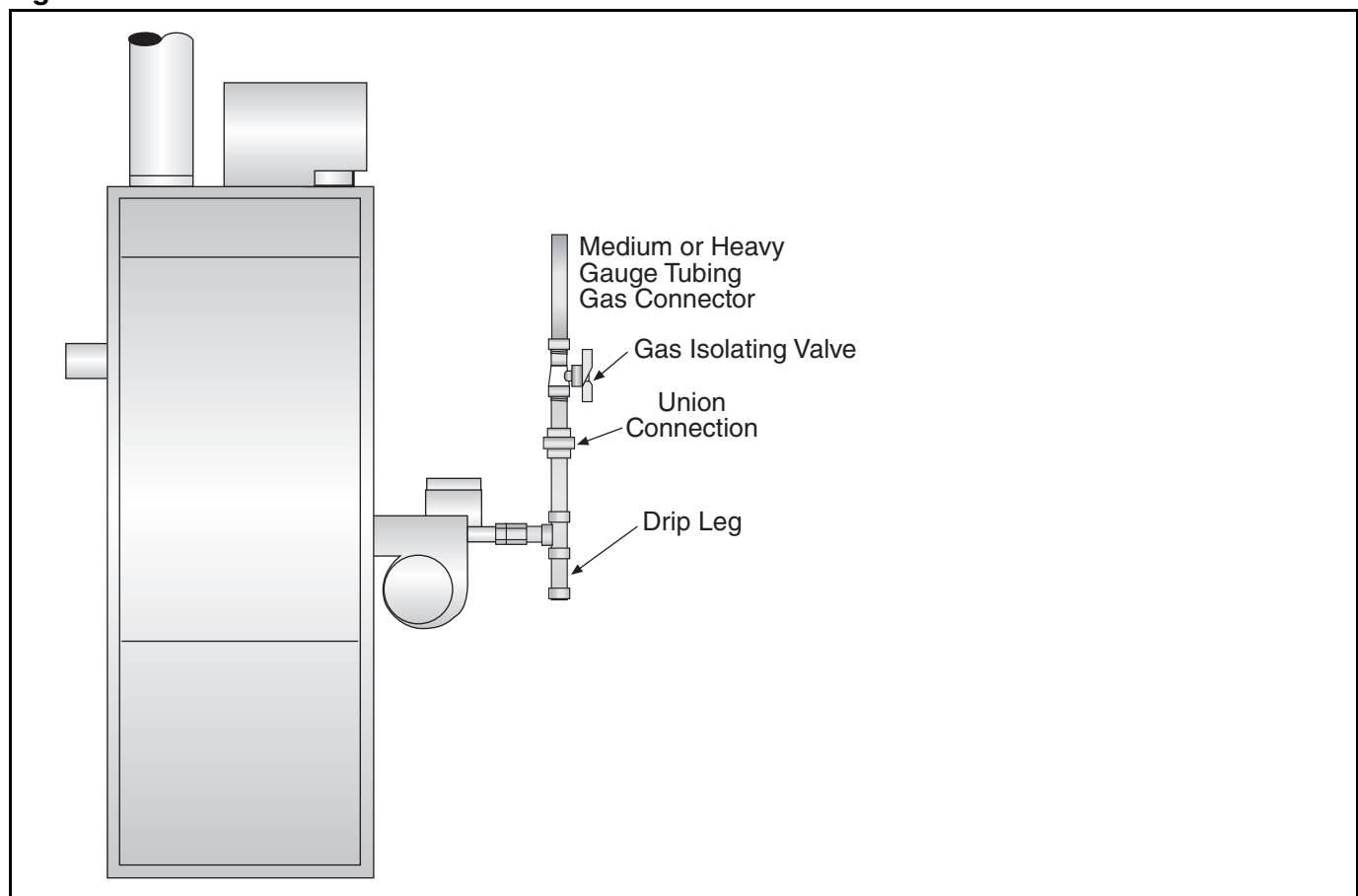
IMPORTANT - The complete installation must be purged and tested for gas soundness in accordance with local and national codes.

It is important that the gas supply pipe and the electrical connections do not support any of the heater's weight.

A gas meter is connected to the service pipe by the Gas Supply Company. Any existing meter should be checked, preferably by the company, to ensure that the meter is adequate for the rate of gas supply required.

Installation pipes must be fitted in accordance with local and national codes. Pipe work from the meter to the heater(s) must be of adequate size. Pipes of smaller size than the heater inlet gas connection should not be used.

Figure 10: Gas Connection



8.2 Fuel Oil Supply

8.2.1 Fuel Storage Tank

The fuel storage tank should be located outside the building as close as possible to the heater. The tank must be installed per local and national codes.

8.2.2 Fuel Pipes

The fuel pipes must be sized to ensure an adequate supply of oil to the entire installation. Galvanised pipe must not be used for oil installations. The fuel pipe must terminate at each heater with an isolating manual valve, a fire valve and a fuel filter. See Page 12, Figure 3. The fusible link of the fire valve should be installed 100 mm (4 in) above the burner.

The heater's oil burner pump inlet is provided with a flexible oil line which should be used for the final connection. When making the final connection to the heater, do not block any of the removable panels of the heater. All COMBAT® oil-fired cabinet heaters are supplied with burner pumps fitted for one pipe systems.

8.2.3 Gravity Feed Systems

The simplest installation is a gravity feed system. This system relies on the head of the fuel to push the fuel through the system. See Page 12, Figure 3.

8.2.4 B. M. Oil Lifter

Where a gravity feed system cannot be used, a B. M. oil lifter may be used for small installations up to the equivalent of a single model 050 on minimum lift or a single model 020 on maximum lift.

The fuel output from the oil lifter is gravity fed. The B. M. oil lifter requires a constant 230 V 50 Hz 1 Ø electrical supply. The maximum pipe size to be used on the suction side is 1/4" ID, 5/16" OD (8 mm). For maximum loading of oil lifters See Page 17, Figure 11. Consult the manufacturer's information regarding the need to prime these devices.

8.2.5 Pressurised Systems

See Page 18, Figure 12. For larger installations, a pressurised system may be used. In this type of system the pump draws fuel from the tank, then pushes it through the installation under pressure.

The pressure is controlled at the pump by a pressure relief valve at approximately 0.8 BAR (12 psi). When a pressurised system is used, a pressure reducing valve set at approximately 0.3 BAR (5 psi) should be installed on the fuel inlet to each heater after the manual isolating valve. This protects the oil pump from the danger of possible over pressure under fault conditions.

The electrical supply for the pump installation will depend upon the type of pumps chosen, but will normally be set to run continuously.

Figure 11: B. M. Oil Lifter

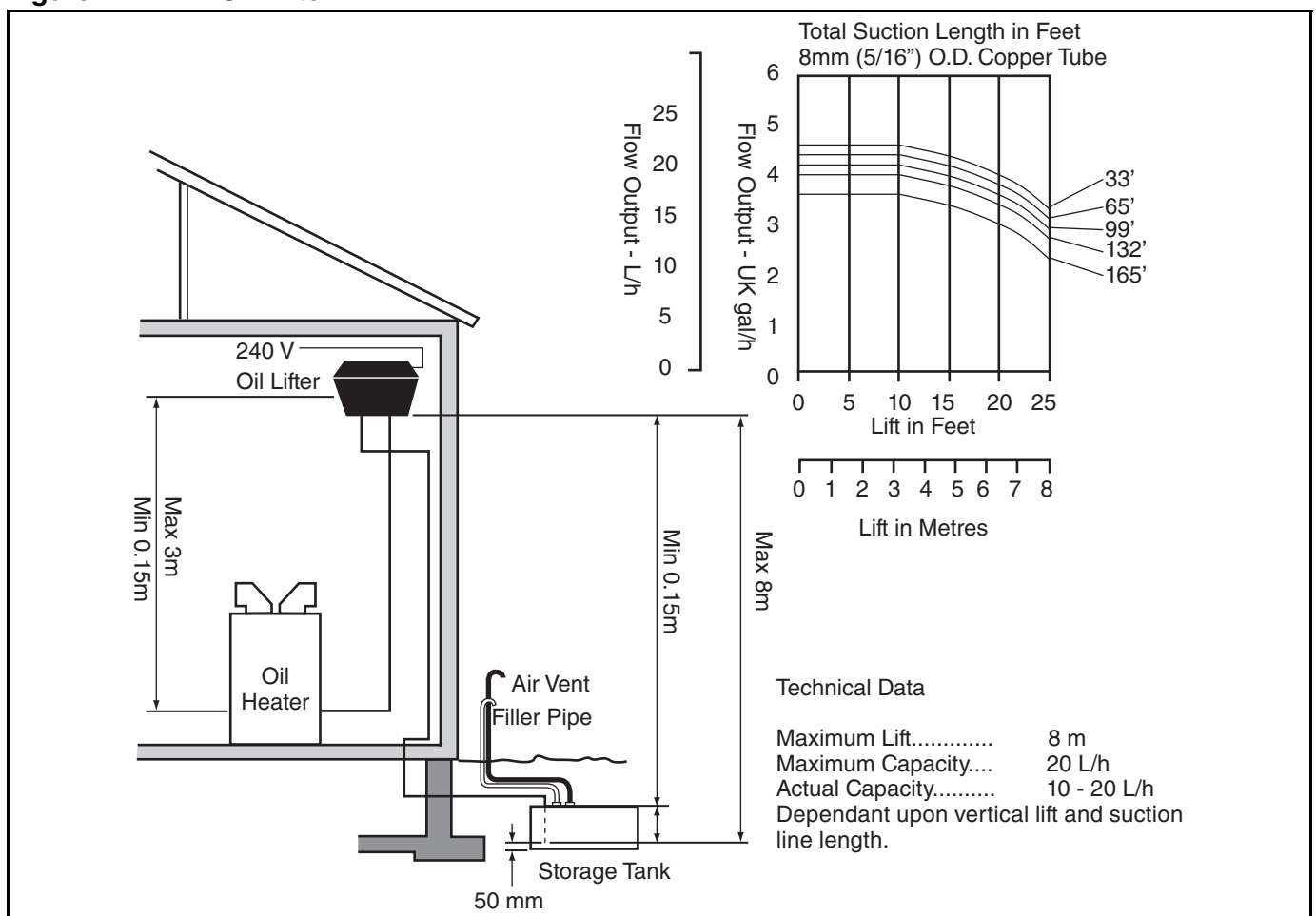
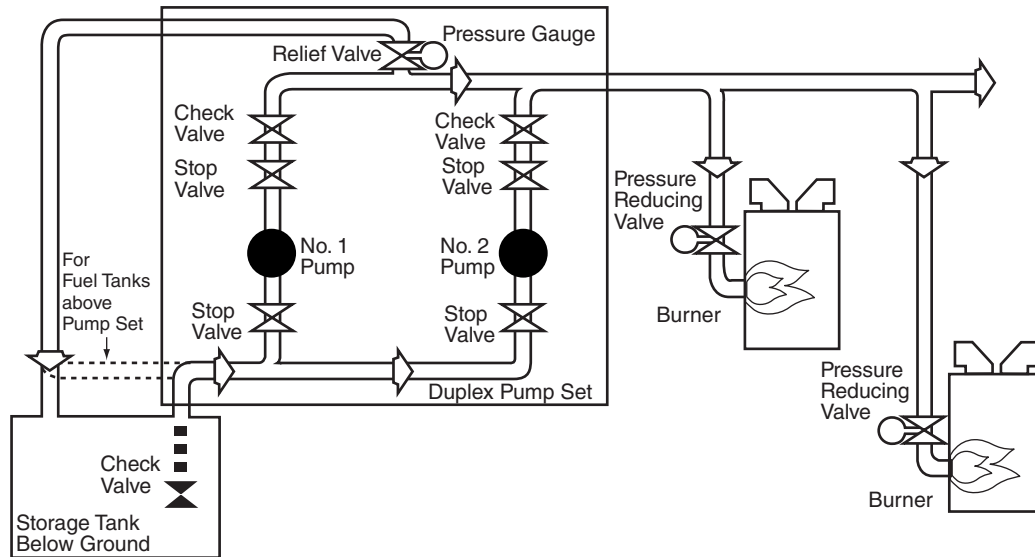


Figure 12: Pressurised System Installation - Duplex System



(The system shown has one pump for run and the other for standby. The valves allow the standby pump to be removed for maintenance while the system is still running).

SECTION 9: WIRING AND ELECTRICAL INFORMATION

9.1 Electrical Supply

A 230 V 50 Hz 1 Ø supply is required for all heater Models 015 to 030 connected to the heater terminals L1, N and Earth.

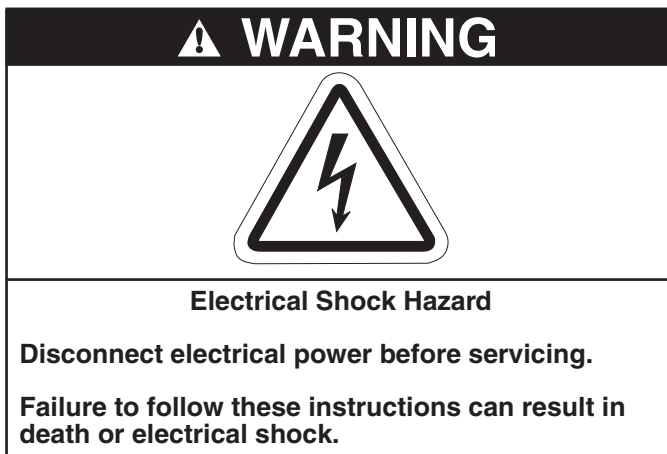
Standard models 040 to 0100 and all High Flow models require a 400 V 50 Hz 3 Ø and neutral supply connected to the heater terminals L1, L2, L3, N and Earth.

All heaters and controls must be correctly earthed. All external wiring must comply with the relevant IEE and local regulations and be carried out by a qualified electrician.

It is important that "L and N" polarity is correct for these heaters, as incorrect polarity may prevent the burner control box from operating properly. It is also important that the voltage between N and earth is at 0 V and can never exceed 15 V.

An isolator with a contact separation of at least 3 mm on all poles should be installed adjacent to the heater, but not attached to it, to disconnect all supplies to the heater and where necessary to isolate the remote control panel.

The final connection to the heater should be made in metal sleeved flexible cable or flexible conduit to the main terminal block under the front lower panel of the heater using 1 sq. mm cable. Model 0100 and High Flow models with 5.5kW or 7.5kW motors use 1.5 sq. mm cable. Cable entry is provided into the rear horizontal frame of the cabinet.



9.2 Remote Controls

The heater is designed to be operated by controls installed remotely from the heater. *See Page 20, Section 9.3. through Page 27, Section 9.10.*

9.2.1 Burner Controls (Thermostat)

Controls to operate the burner must be voltage free contacts connected between terminals 2 & 3 of the main terminal block.

9.2.2 Positioning Room Thermostats or Roberts-Gordon Control

A room thermostat or Roberts-Gordon control should be mounted on a wall or column at a height of approximately 1.5-1.8 metres from the floor to measure the ambient temperature. It should be clear of both cold draughts and the direct path of warm air from the heater.

9.2.3 Remote Frost Thermostat

When required, connect to terminals 2 and 3 in the main terminal block.

Locate the thermostat within the heated space adjacent to the most vulnerable equipment that requires protection.

See Page 20, Section 9.3 through Page 27, Section 9.10.

9.2.4 Controls for High/Low Burner Operation

For heaters with a high/low burner, the controls will need to provide two stage signal to operate these burners. This is best provided by a two stage thermostat.

The thermostat may control the heater outlet temperature if the heater is designed for a duct distribution system or the room temperature.

The site wiring will be across terminals 2 and 3 for any time control and the on/off function of the burner (stage two), and across terminals 7 and 8 for the high fire (first stage) setting.

The burner will then operate as follows:

Temp. from cold up to	
the 1st set point	Full fire at max. rate
Temp. above 1st set point	
up to 2nd set point	Low fire at min. rate
Temp. above 2nd set point	Off.

9.2.5 Controls for Fully Modulating Burners

For heaters that incorporate a fully modulating burner, a special temperature control is provided with the heater. On-site wiring of the temperature sensor is required with any time control.

The heater will normally be controlled by the temperature of the air in the outlet duct, but it is possible to control on room temperature.

The position of the sensor in the outlet duct is determined on site. Using a thermometer, select a position in the outlet duct approximately 1 m from the heater, across the cross section of the duct that provides a reasonable average of the temperatures found. Mount the sensor at this position for best results.

When operating at reduced heat input, the leaving air temperature may be low when controlled on room temperature.

The time control and any other on/off controls will be across terminals 2 and 3. The sensor will be connected to terminals 8 and 9.

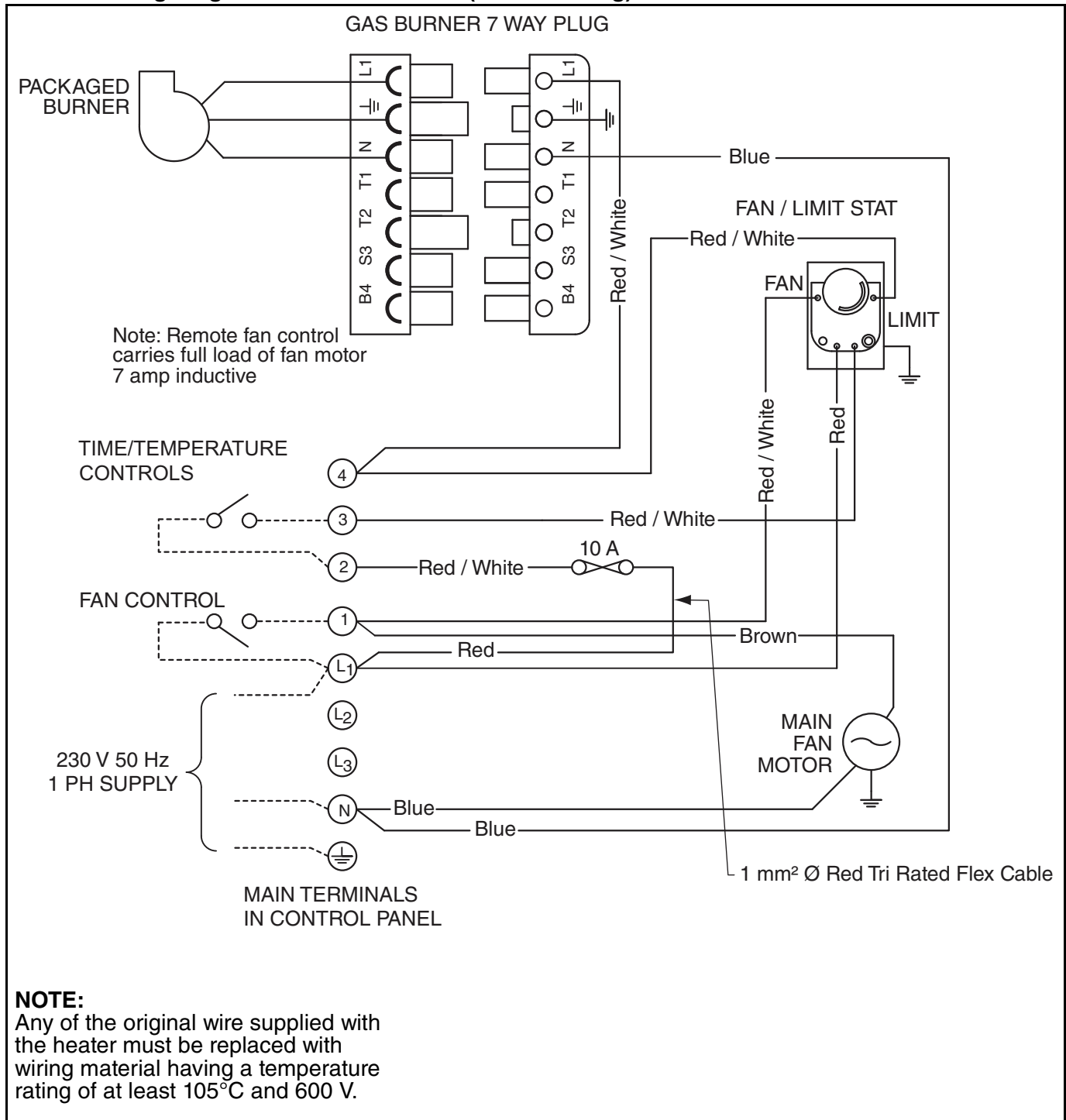
The operation will occur in the following sequence:

1. The burner will fire. When the burner sequence reaches the release to modulation stage, the control will begin to monitor the outlet temperature.

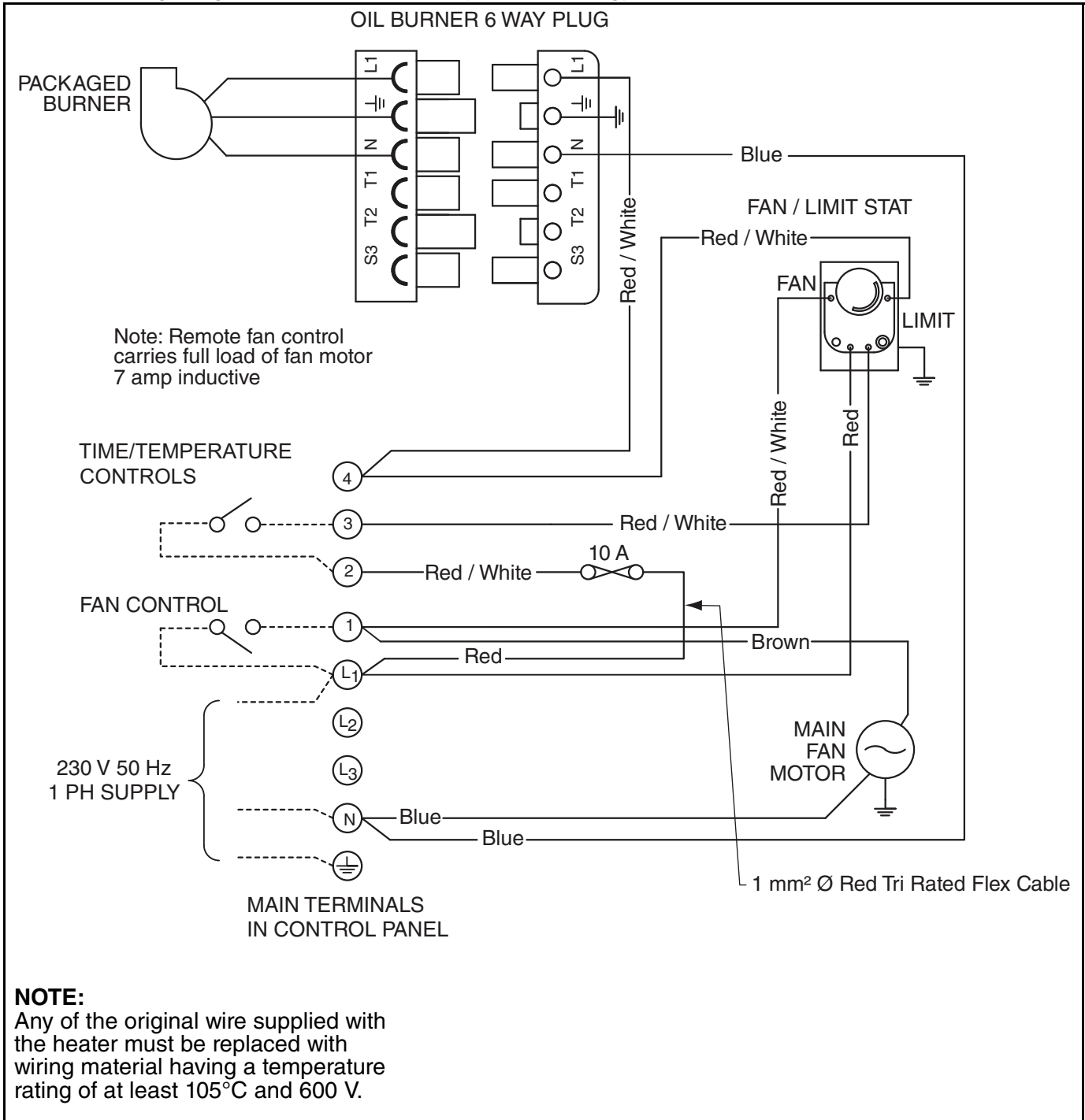
2. The control will then adjust the burner input continuously to attempt to maintain the temperature set on the control.
3. If the temperature continues to rise with the burner operating at minimum fire, the control will turn off the burner until the temperature falls again, and the burner will restart.

If a switch is required to turn on the main fan for ventilation, this must be voltage free, from external sources, and may be connected between terminals L₁ & 1 for models 015 to 030 and terminals 2 & 1 for all other models.

9.3 CCH Wiring Diagram Gas Models 15-30 (floor standing)



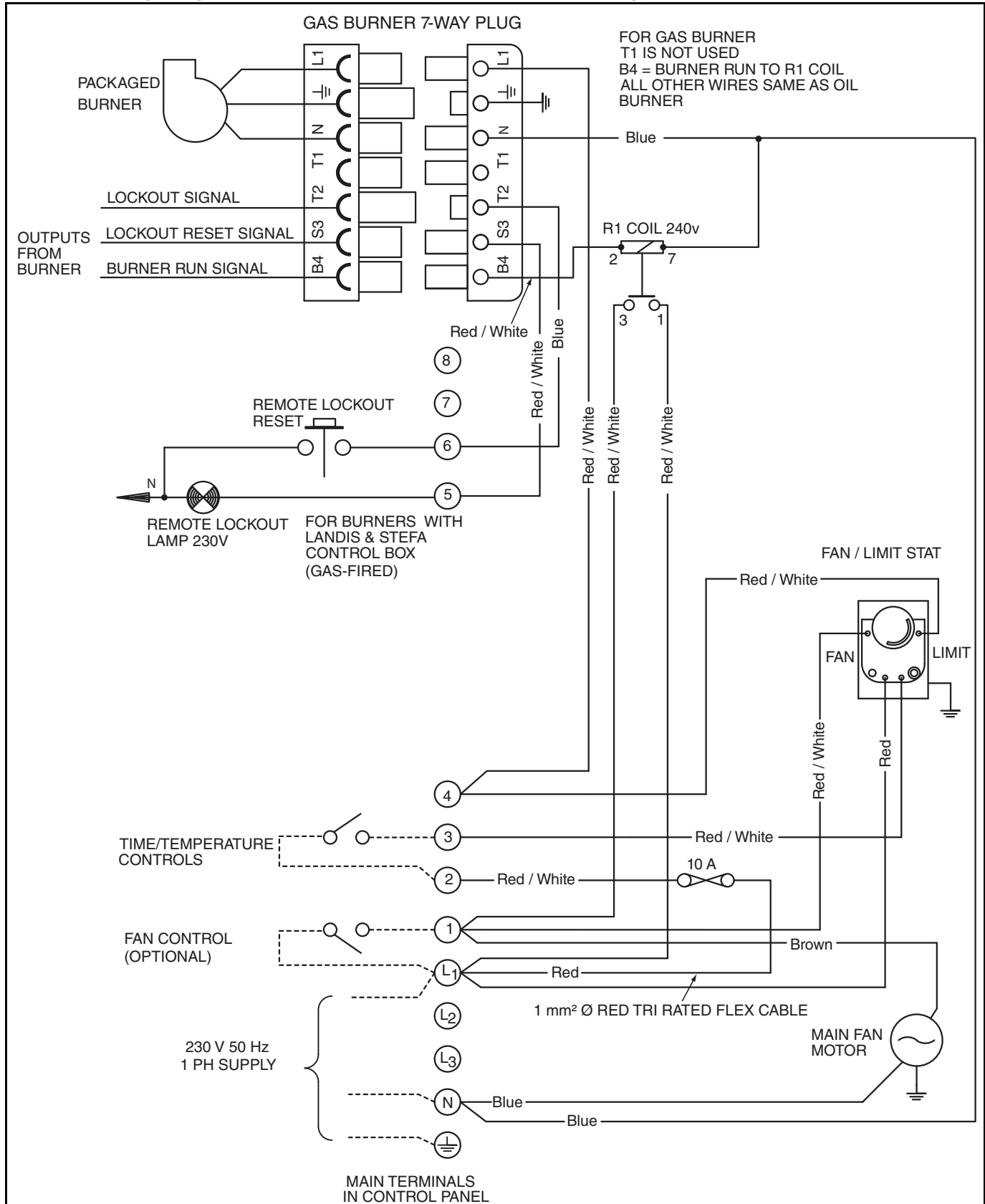
9.4 CCH Wiring Diagram Oil Models 15-30 (floor standing)



NOTE:

Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

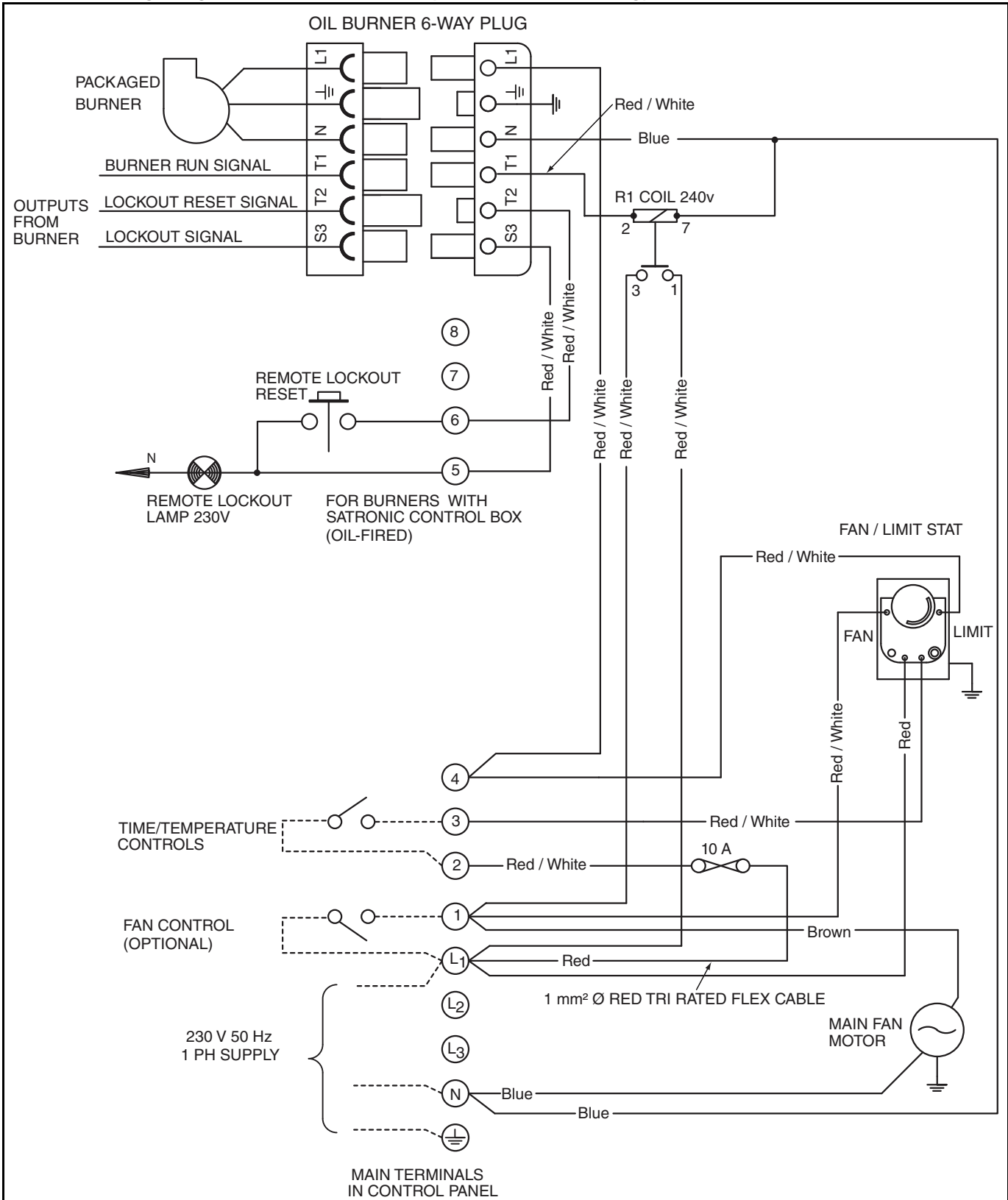
9.5 CCH Wiring Diagram Gas Models 15-30 (horizontal mounting)



NOTE:

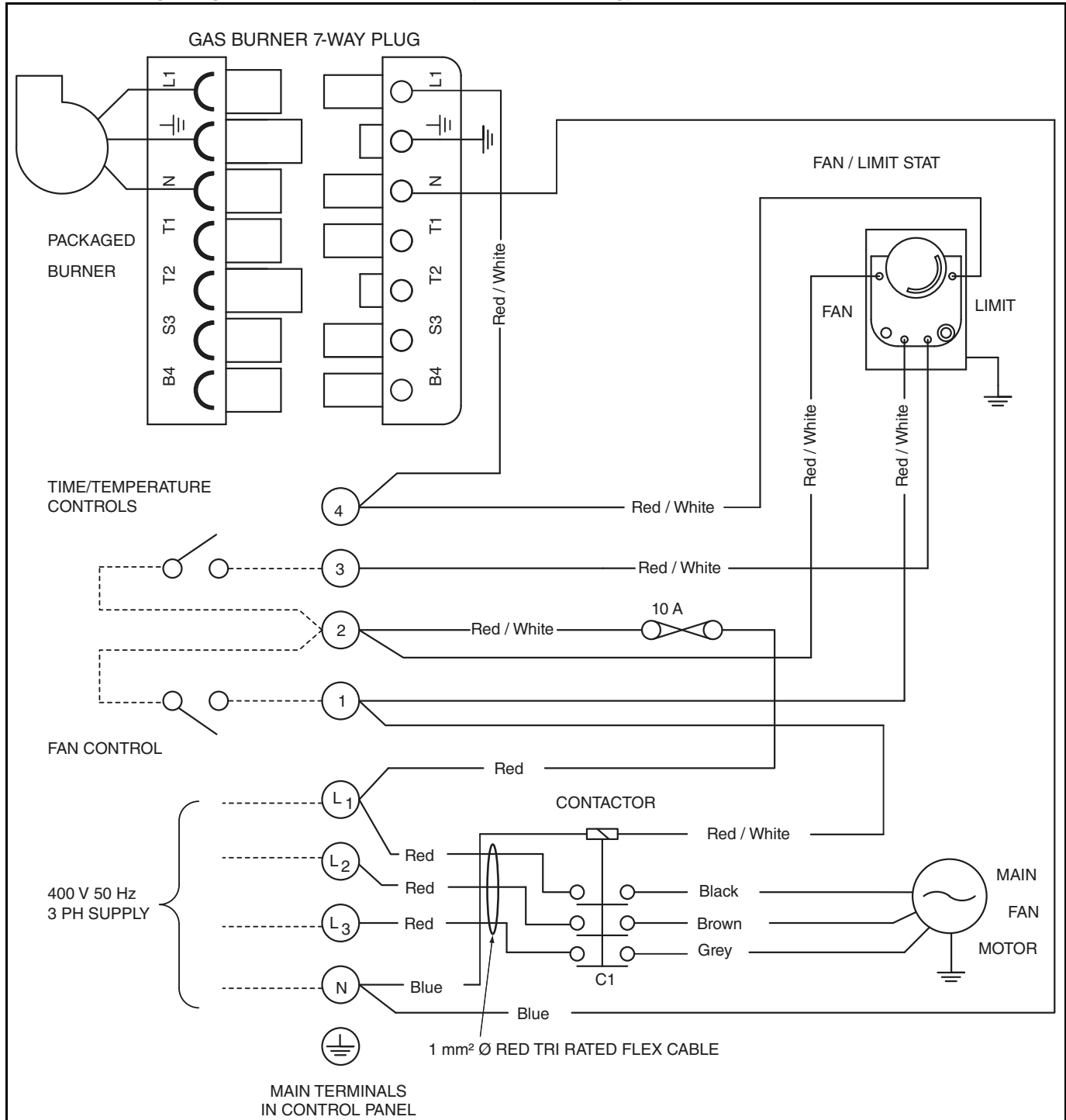
Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

9.6 CCH Wiring Diagram Oil Models 15-30 (horizontal mounting)



NOTE:
Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

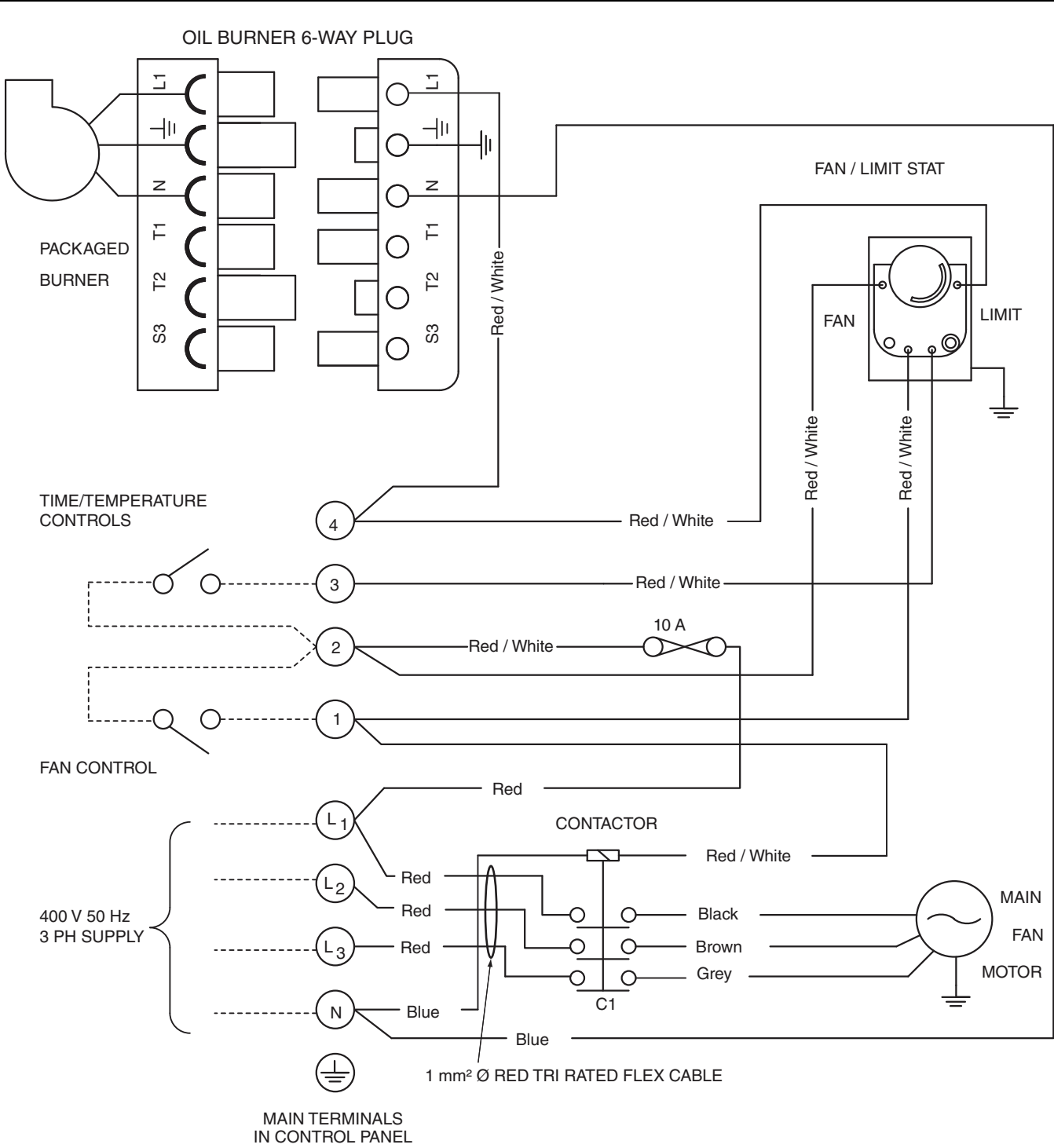
9.7 CCH Wiring Diagram Gas Models 40-50 (floor standing)



NOTE:

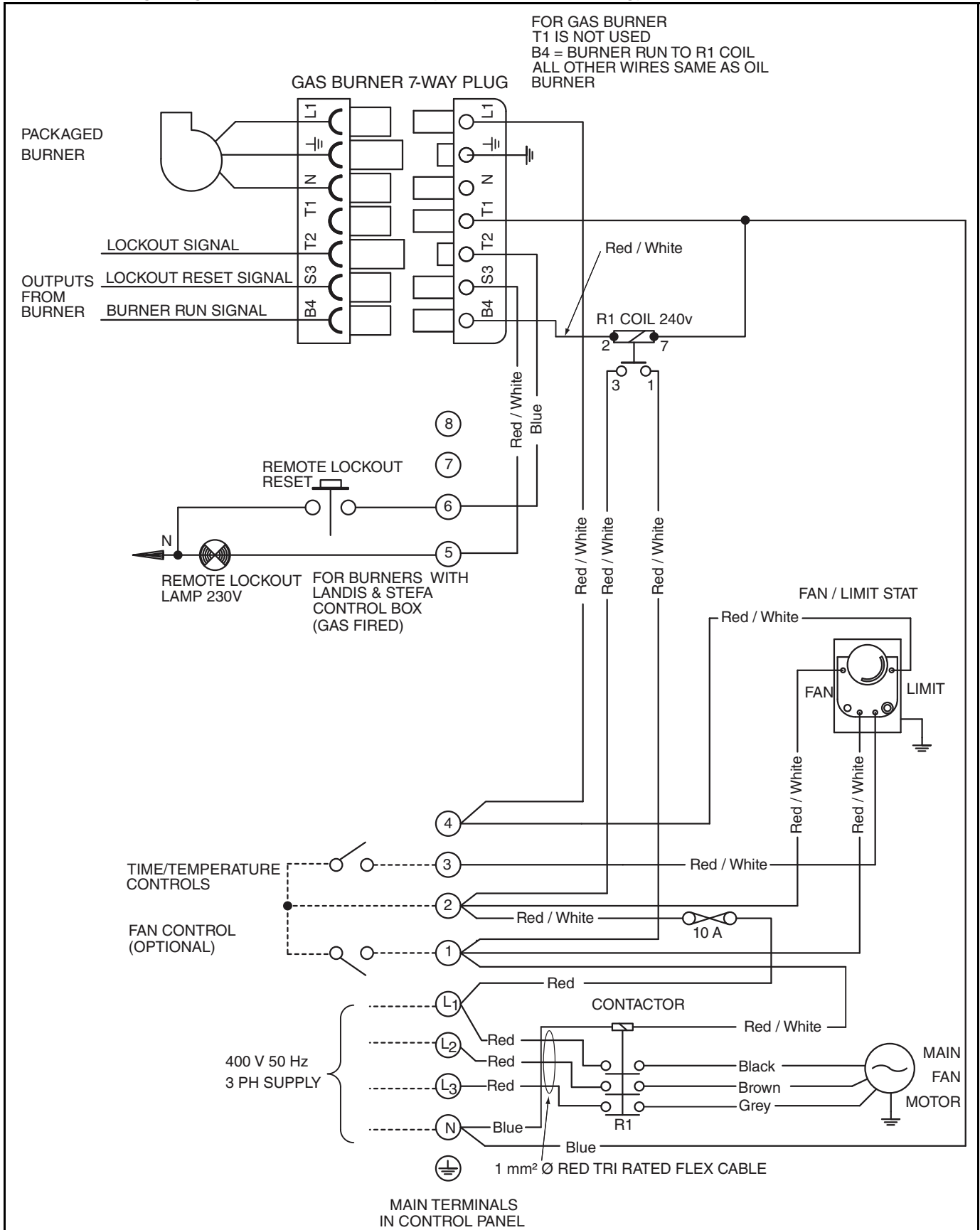
Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

9.8 CCH Wiring Diagram Oil Models 40-50 (floor standing)



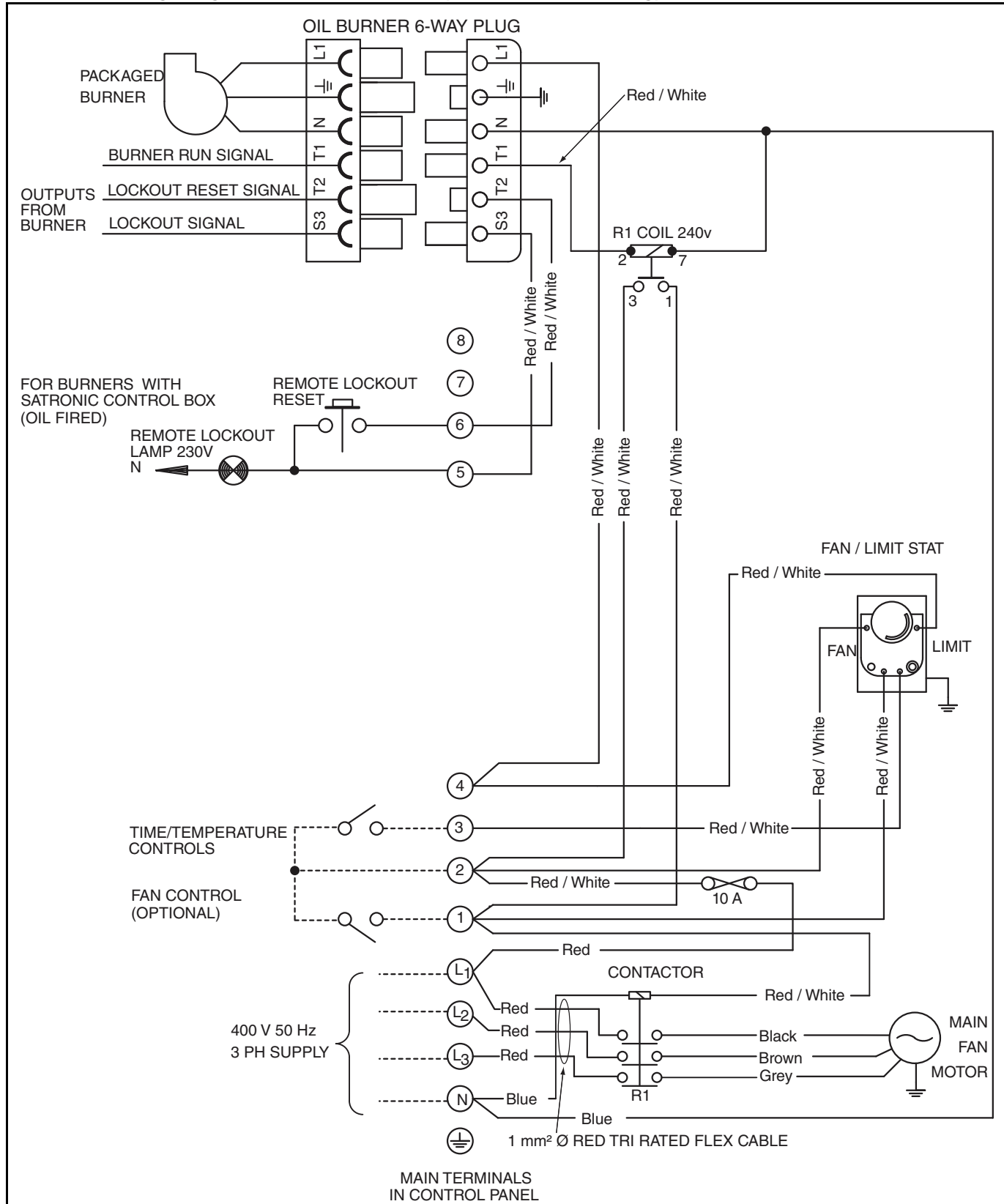
NOTE:
Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

9.9 CCH Wiring Diagram Gas Models 40-50 (horizontal mounting)



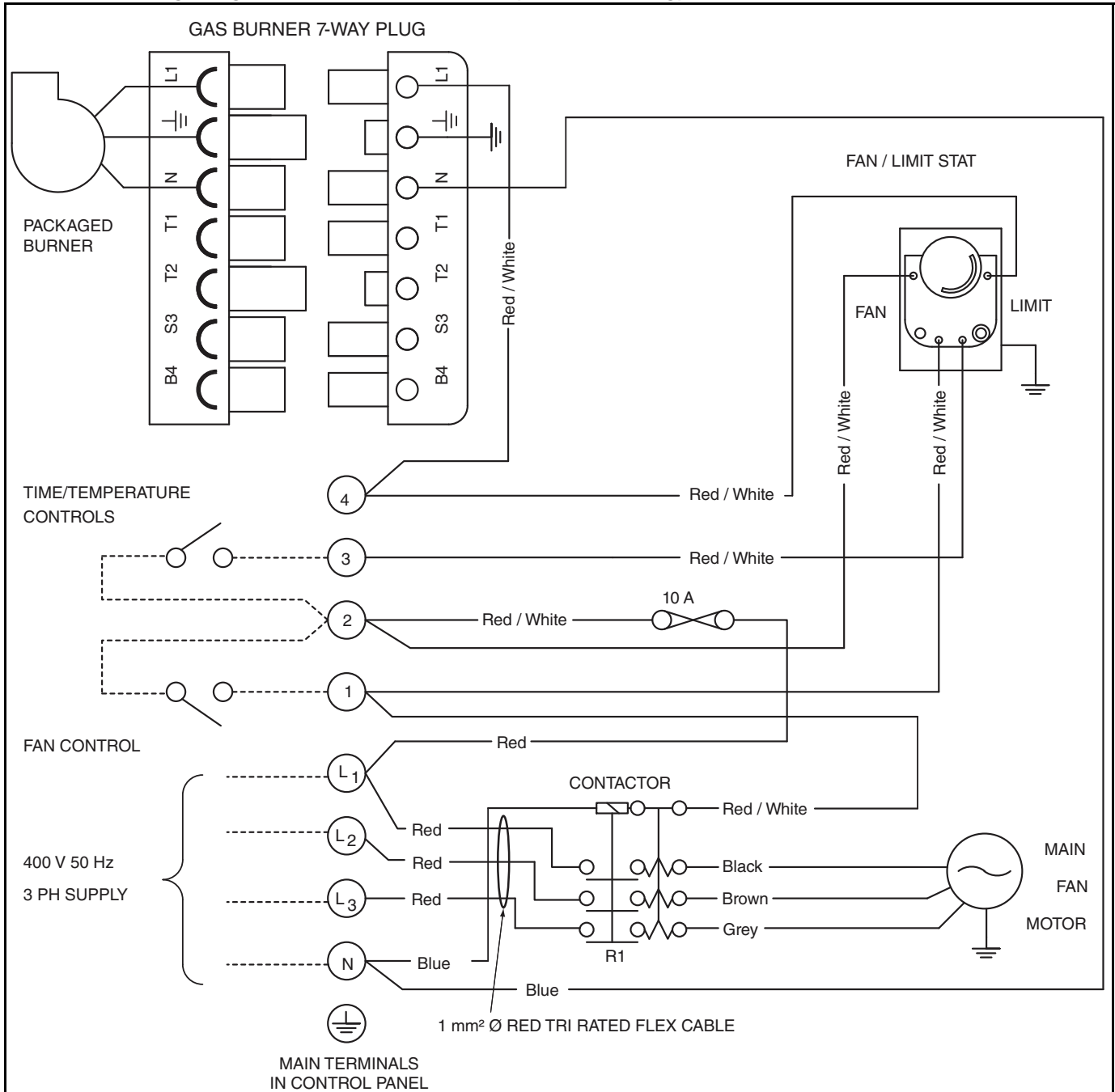
NOTE:
Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

9.10 CCH Wiring Diagram Oil Models 40-50 (horizontal mounting)



NOTE:
 Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

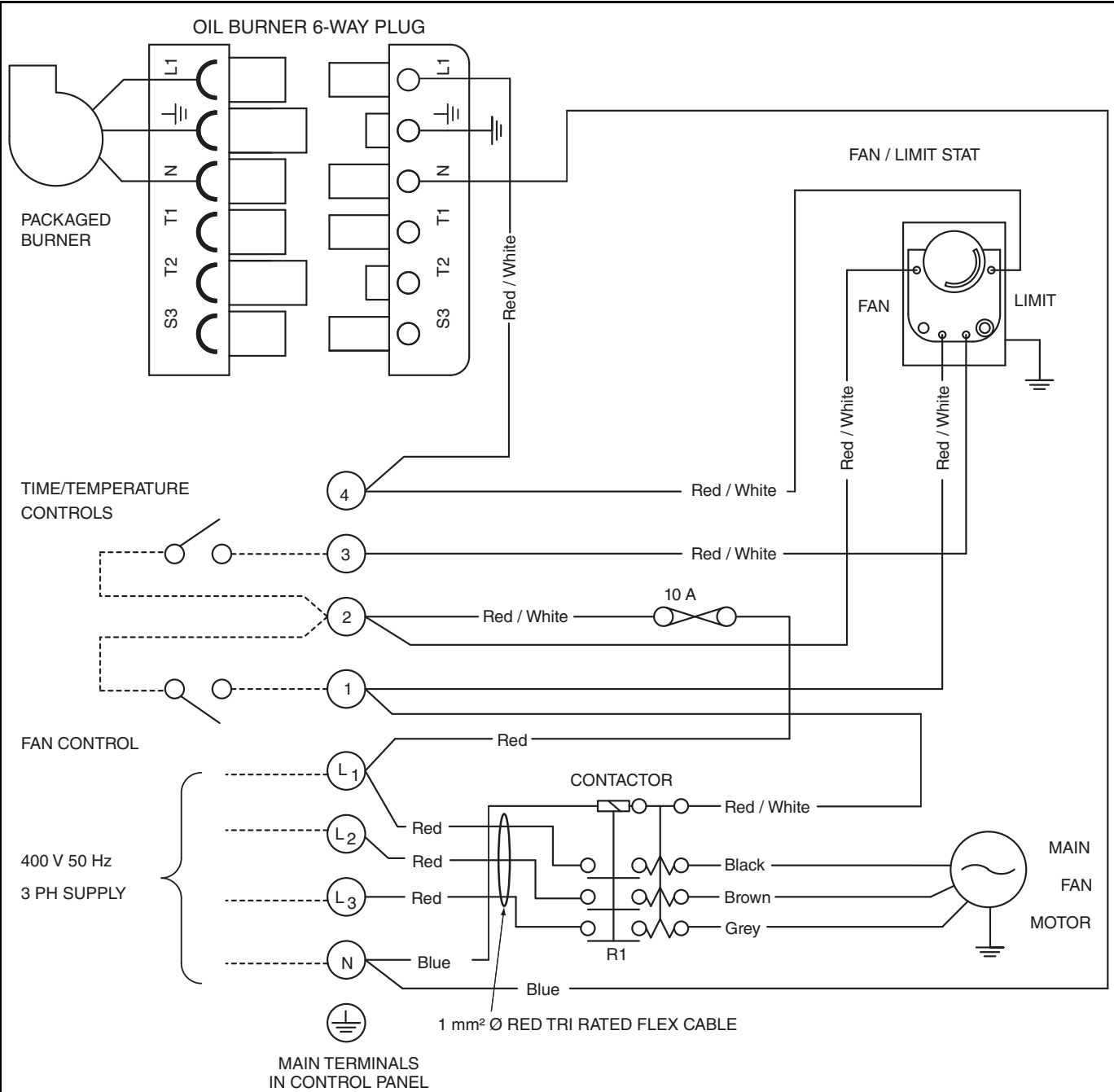
9.11 CCH Wiring Diagram Gas Models 60-100 (floor standing)



NOTE:

Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

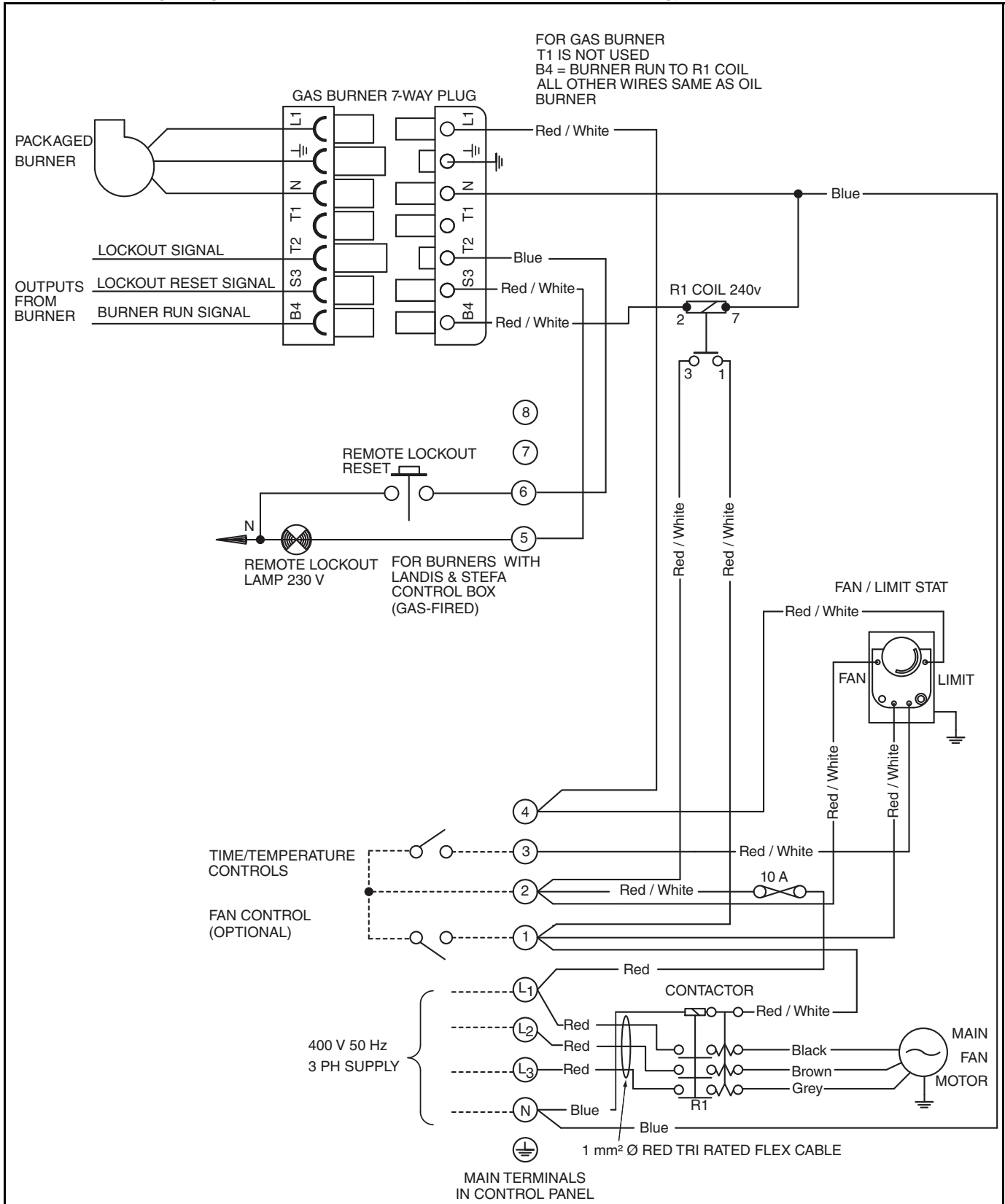
9.12 CCH Wiring Diagram Oil Models 60-100 (floor standing)



NOTE:

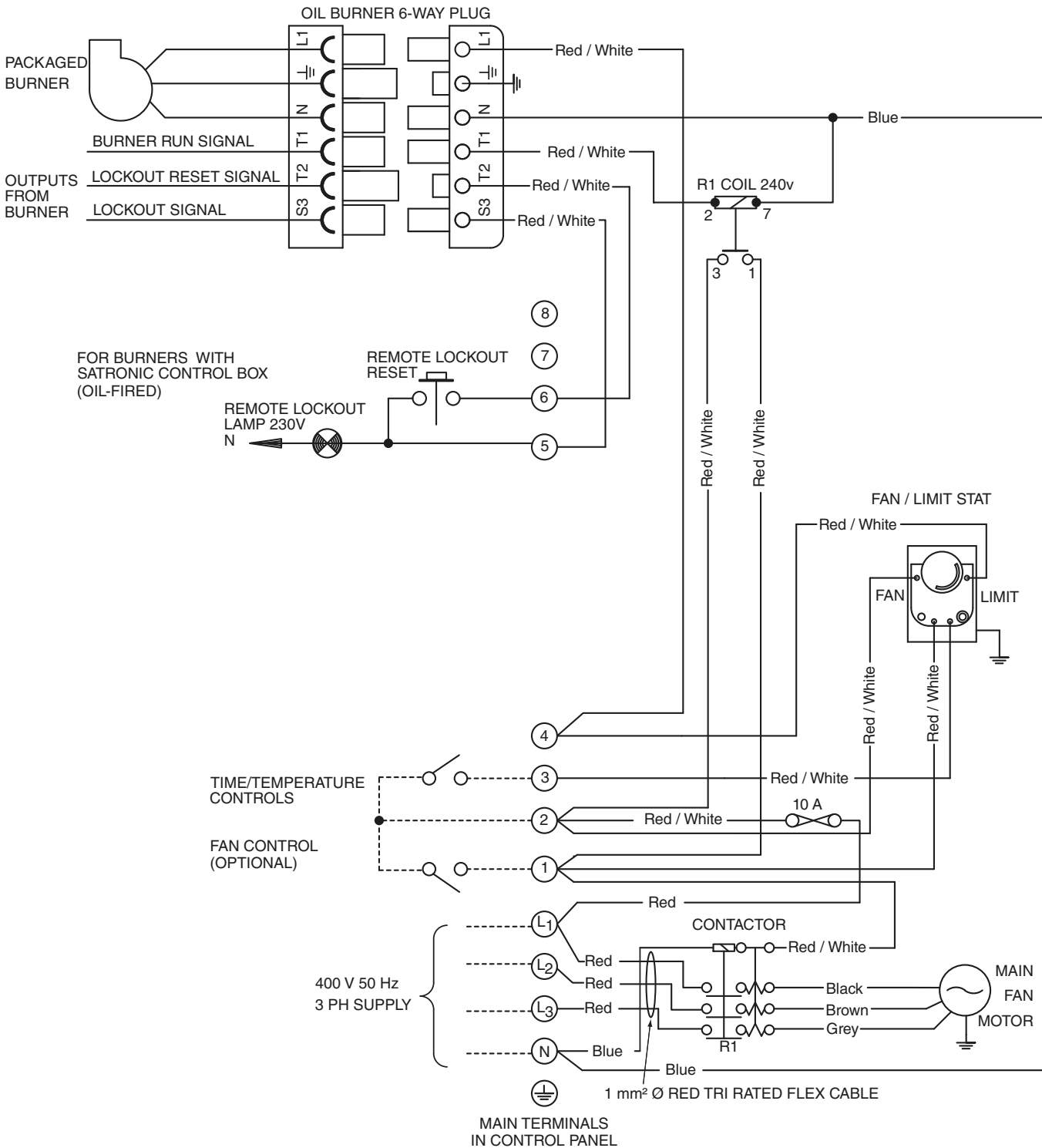
Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

9.13 CCH Wiring Diagram Gas Models 60-100 (horizontal mounting)



NOTE:
Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

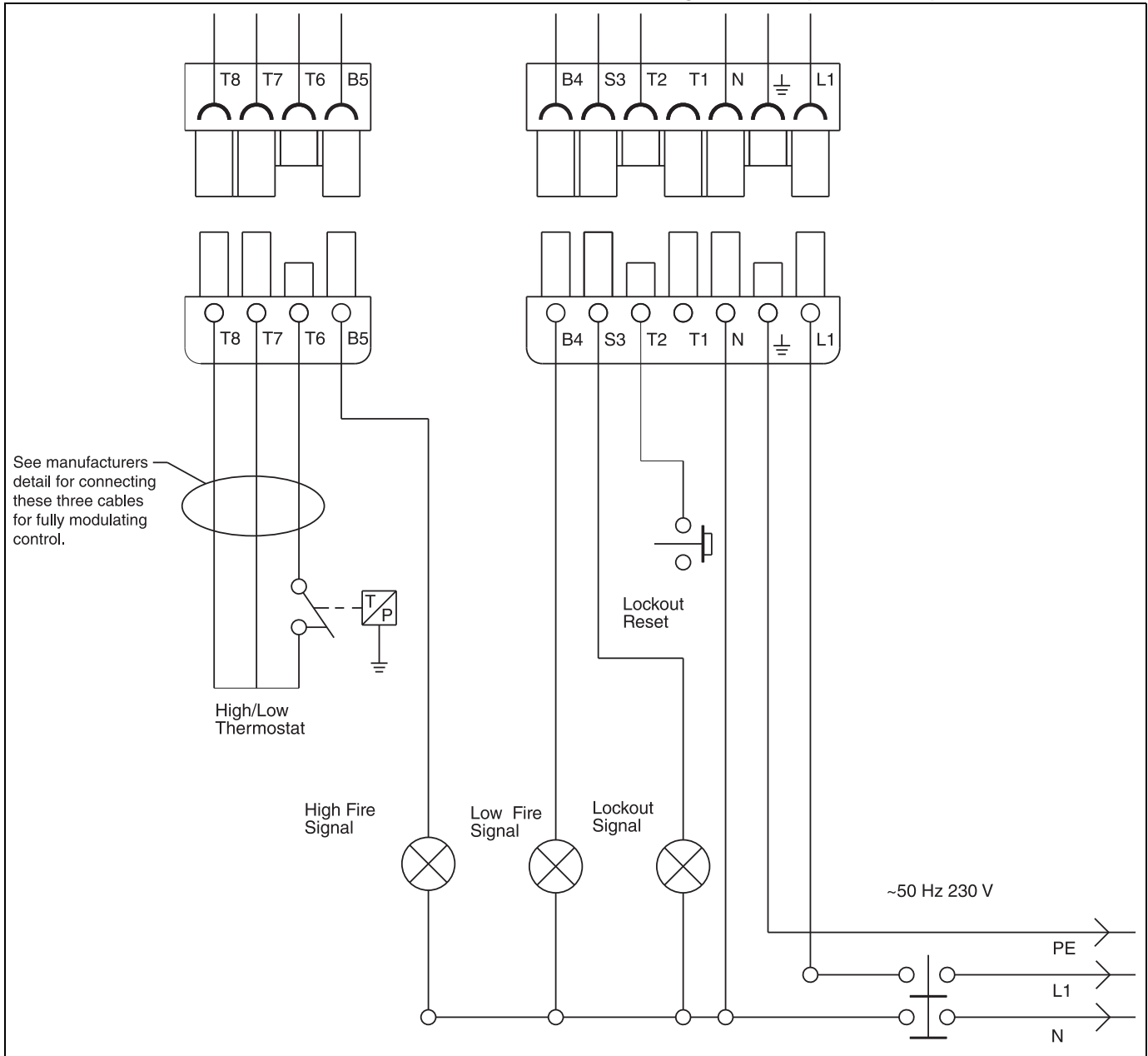
9.14 CCH Wiring Diagram Oil Models 60-100 (horizontal mounting)



NOTE:

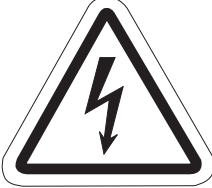
Any of the original wire supplied with the heater must be replaced with wiring material having a temperature rating of at least 105°C and 600 V.

9.15 Final Connections to Ecoflam HIGH/LOW or Modulating Burners (all models)



SECTION 10: COMMISSIONING

Installation, service, commissioning and annual inspection of the heater must be done by a contractor qualified in the installation and service of gas or oil-fired heating equipment. Read this manual carefully before installation, commissioning, operation or service of this equipment.

⚠ WARNING

Electrical Shock Hazard
Use extreme caution while commissioning.
Failure to follow these instructions can result in death or electrical shock.


10.1 Pre-Commission Checks

All pre-commission checks must be carried out before lighting the heater.

Ensure that the heater and all controls are suitable for the fuel, pressure and electrical supply to which they are to be connected.

10.1.1 Louvers

Where fitted, the air delivery louvers need to be set during commissioning to give the required air distribution.

⚠ WARNING

Cut Hazard
Turn off fuel and electrical supply before maintenance.
Fan can start automatically at any time.
Failure to follow these instructions can result in severe injury or product damage.

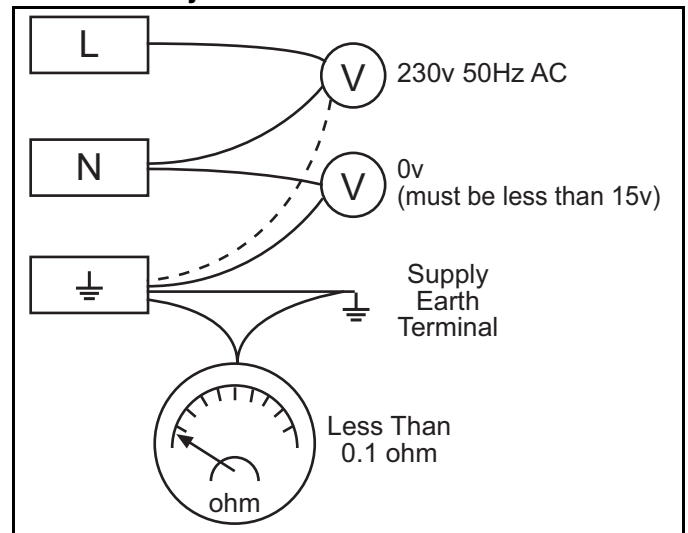
10.1.2 Electrical Checks

All pre-commission checks must be carried out before commissioning the heater.

1. Check that all site wiring is connected in accordance with the appropriate wiring diagrams on Page 20, Section 9.3 through Page 32, Section 9.15.

2. Check the correct fuse size is fitted in the local supply isolator. See Page 8, Section 4.4.

10.1.3 Polarity Test - 1 Ø



10.1.4 Polarity Test - 3 Ø

Voltage between each phase L1, L2 and L3 and Earth or Neutral should be approximately 230 V. Voltage between any 2 phases should be approximately 400 V. Test Neutral to Earth as single phase.

10.1.5 Fan Rotation Check

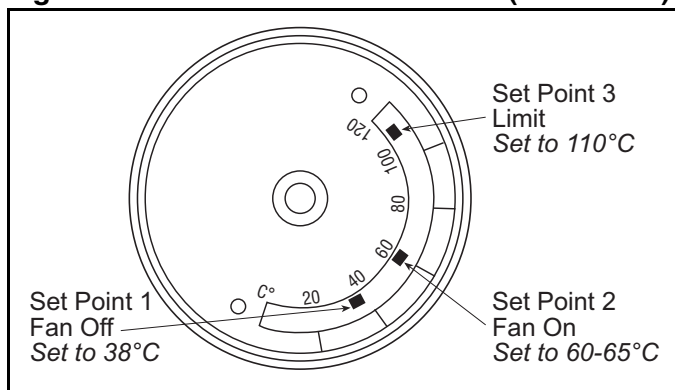
Switch on the electricity supply at the isolator and the manual switch to "fan on" (if no remote fan switch is installed, press the white button on the fan/limit thermostat). On 3 Ø heaters, check the rotation of the main fan. Rotation should be clockwise looking at the drive end. If rotation is not correct, turn off the isolator and change over any two of the incoming supply phases and recheck. It will be necessary to remove the lower front or right side panel to see fan rotation.

10.1.6 Fan Motor Overload Check

On 3 Ø belt drive heaters, check the correct settings of the fan motor overload. This should be 0.2 A above the rated current on the heater data plate. See Page 8, Section 4.4.

10.1.7 Mechanical Checks

1. Check that the flue is installed in accordance with these instructions and local regulations.
2. Check that the settings of the Combination Fan/Limit thermostat are correct - See Page 34, Figure 13.

Figure 13: Combination Thermostat (all models)

See Page 34, Section 10.2.5 and repeat until the burner fires.

10.2.4 Initial Setting

NOTE: Skip this step for models 015 to 030.

Once firing, the start gas pressure should be set to the value given in the Data Tables for the burner type and the model concerned (see the burner reference letter on data plate). This is carried out by turning the governor adjusting screw (accessed under the black push-on cover) clockwise to increase pressure, or counter clockwise to decrease pressure.

10.2 Commissioning the Burner (gas heaters)

High/Low and modulating burners have additional specific requirements. Follow the manufacturer's instructions using the data provided on Page 8, Section 4.4 through Page 10, Section 4.7.

10.2.1 Gas Supply

All aspects of the gas installation, including the gas meter, must be inspected, tested for soundness and purged in accordance with local and national codes. Ensure that the air is fully purged from the heater inlet pipe up to the main gas valve inlet test nipple.

10.2.2 Before Operating the Heater

Ensure the burner head, air damper and pressure switch settings are adjusted for the correct burner in accordance with the Data Tables on Page 8, Section 4.4 through Page 10, Section 4.7 (see the burner reference letter on data plate).

To ensure that all the controls are in safe working order, operate the heater for the first time with the isolating gas valve turned off.

1. Turn off the gas isolating valve
2. Using the installed external control, turn on the burner. The automatic sequence will now begin as described on Page 35, Figure 14.

There will be no ignition of the burner and lockout will occur, which proves the controls are operating correctly.

10.2.3 Fire the Burner for Dungs Combination Gas Valves

1. Open the gas isolating valve.
2. Connect a suitable pressure gauge to the burner pressure test point.
3. On models 040 or larger, to ensure that start gas only may pass to the burner, remove the gas valve electrical plug for the main gas valve.
4. Reset the lockout button of the control box and the burner should now fire. If lockout should occur when the start gas valve energises (or the main gas valve for models up to 030), repeat 3 or 4 times. If after several attempts the burner does not fire, then turn the start gas governor adjusting screw (or main gas governor for models 015 to 030) 3 turns clockwise.

10.2.5 Set Gas Rate

1. Switch off and refit the main gas valve plug (removed earlier to allow the main gas valve to operate).
2. Switch on again and allow the burner to fire and to settle for a few minutes.
3. Adjust the main gas burner pressure to the value given in the relevant Data Table for the model concerned using the Main Gas Regulator (accessed under the swivel cover). See Page 37, Figure 17.

The results of setting the gas flow rate by using burner pressure only can lead to quite wide variations in heat input due to the nature of the burners used.

NOTE: If the correct burner pressure cannot be reached, then check the inlet pressure to the valve, with the burner firing. See Technical Data Tables on Page 8, Section 4.5 for inlet pressure requirements.

Do not continue to adjust the regulator if the pressure is not changing.

If the inlet pressure is too low to allow the correct burner pressure setting, then the gas inlet pressure must be corrected before completing the commissioning.

10.2.6 Check Gas Rate

It is important to check that the gas rate set during the commissioning is within $\pm 5\%$ of the required flow rate.

This may be achieved by checking the gas flow to the heater wherever possible by using the gas meter and timing the flow through the meter. The results should be compared with the required flow rate for the model given in the Data Tables, adjusting the burner pressure to correct for any error. Checking the gas rate must be carried out with all other appliances including any pilots, turned off.

1. After burner pressure adjustment, allow the heater to operate for at least 15 minutes and then re-check settings.
2. Remove the manometer and refit all covers to the valve and tighten the screw of the outlet pressure tap.

3. Check gas flow rate at gas meter.

10.3 Control - Gas-Fired Heaters

For High/Low and modulating burners, follow the general sequence as described below and also have extra functional stages related to air damper positions. Refer to the burner manufacturers instructions for further detail. Gas burners have only one pressure switch, which is configured to cover combustion air and reaction to increases in combustion chamber pressure.

10.3.1 Description of Gas-Fired Heater Control

The gas fired burner fitted to all COMBAT® cabinet heaters is controlled by a full sequence plug-in control. This control ensures the safe start and stop sequence and also monitors the safe presence of a flame and burner air pressure.

Models 015 - 030 are wired for direct ignition of the main flame. All other models are wired for ignition of a start gas flame as the first stage and then the main gas flame as the second stage.

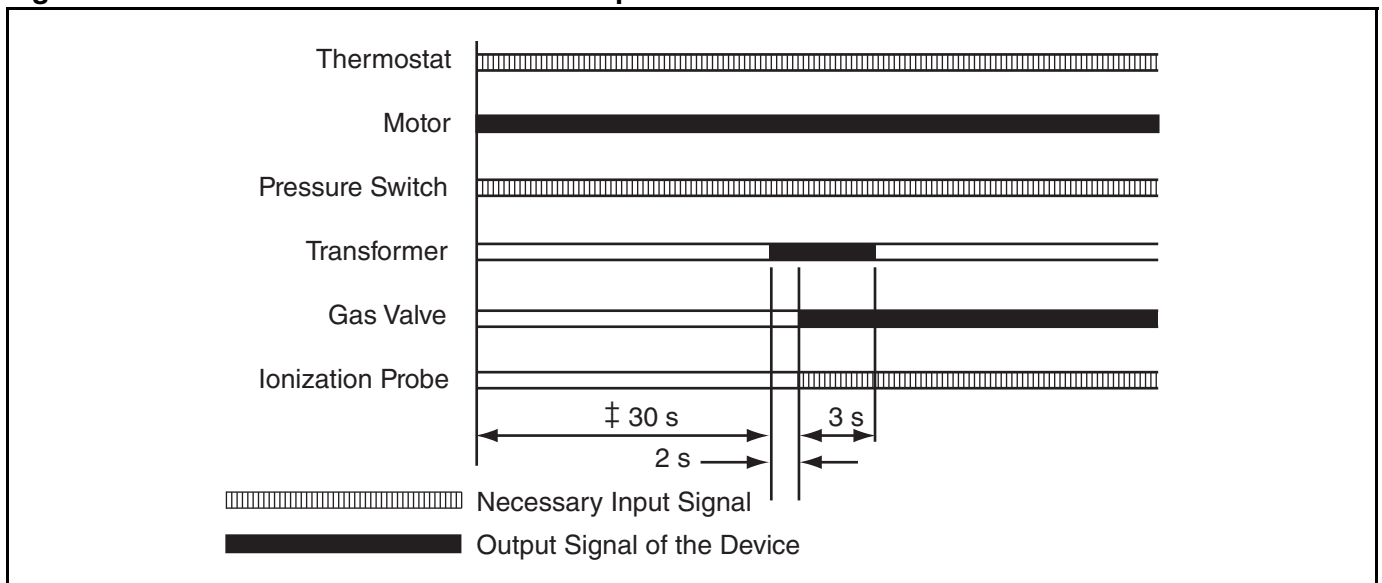
10.3.2 Sequence of Operation

1. With the external controls on calling for heat, and the pressure switch at rest, the burner fan will switch on after the control does a "self check".

NOTE: If the pressure switch contacts (normally closed) are open, the heater will not start.

2. The combustion air fan turns on and the pressure switch contacts close within the next 5 seconds to indicate sufficient combustion air or lockout will occur.
3. The sequence continues with a purge period with the burner fan running.
4. The electrical ignition switches ON at the end of the purge period.
5. The start gas valve opens (main gas valve for 015 - 030) and once a flame has been established, this remains open until close down. The flame probe is now continuously monitoring for the safe presence of flame.
6. Five seconds later, the electric ignition turns off, leaving the start gas flame to be proved as stable.
7. The start gas runs for ten seconds, then the main gas valve opens. The control is now in its normal run position

Figure 14: Gas-Fired Heater Control Box Sequence



10.3.3 Motor Starter and Thermal Overload

On belt-driven models, the motor is controlled by a direct on-line contactor starter fitted with thermal overload protection. If the thermal overload operates, the main fan will not run. To reset, press the reset button on the overload unit.

NOTE: For models with a 5.5 kW motor or larger, the direct on-line starter will be replaced by an automatic starter.

The overload should be set to indicate approximately 0.2 A above the normal running current of the heater. See Page 8, Section 4.4.

10.3.4 Burners

For details of the packaged burners, see the manufacturer's instructions and Page 8, Section 4.5 through Page 9, Section 4.6. When reading the data tables, ensure that the correct table for the burner and gas valve installed is being used. The data tables are listed under a burner reference letter which can be found on the heater data plate.

Figure 15: Motor Starter (models 040 -100 and Thermal Overload (models 060 - 100)

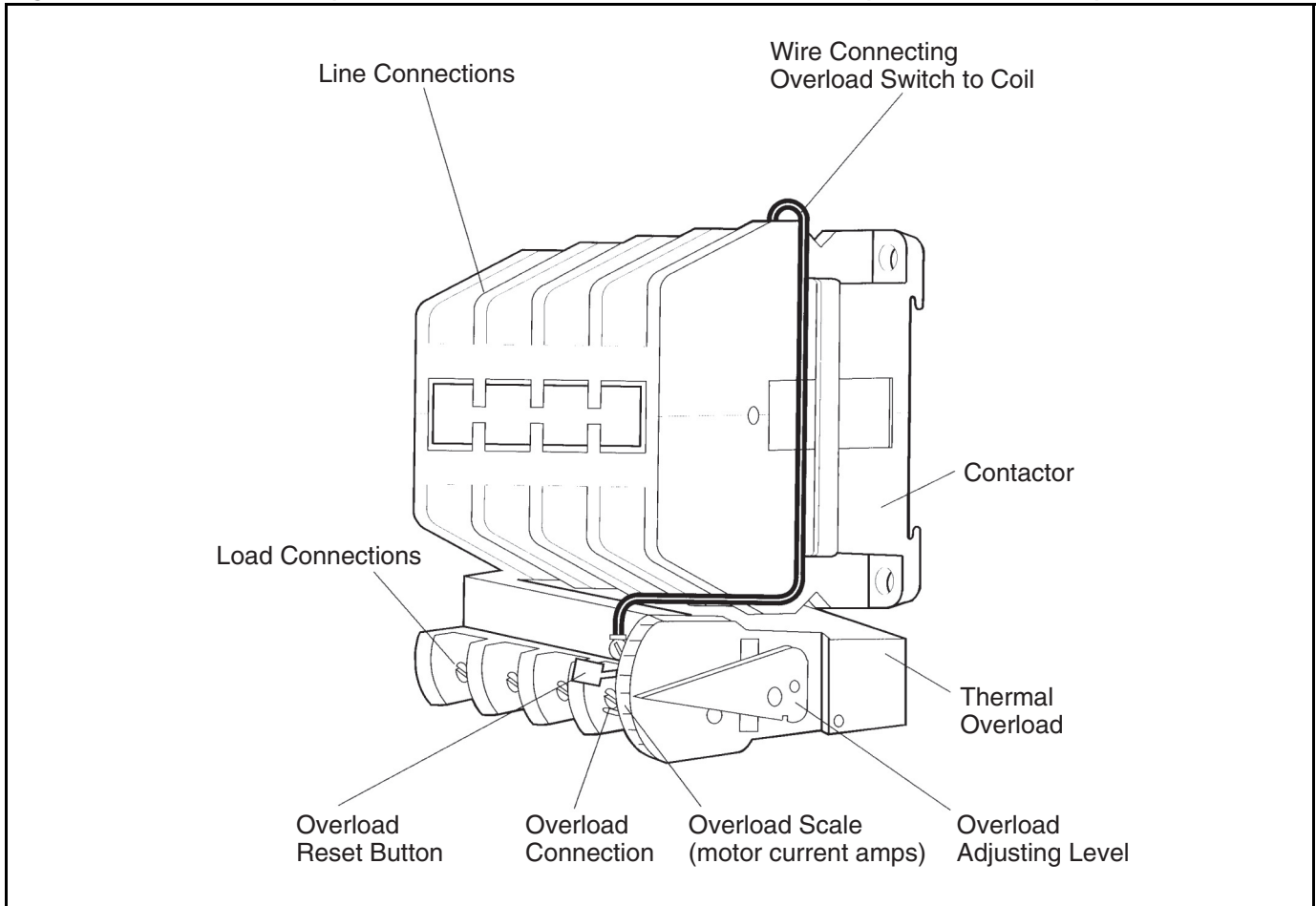


Figure 16: Gas Train Circuit for Dungs Gas Valves (all models)

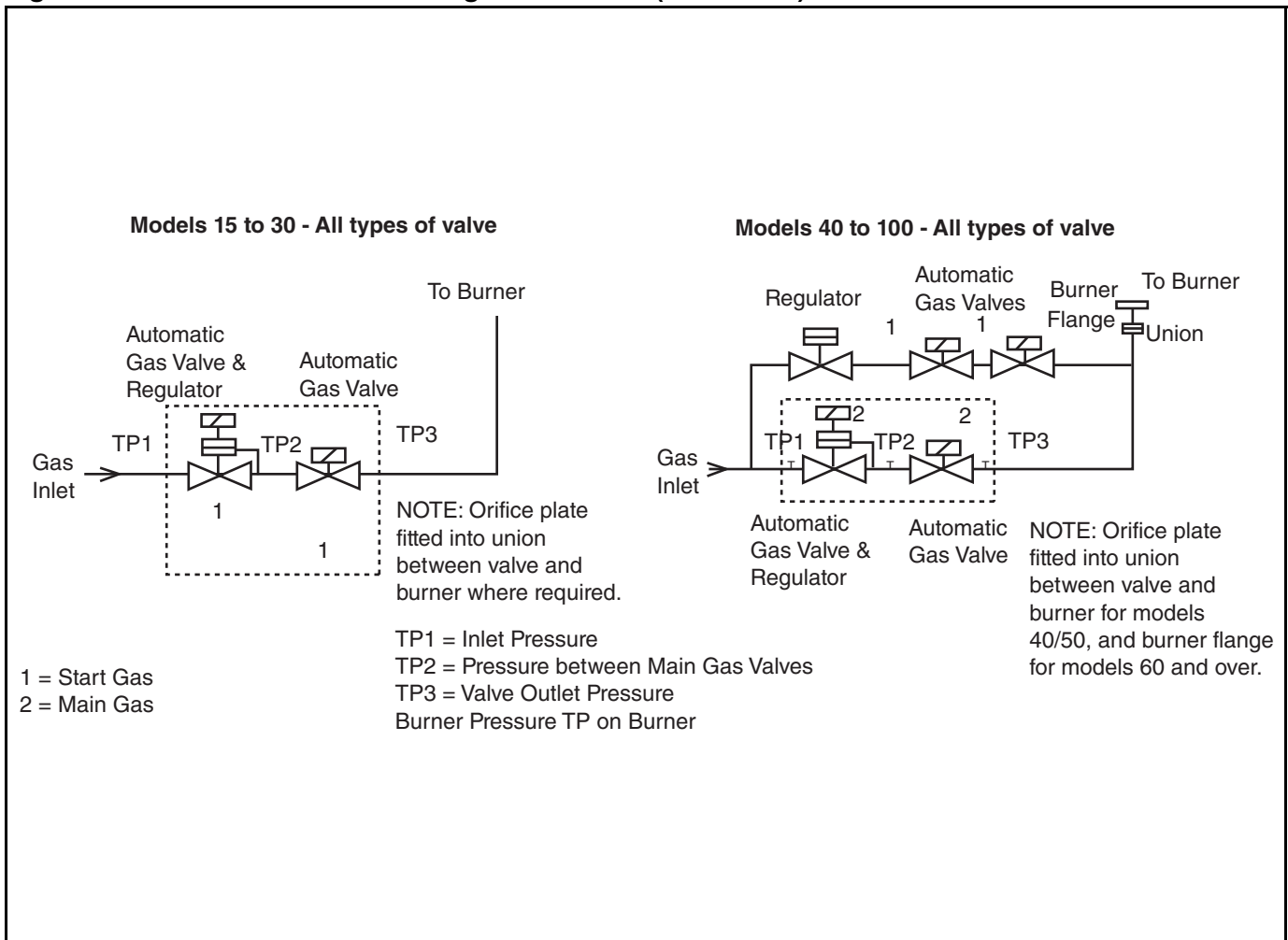
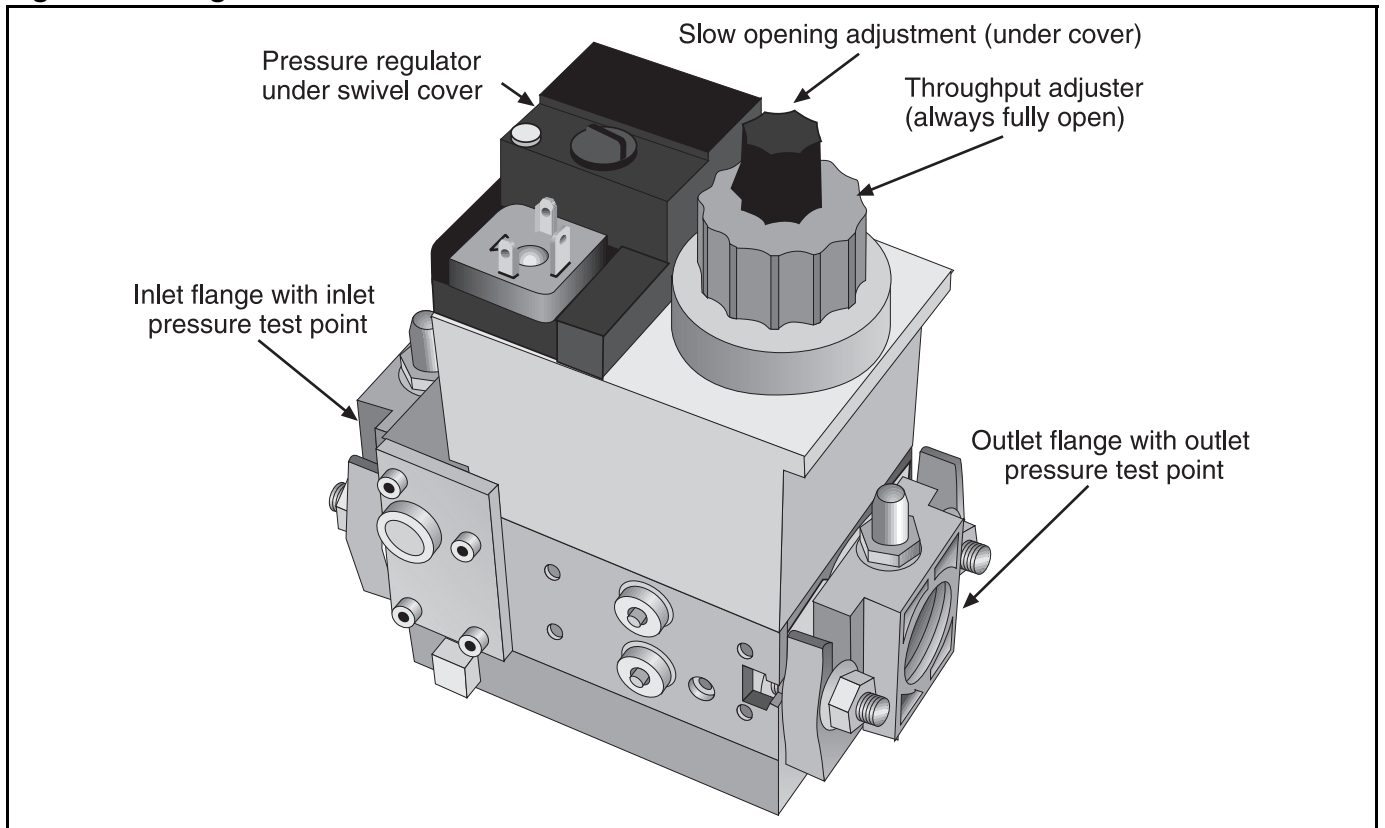


Figure 17: Dungs Gas Valve



10.4 Gas Valves

Dungs Combination Gas Valve

All model 015 - 030 gas-fired burners operate as direct main flame ignition and have no separate start gas train. All other models operate with a first stage start gas flame supplied from a start gas train containing a start gas pressure regulator and two safety shut-off valves, for all gas types.

The main gas is released at the second stage, and the combination main gas valve block contains a main burner pressure regulator and two safety shut-off valves, for all gas types. See Page 37, Figure 17. For high/low or modulating burners, the Dungs gas valve has extra features because it is an air/gas ratio control valve. Please refer to the manufacturer's instructions for setting the controls.

10.4.1 Start Gas Valves

Where fitted, the start gas valve train is fitted with a pressure regulator and two start gas safety shut off valves. The start gas regulator is used to adjust the burner firing rate during the start gas phase of these models.

10.4.2 Main Gas Valves

See Page 37, Figure 17 for the position of the burner pressure regulator. This must be used to set the burner pressure indicated in the data tables in Section 4.

For high/low or modulating burners, the Dungs gas valve has extra features because it is an air/gas ratio control valve. Please refer to the manufacturer's instructions for setting the controls.

10.4.3 Throughput Adjuster

These valves have a throughput adjuster fitted to the second main gas valve. See Page 37, Figure 17. This will be factory set at fully open on new

appliances and need no further adjustment. When replacing a gas valve, ensure that this device is set in the fully open position by releasing the locking screw and turning the "V MAX" fully counter-clockwise towards the "+" and then retightening the locking screw.

10.4.4 Rate of Opening

The slow opening adjustment can be seen on Page 37, Figure 17. This device is a hydraulic damper which slows down the rate of opening of the second main gas valve to give a smooth main gas ignition. This is preset at the factory at the slowest setting and will need no further adjustment. If a new valve is fitted, then remove the plastic screw on top and with a small screwdriver turn the "V Start" screw fully clockwise towards the "-" and refit the plastic cover.

10.5 Combustion Testing (all models)

Combustion quality must be tested to prove correct heater operation. Incorrect results will indicate faults with the installation or appliance.

Combustion testing must be carried out with all covers in place. The flue gas is sampled in the flue, within 1 meter of the heater. The values of CO₂ should be between 9.5% and 10.0% for natural gas and 11% for LPG, depending upon the model. The CO will be up to 80 ppm (0.008%) dry, air free, depending upon the model. Temperature rise of the flue gases above ambient should be approximately 160°C to 180°C. Seal the test hole in the flue after testing.

To alter combustion performance, open/close the combustion air damper to reduce or increase these values. Once adjusted to the optimum combustion setting, lock the air damper into position. Repeat the steps in Section 10.2.6.

10.5.1 Pressure Switch

⚠ WARNING



Electrical Shock Hazard

Use extreme caution while commissioning.

Failure to follow these instructions can result in death or electrical shock.

Setting of the pressure switch must only be carried out as part of a complete commission which includes combustion testing.

Remove the cover of the pressure switch. With the burner firing, turn the pressure switch dial to the setting indicated for that model and burner. See Page 8, Section 4.5 through Page 9, Section 4.6.

10.5.2 Complete the Commissioning

Ensure that all covers are fitted correctly and all test points are properly sealed.

10.5.3 High/Low and Modulating Burners

After setting the minimum burner input and combustion, the following check must be made: Run the heater on low fire for a minimum of 15 minutes. Check the flue gas temperature. If the flue gas temperature falls below 125° C, increase the low fire gas setting until the temperature reaches 125° C, otherwise condensation may form.

10.6 Commissioning the Burner (Oil Heaters)

Check all valves between the fuel tank and the heater are open, including the fire valve. Ensure that oil is available at the heater inlet and that the air has been vented from the fuel pipe installation. Vent the air by opening the bleed screw on top of the fuel filter. On pressurised systems, check that the installation is running at the correct pressure. B.M. oil lifters will need priming.

10.6.1

Ensure that the burner head and air damper settings are adjusted for the correct burner and that the correct atomising nozzle is fitted. See Page 10, Section 4.7 and the burner reference number on the data plate.

10.6.2 Preparation for Burner Pressure Test

Attach a pressure gauge 0-15 BAR (0 - 200 psi) to the burner pump pressure test port. (See manufacturer's information). A test manifold gives you the facility for the connection of the pressure gauge and the venting of the pump.

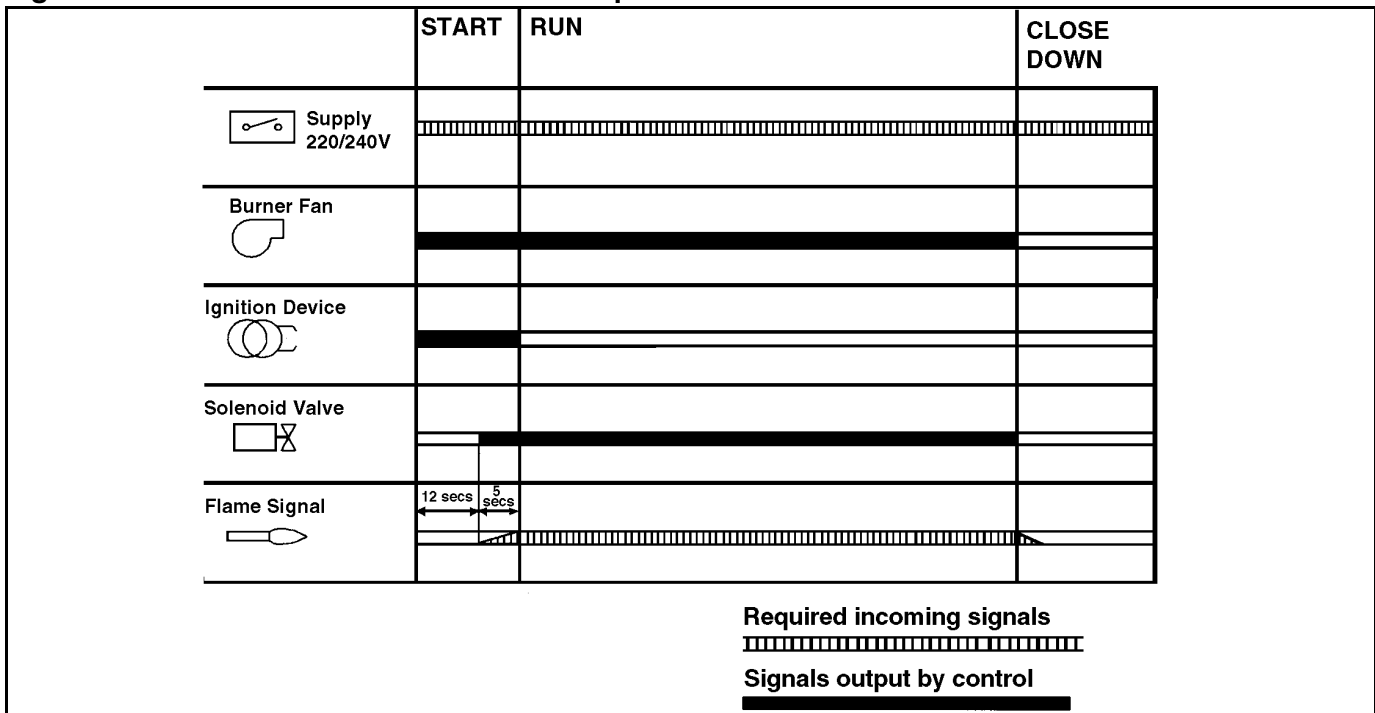
10.7 Control - Oil-Fired Heaters

For High/Low oil burners, follow the general sequence as described below and also have extra functional stages related to air damper positions. Refer to the burner manufacturer's instructions for further detail.

10.7.1 Description of Oil Fired Heater Control

The oil fired burners fitted to the heater are controlled by a fully automatic control and photoelectric flame monitor unit. This control ensures the safe start, ignition and stop sequence and also monitors the flame. If the flame should fail the control will go into "lockout". The button on the front of the control will illuminate to indicate lockout. Press the button to reset the control to restart the burner firing cycle.

Figure 18: Oil-Fired Heaters Control Box Sequence



10.7.2 Sequence of Operation

The operating sequence is as follows:
With the external controls on and calling for heat, the burner fan and electric ignition will switch on. After a combustion air purge of approximately twelve seconds, the oil solenoid valve will open and the burner will fire. After another five seconds, the electric ignition is turned off and the burner will go into its normal run position. The photo cell continuously monitors the safe presence of the flame. When the temperature control is satisfied, the control box will turn off all its outputs simultaneously and return to the rest position for the beginning of the next sequence.

10.7.3 Fault Display Messages

On burner failure, the red LED is permanently illuminated for a period of approximately 10 seconds, followed by a brief "dark phase"; then one of the following flash-codes will indicate the cause of the fault. See *Table 1 and Table 2*. This indication will repeat as long as the lockout reset button is not reset.

Table 1: Fault Display

Flash-Code Key	Message	Flash-Code
Short Pulse	Pre-ignition tv1	.
Long Pulse	Safety Time tv2	.
Short Pause .	Delay Time to Valve V2 tv2	.
Long Pause _	Running	_
	Low Mains Voltage	_

Table 2: Error Diagnosis

Error Message	Flash-Code	Possible Fault
Lockout		Within lockout safety time, no flame established.
Stray Light		Stray light during monitor phase, detector may be faulty.
Flash-Code for Manual Lockout		
Manual/External Lockout	_	

10.7.4 Fault Conditions

If at any stage during normal running the photo electric cell fails to detect the flame, the control will switch off and make an instant restart attempt. If the flame signal is still missing, "lockout" will occur. If the flame is not detected by the photo cell during a normal start, there will be no restart attempt and "lockout" will occur in approximately 17 seconds after the start.

If a flame is detected during the first 12 seconds (purge), the solenoid valve will not open and the control will "lockout". For the control sequence, see *Page 38, Figure 18*.

10.7.5 Switching On

Turn on the heater with the external controls. (Heat ON). If the "Lockout Reset" button is illuminated, press to reset. The combustion air fan and electric ignition should work immediately. Vent the burner oil

pump at the same time by loosening the pump vent port (pump must be running). If the burner goes into "lockout" before the pump has vented, wait one minute, then reset the control box and repeat 10.7.5 until all the air has been vented from the pump and the burner fires.

NOTE: The burner plug and socket may be used to turn off the burner during commissioning.

10.7.6 Adjust Burner Oil Pressure

Adjust the burner oil pressure to the value in the data table for the burner reference letter and burner manufacturer's information for details of the burner oil pump. When completed, turn off burner and remove test gauge and refit plug.

10.7.7 Set Combustion Air

The combustion air must be set. Measure the emissions in the flue at a point within one metre from the outlet of the heater and adjust for the highest carbon dioxide (CO₂) levels obtainable, usually 10.5 - 11.0%, while making little or no smoke (smoke number 0-1). The test must be carried out with all covers fitted and after the heater has been running for 15 minutes.

10.7.8 Complete the Commissioning

Test the burner for correct start and stop operation several times. Check that all safety devices operate correctly. Inspect the heater for any oil leaks and repair where necessary.

10.8 Turning Off the Heater (all models)

Set the external controls to the "off" position and the main burner will stop. The fans will run until they are stopped automatically by the fan thermostat.

Do not use Electrical Isolator for control of heater. The Electrical Isolator will switch off the fan. The heat exchanger could be damaged. The Warranty will not cover damage to the heat exchanger if operated improperly.

10.9 External Controls

External controls may include a time switch, room thermostat and frost thermostat. Operate each control to ensure that they function correctly. Set the time switch (if fitted) and room thermostat to the user's requirements.

10.10 Instruction to the User

Explain the controls of the heater to the user, including how to turn it on and off, using the controls fitted on site.

Give this manual to the user.

Ensure that the user is shown and understands the importance of maintaining clearances to combustibles; the user instructions on *Page 40, Section 11 through Page 41, Section 11.4*; and all warnings defined in this manual.

SECTION 11: USER INSTRUCTIONS

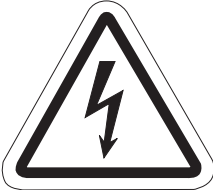
11.1 User Instructions

The COMBAT® Cabinet heaters are fully automatic and operate from the external controls fitted on site. The only user controls at the heater are the:

Fan Run Button - See Page 40, Figure 20.
 Burner lockout reset button - See Page 41, Section 11.2.2.

Limit thermostat reset button - See Page 40, Figure 20.

⚠ WARNING



Electrical Shock Hazard

Disconnect electrical power before servicing.

Failure to follow these instructions can result in death or electrical shock.

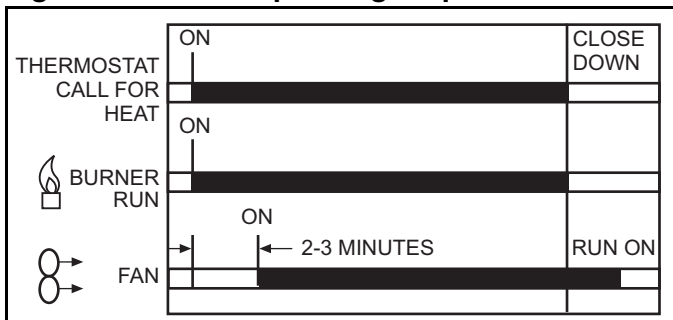
11.1.1 Heater Operation

When the heater has been switched on by the remote controls installed on site, the main burner will automatically turn on. The burner control will control the safe ignition of the flame. When the heat exchanger is sufficiently heated, the fan thermostat turns on the main fan(s).

All heaters require a constant gas and electricity supply, which must not be interrupted during the normal operation of this heater.

NOTE: The fan will come on during burner firing for horizontally mounted and high-flow heaters and modulating burners.

Figure 19: Heater Operating Sequence



11.1.2 Heater Operation (high/low or modulating)

The heater will operate as described in Section 11.1.1 with these added features:

High/Low Operation

A second limit thermostat or a two-stage thermostat will be installed on site so that as the temperature reaches the first set point, the firing rate will reduce

to low fire. If the temperature rises to the second set point, the burner will turn off. The burner will come on again at either High or Low fire, depending on the thermostat set point.

Set the two stage thermostat to the desired temperature.

Modulating Operation

The on-site control for modulating burners is a temperature controller that provides a varying output signal dependant upon the ambient temperature to the control. The burner firing rate will continuously vary between the maximum and minimum setting. If the temperature rises with the firing rate set to the minimum, the burner will shut down. Set the operating temperature according to the instructions provided with the control.

11.2 Common User Controls (all models)

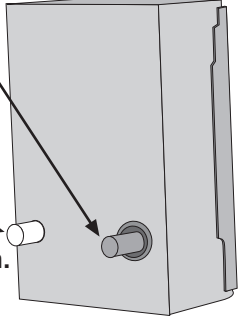
11.2.1 Combination Fan/Limit Thermostat

The Combination Fan/Limit Thermostat is located at the top right side of the heater.

This control ensures the heater does not blow cold air in the normal heating cycle and protects the heat exchanger against overheating.

Figure 20: Fan/Limit Thermostat

If the air flow is reduced due to power failure, the limit thermostat will cause the burner to lockout.



**Pull out for normal operation.
Press in for constant fan.**

The combination fan/limit thermostat is preset during commissioning.
 See Page 8, Section 4.4 and Page 34, Figure 13.

NOTE: To reset, the heat exchanger must be cool.

Description	Part Number
Combination Fan/Limit Thermostat	K017A

! WARNING**Explosion Hazard**

If control locks out, do not make more than 3 attempts to restart the heater.

Dangerous fuel mixtures can build up.

The fault must be traced and repaired by a registered installer or service engineer.

Failure to follow these instructions can result in death, injury or property damage.

11.2.2 Burner Lockout Reset Button

The red warning light built into the burner control box will illuminate when the control has gone to lockout. This may be caused by flame failure. Wait one minute then press the reset button.

11.3 Lighting Instructions (all models)**11.3.1 To Turn On Heater**

1. Ensure that the electrical and gas supplies to the heater are on. Check that the on-site controls are "ON".

NOTE: The thermostat setting must be above the ambient temperature for the heater to operate.

2. The automatic firing sequence will begin as described on Page 40, Figure 19. The heater will now operate automatically under the control of the on-site controls. Following long shut down periods, the control may go to lockout. See Page 41, Section 11.2.2.

11.3.2 To Turn the Heater Off

Set the installed remote controls to the "OFF" position or turn down the remote thermostat below the ambient temperature.

The burner will turn off immediately.

The fan will continue to run for a few minutes.

To restart, turn the remote control to "ON".

If the heater will remain off for a long period of time, when the main fan(s) have stopped, turn off the fuel supply valve and main electrical isolator. To restart open the fuel supply valve and follow the instructions in Section 11.3.1.

11.4 Simple Fault Finding (all models)

Some possible reasons for the heater not operating are:

1. Gas supply not turned ON.
2. Electricity supply not turned ON.
3. The time and/or temperature controls are not ON.
4. The Limit Thermostat may have operated. This may be caused by an interruption of the electrical supply or failure of the distribution fan.
5. The burner supply plug has been disconnected.

If the Limit Thermostat persistently operates, there is a fault which must be investigated by a contractor qualified in the installation and service of gas or oil-fired heating equipment.

NOTE: If the main fan runs continuously, the white button (Figure 20) may have been pressed in - make sure it is pulled out. Alternatively, if a remote fan switch is fitted it may be in the ON position.

11.4.1 Simple Fault Finding (burner faults)

If the burner fails to ignite for any reason, it will go to lockout. This will be indicated by the red light on the heater or at the remote indicator (if fitted).

1. Press in and release the lockout reset button on the burner or, if fitted, the remote reset.

Lockout should not occur during normal operation of the heater and indicates there is a fault condition which must be corrected.

11.4.2 Simple Fault Finding (oil fired heaters)

Make sure the appliance fuel valve is open and there is oil in the tank. If the fuel tank or lines have run dry, the fuel system will need to be vented. For venting oil-fired heaters, See Page 38, Section 10.6 through Section 10.75.

FOR YOUR SAFETY

If you smell gas:

1. Open windows.
2. **DO NOT** try to light any appliance.
3. **DO NOT** use electrical switches.
4. **DO NOT** use any telephone in your building.
5. Leave the building.
6. Immediately call your local gas supplier after leaving the building. Follow the gas supplier's instructions.
7. If you cannot reach your gas supplier, call the Fire Department.

⚠ WARNING



Fire Hazard

Do not store or use petrol or other flammable vapours and liquids in the vicinity of this or any other appliance.

Some objects will catch fire or explode when placed close to heater.


Failure to follow these instructions can result in death, injury or property damage.

SECTION 12: SERVICING

12.1 Servicing Instructions

After commissioning, the heater will require maintenance to be carried out annually. If the heater is used in a dirty or dusty area, more frequent maintenance may be necessary.

Installation, Service and Annual Inspection of the heater must be done by a contractor qualified in the installation and service of gas or oil-fired heating equipment.

⚠ WARNING

Cut Hazard
<p>Turn off fuel and electrical supply before maintenance.</p> <p>Fan can start automatically at any time.</p> <p>Failure to follow these instructions can result in severe injury or product damage.</p>

NOTE 1: After any maintenance or repair work, always test fire the heater in accordance with the commissioning instructions on Page 33, Section 10 through Page 39, Section 10.10 to ensure all safety systems are in working order before leaving the heater to operate. Minor faults may be traced by using the troubleshooting charts on Page 45, Section 14 through Page 50, Section 14.7.

NOTE 2: Check all fuel pipes and pipe joints to ensure there are no cracks or gas leaks. Any cracks in the pipes or pipe joints must be repaired.

NOTE 3: Inspect all suspended components and hardware. Insure that they are in good condition, properly tightened, and corrosion free.

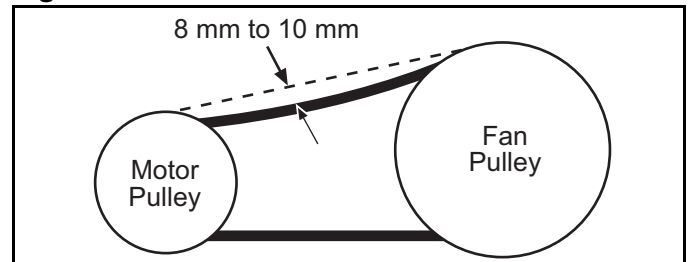
12.2 Burner Maintenance

1. See the manufacturer's information for specific instructions.
2. Clean the fan (and fuel filters, when fitted). Inspect all components, including the flame monitoring and ignition system, and correct operation of fuel control valves.
3. For oil-fired burners it is recommended that the atomising oil nozzle be replaced during the annual service.

12.3 Fan/Motor Assembly Maintenance (all models)

The main fan bearings are permanently sealed and do not need lubrication. Before cleaning, turn off fuel and electrical supply. Remove the heater side panels and use a small brush or duster to clean the fan blades from each side. Replace panels when done.

Figure 21: Belt Tension



Check the condition and tension of the drive belts. The condition is best inspected with the belts removed. Check for chaffing or lateral cracks. Replace belts as a matched pair as necessary. Do not over-tighten belts, as this may cause bearing damage.

12.4 Heat Exchanger Maintenance

Ensure that the front collector box is clean and that the turbulators fitted to the tubes are in good condition.

Also inspect the joint between the heat exchanger and the flue to ensure that it is still sealed.

1. If maintenance is needed, remove the burner. See Page 51, Section 15.1.
2. Remove the upper front panel.
3. Remove the front cover of the heat exchanger.
4. Remove and inspect the turbulators.
5. Clean out any deposits from flue ways and the combustion chamber, using a vacuum cleaner and brush. Inspect the combustion chamber and heat exchanger for damage or corrosion.
6. Any damage must be referred to Roberts-Gordon.
7. Replace components in reverse order to above - replacing gasket material and any damaged turbulators.
8. Inspect and repair any damage to the seal between the flue and the flue spigot.

12.5 Thermal Insulation

While the upper panels are removed for heat exchanger servicing, the thermal insulation fitted to all the upper panels must be inspected. Insulation should be sound, with the foil face in good condition. If any thermal insulation is in poor condition, then it must be replaced with new insulation material and suitably sealed at the edges with adhesive foil tape.

SECTION 13: CONVERSION BETWEEN FUELS

13.1 General

All COMBAT® Cabinet heaters may be operated on fuel oil, natural gas or propane gas, depending on which burner type has been fitted. Any conversion between fuels must be done by a contractor qualified in the installation and service of gas or oil-fired heating equipment. Conversion must be carried out in accordance with the information provided to maintain compliance with the CE product certification.

13.2 Burner Conversion

Burners designed to operate on class D (35 sec) fuel oil (Gas Oil) may be converted to operate on kerosine (28 sec). This may shorten the life expectancy of the fuel pump and fuel train components.

Burners designed to burn natural gas may be converted to burn LPG propane gas or vice versa.

For details of the changes necessary, please contact Roberts-Gordon with the heater serial number and burner type or consult the burner manufacturer's information.

Heaters designed to burn fuel oil may only be converted to burn gas by replacing the complete burner.

Heaters designed to burn gas may only be converted to burn fuel oil by replacing the complete burner.

SECTION 14: TROUBLESHOOTING

14.1 General

⚠ WARNING

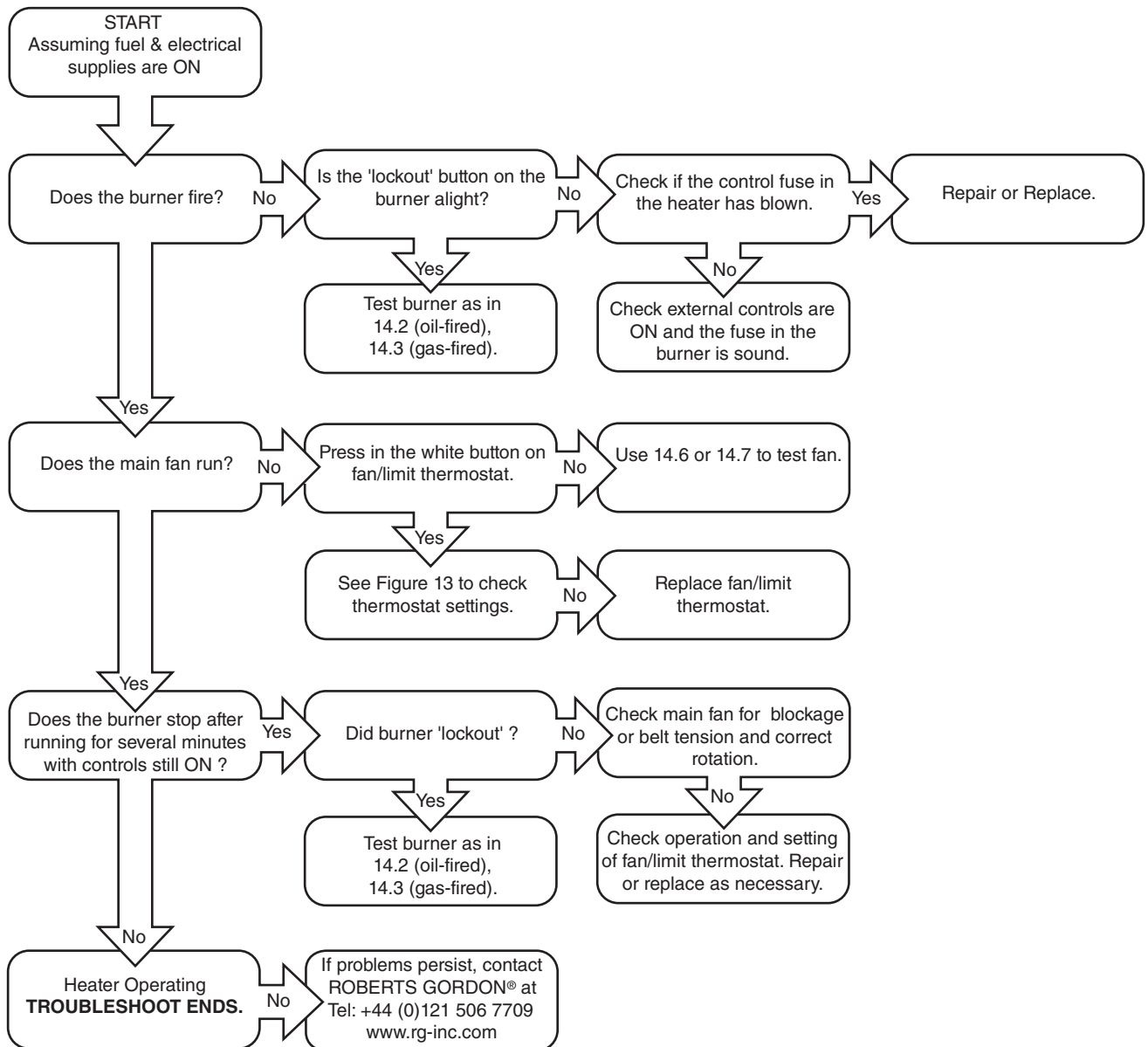




Explosion Hazard

**Installation must be done by a registered installer/
contractor qualified in the installation and service of
gas-fired heating equipment or your gas supplier.**

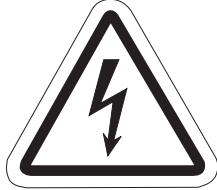
**Failure to follow these instructions can result in death,
injury or property damage.**



For your safety and optimum heater performance, use only ROBERTS GORDON® replacement parts.
Conduct Commissioning procedure as shown on Page 33, Section 10.

14.2 Troubleshooting for Oil Burners (see manufacture's instructions)

⚠ WARNING

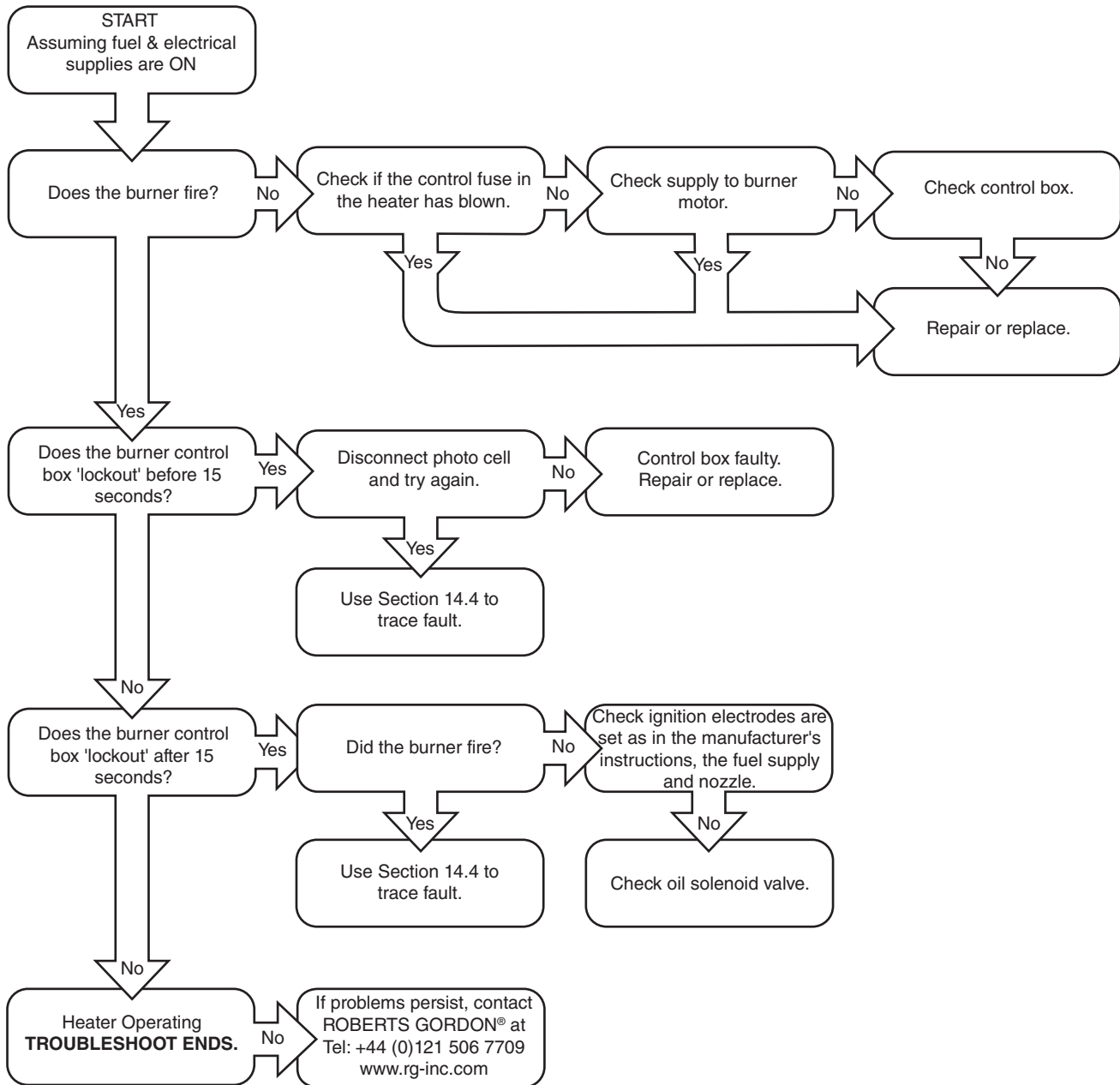


Electrical Shock Hazard

Do not touch ignition components.

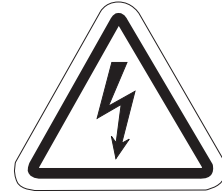
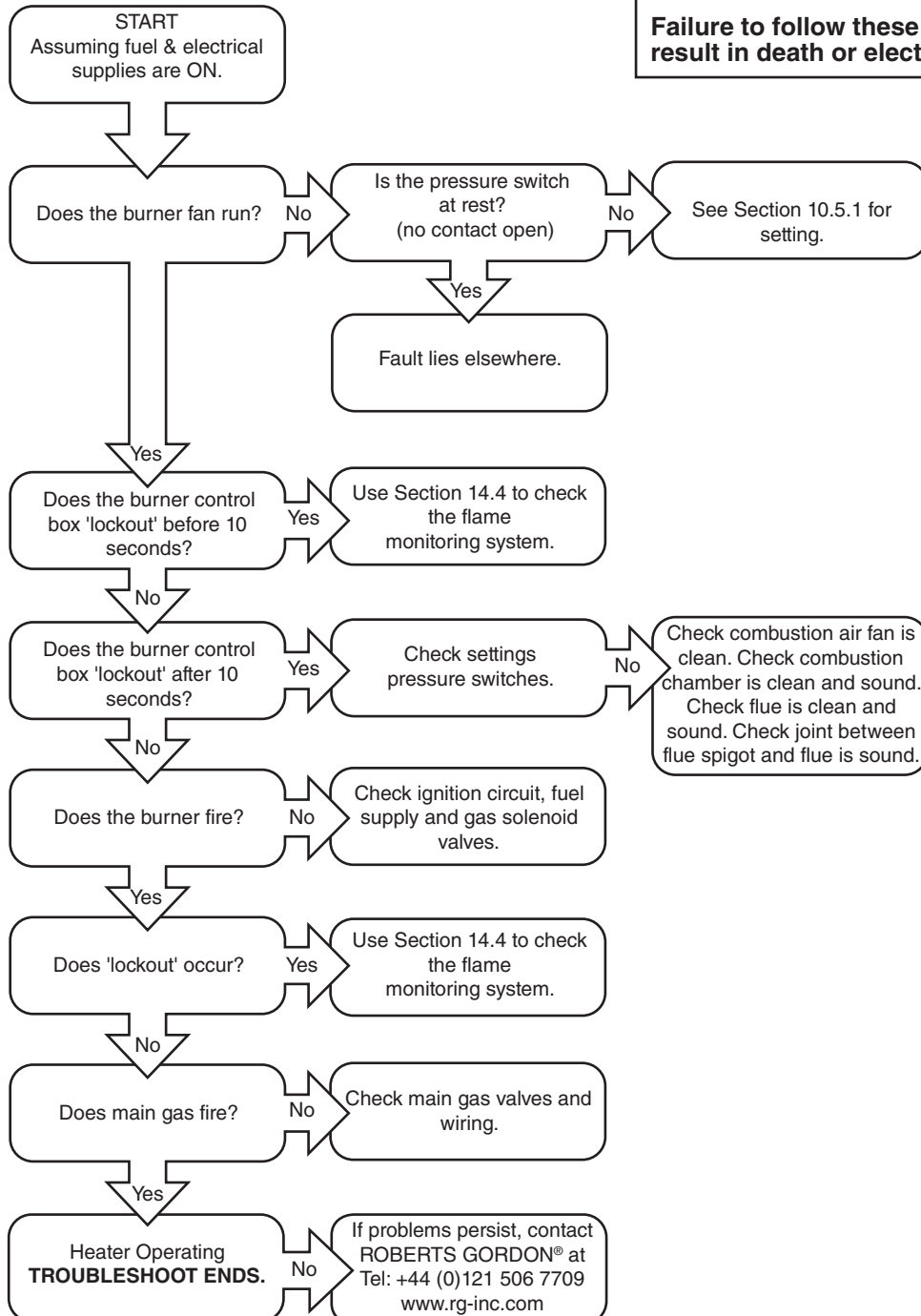
Voltage from ignition components is high.

Failure to follow these instructions can result in death or electrical shock.



For your safety and optimum heater performance, use only ROBERTS GORDON® replacement parts. **Conduct Commissioning procedure as shown on Page 33, Section 10.**

14.3 Troubleshooting for Gas Burners (see manufacturer's instructions)

⚠ WARNING**Electrical Shock Hazard****Do not touch ignition components.****Voltage from ignition components is high.****Failure to follow these instructions can result in death or electrical shock.**

14.4 Troubleshooting for Flame Supervision System

The flame supervision system is different for gas-fired and oil-fired heaters but may be tested in a similar way.

Gas-fired heaters use a rectification flame probe to monitor the flame.

Oil-fired heaters use a photo sensitive cell to monitor the flame.

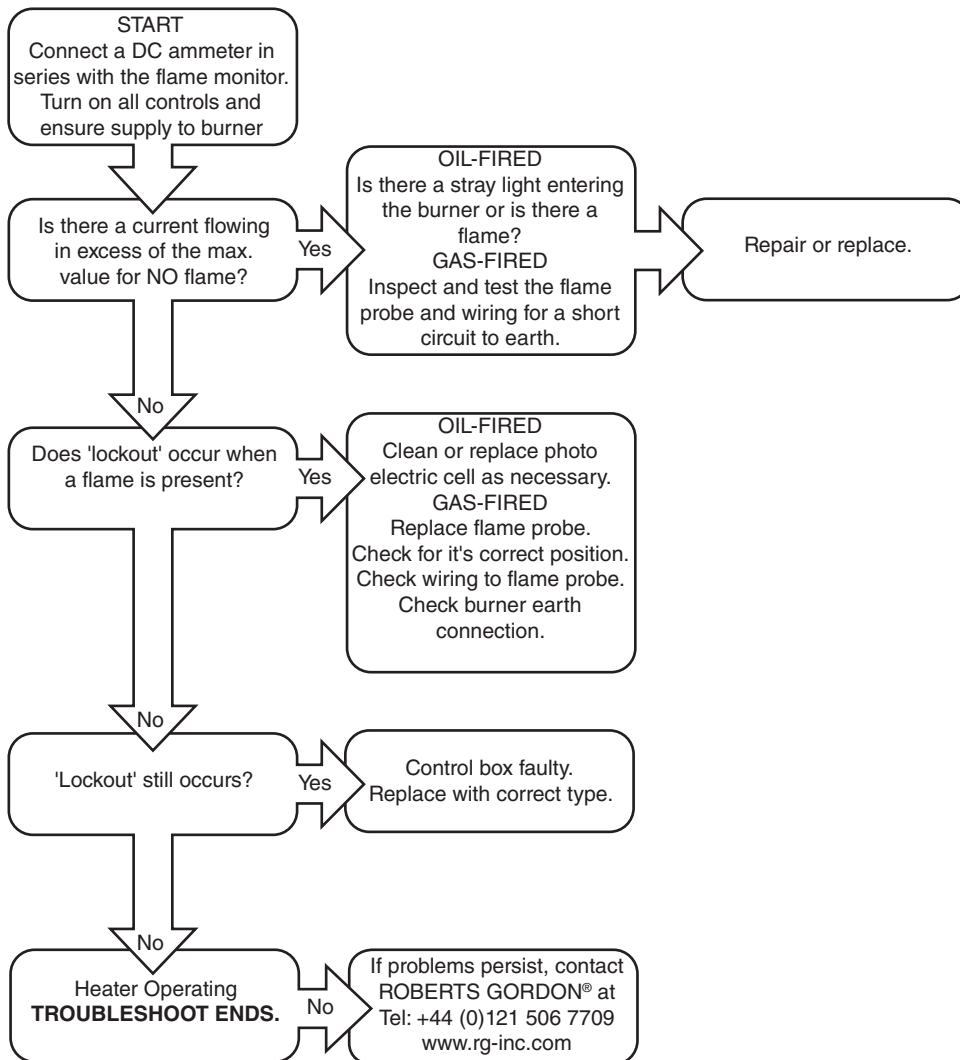
To connect a suitable meter into the circuit to monitor the flame signal current, disconnect one of the wires to the monitor (there is only one for gas-fired).

Connect a suitable DC ammeter between the terminal just disconnected and the wire taken from it.

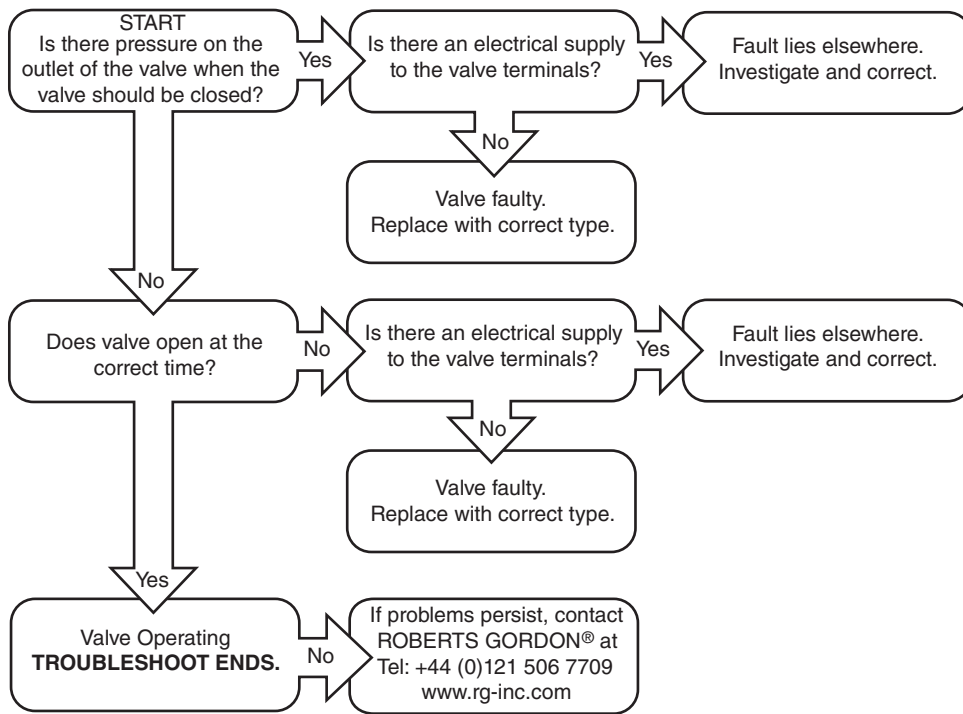
Should the meter read backwards, then reverse its connections.

Readings should be approximately as follows (For further details see burner manufacturer's instructions):

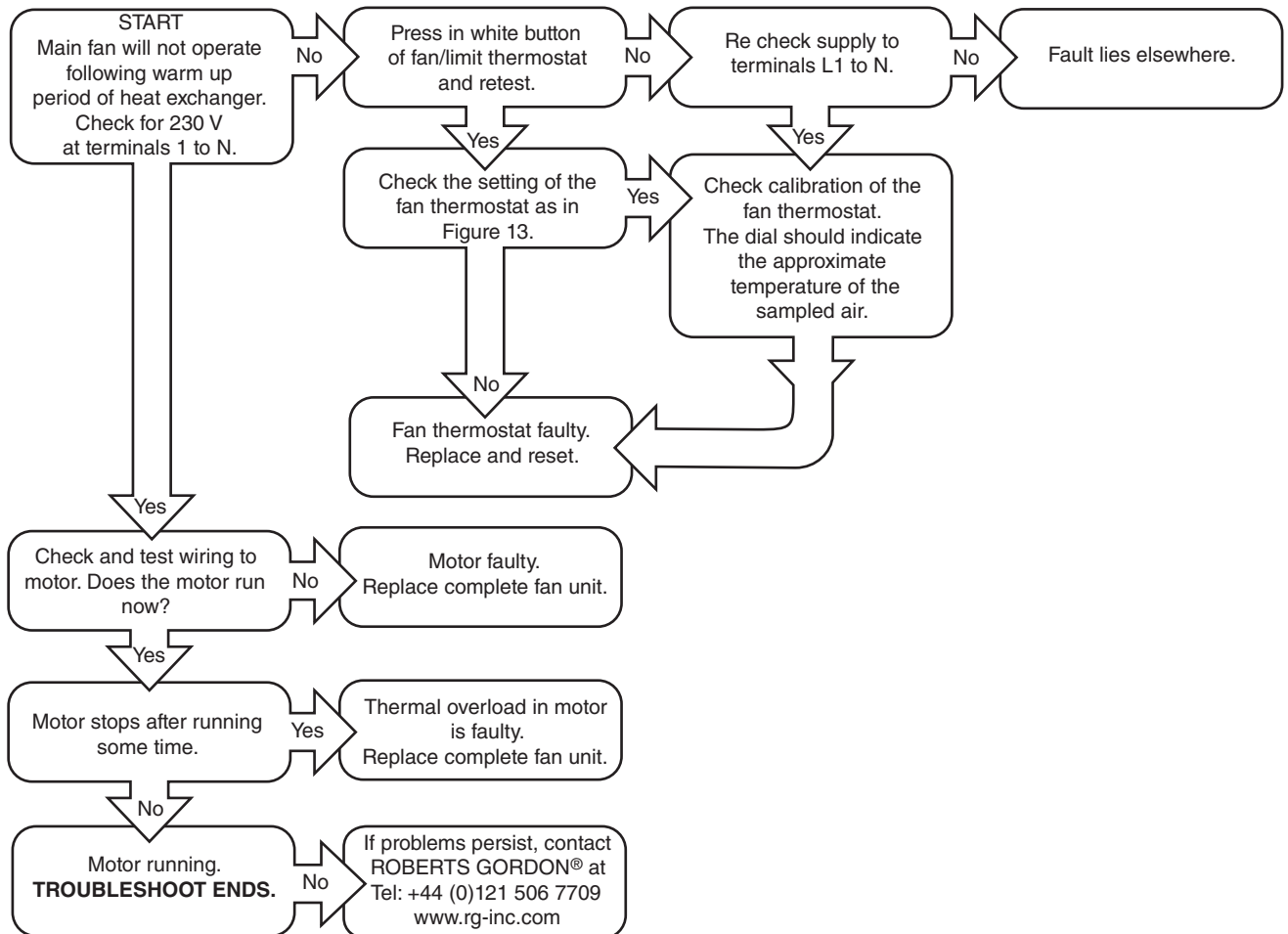
Oil-Fired		Gas-Fired	
Maximum flame current with no flame	Minimum flame current with flame	Maximum flame current with no flame	Minimum flame current with flame
12 μ Amp	25 μ Amp	0.5 μ Amp	1.0 μ Amp



14.5 Troubleshooting for Solenoid Valves Circuit

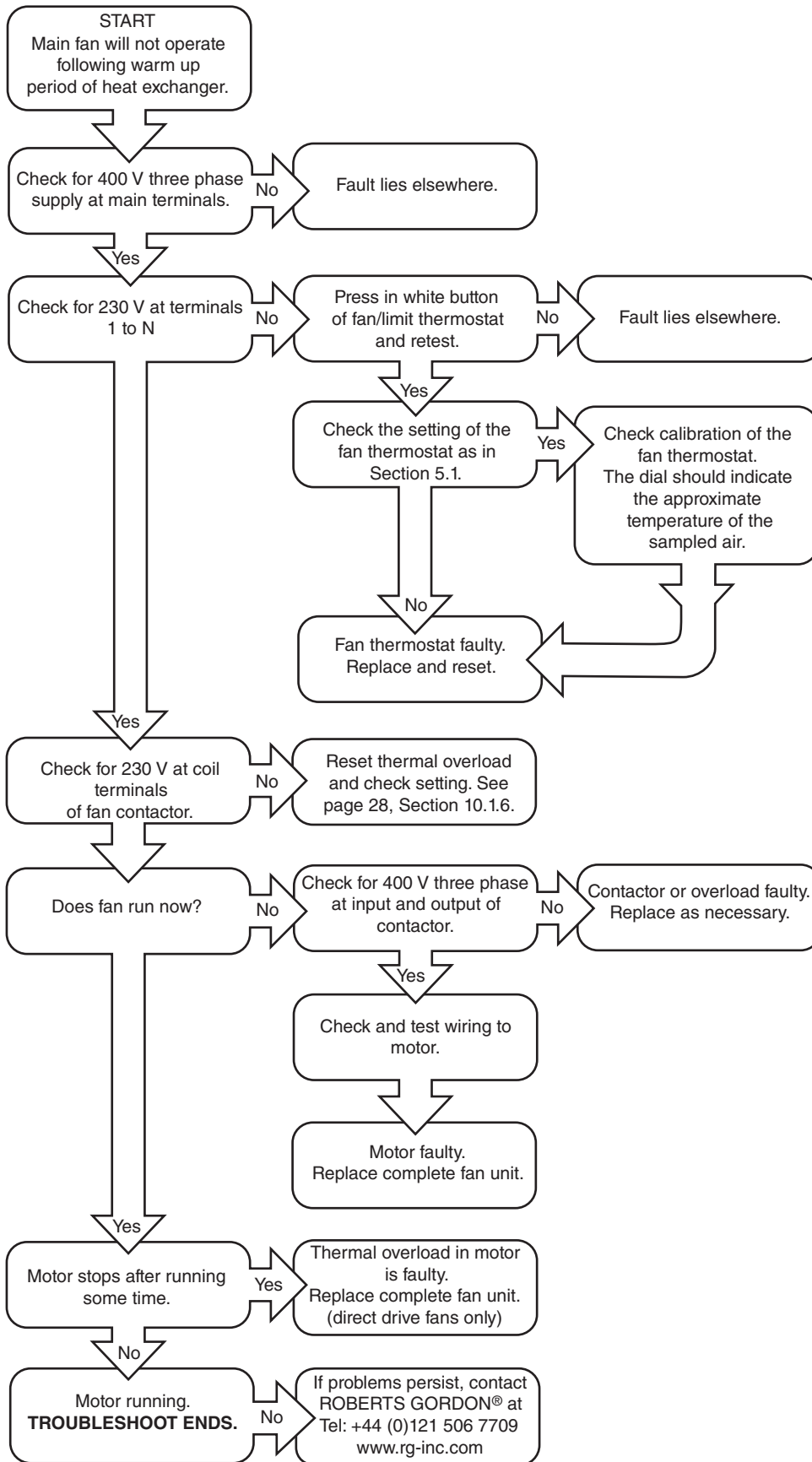


14.6 Troubleshooting for Main Fan Circuit (1 Ø)



For your safety and optimum heater performance, use only ROBERTS GORDON® replacement parts. **Conduct Commissioning procedure as shown on Page 33, Section 10.**

14.7 Troubleshooting for Main Fan (3 Ø)



For your safety and optimum heater performance, use only ROBERTS GORDON® replacement parts.
Conduct Commissioning procedure as on Page 33, Section 10.

SECTION 15: REMOVAL AND REPLACEMENT PARTS

See warnings and notes on *Page 43, Section 12* before removing or replacing parts.

15.1 Burner Components

To remove the burner from the heater:

1. Unplug the burner electrical supply from the heater.
2. Isolate the fuel supply at the inlet manual valve and disconnect the inlet fuel pipe.
3. Unscrew the nuts holding the burner mounting flange to the heater.
4. Remove the burner from the heater, retaining the gasket for reuse.

For removal of burner components, follow the manufacturer's instructions. To refit the burner, reverse the instructions above. Fit the gasket between the burner mounting flange and the heater. Use a new gasket if necessary.

15.2 Direct On-Line Main Fan Starter and Thermal Overload Unit (3 Ø)

This assembly comprises two parts, the contactor and the overloads, which may be changed separately.

15.2.1 The Contactor

To remove the contactor:

1. Remove the overloads as on *Page 51, Section 15.2.2*.
2. Remove the line connections to the top of the contactor (noting the colour code) and the two coil connections at the top rear of the contactor.
3. Unscrew the fixing screws to remove the contactor from the panel.
4. Reverse these instructions to refit. Check rotation of the fan after working on the contactor.

15.2.2 The Overloads (models 060 to 100)

To remove the overloads:

1. Unscrew the motor connecting wires from their terminals at the bottom of the assembly. Note the colour code.
2. Disconnect the overload circuit connections near the overload reset button.
3. Disconnect the overload fixing and connecting screws from the bottom of the contactor.
4. Ensure that any replacement overload is of the correct rating and that it is reset correctly. See *Page 33, Section 10.1.6*.

15.3 Control Circuit Fuse (10 or 5 A, 1-1/4" long sand filled)

The control fuse is removed by grasping the centre and pulling it out of the spring clips. To replace, push

a new fuse into the spring clips. To replace the holder, remove the fuse, pull off the two tag connectors from either end, and then unscrew the central screw. Reverse these instructions to refit.

15.4 Combination Fan/Limit Thermostat

To gain access to the thermostat:

1. Loosen the cover retaining screw (on top) and remove cover.
2. Disconnect the electrical connections by pushing in with a small screwdriver and pulling out the wiring. See *Page 52, Figure 22*.
3. Unscrew the conduit bush and the two screws and withdraw the unit from the cabinet.
4. Reverse these instructions to refit. See *Page 34, Figure 13* to set the new thermostat.

15.5 Main Fan Motor (3 Ø Belt Drive)

1. Disconnect electrical connections at contactor and overloads. See *Page 51, Section 15.2*.
2. For Star/Delta starters, there are six wires between the motor and the starter.
3. Remove the left lower side panel to access the motor.
4. Unscrew the bolts securing the motor to the mounting bracket. Lift the motor out.
5. Reverse these instructions to refit, tensioning the belts as on *Page 43, Figure 21* and ensuring the pulleys are aligned.
6. For Star/Delta starters, pay specific attention to the six motor connections.

15.6 Main Fan Units

Depending on the model of the heater, the main fan unit will be direct drive (with integral motor) or belt drive. Models 060-100 are belt drive, double fan units. All the fans are secured to the base of the heater by four bolts per fan case, and to the fan tray by bolts through the outlet flange.

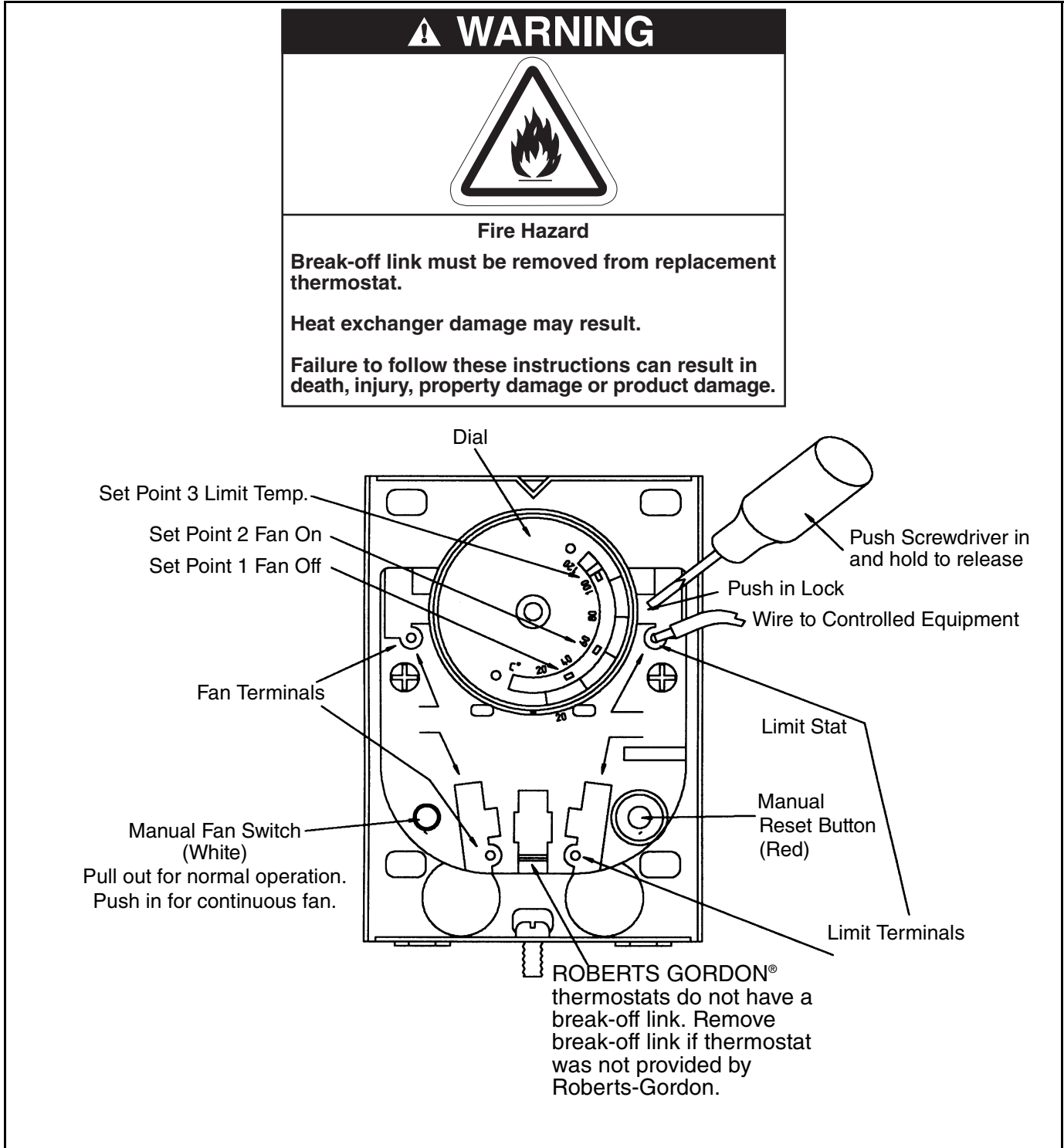
To gain access to the fans:

1. Remove the lower side panels of the heater. For models 060-100 and High Flow models, remove the upper side panels of the same side and the vertical centre bar to allow the fans to slide out of the cabinet.
2. Disconnect the electrical connections. On direct drive units, these will be at the terminal block for single phase and at the contactor for three phase.
3. Remove the screws. The fan will pull out of the heater through the side.
4. Reverse these instructions to refit, tensioning the belts as on *Page 43, Figure 21*.

5. Check the correct rotation of the fan as *on*
Page 33, Section 10.1.5.

NOTE: The direct drive fan unit motor can only be replaced as a complete fan/motor assembly.

Figure 22: Combination Fan/Limit Thermostat



SECTION 16: PARTS LIST

The following items are recommended as spares which may be required during routine service and replacement of the air heater. There is also a list of parts in the burner manufacturer's manual which relates to the parts required for the packaged burner fitted to the heater.

16.1 Spare Parts List

Part No.	Description	015	020	030	040	050	060	070	080	0100
A 025	DDC 1220 Direct Drive Fan	1	1	1	-	-	-	-	-	-
A 029	DDC 1500 Direct Drive Fan	-	-	-	1	1	-	-	-	-
A 038	BDC 1500 Belt Drive Fan	-	-	-	-	-	1	1	1	1
A 136	A49 Vee Belt	-	-	-	-	-	2	2	2	2
K 017	Combination Fan/Limit Thermostat	1	1	1	1	1	1	1	1	1
D 004A	Motor Contactor	-	-	-	-	-	1	1	1	1
D 020A	Motor Overload 4.5/7.5 A	-	-	-	-	-	1	1	1	-
D 024A	Motor Overload 6-10 A	-	-	-	-	-	-	-	-	1

Attach this information to the wall near the ROBERTS GORDON® heater



Read the Installation, Commissioning, Operation and Service Manual thoroughly before installation, operation or service.

OPERATING INSTRUCTIONS

1. STOP! Read all safety instructions on this information sheet.
 2. Open the manual fuel valve in the heater supply line.
 3. Turn on electric power to the heater.
 4. Set the thermostat to desired setting (above ambient temperature).
The automatic starting sequence begins.
- NOTE:** Following long shutdown periods, the burner control may go to 'LOCKOUT' during the start sequence. Push the reset button to recommence firing. Contact service department if 'LOCKOUT' continues (see manual for details).

TO TURN OFF THE HEATER

1. Turn the thermostat/time switch to 'OFF'. The burner will turn off immediately, but fans will continue to cool the heat exchanger until the fan thermostat switches off.

IF THE HEATER WILL NOT OPERATE, TO ENSURE YOUR SAFETY, FOLLOW THESE INSTRUCTIONS TO SHUT DOWN YOUR HEATER

1. Set the thermostat to 'OFF' or the lowest setting.
2. Turn off electric power to the heater.
3. Turn off the manual fuel valve in the heater supply line.
4. Call your registered installer/contractor qualified in the installation and service of gas or oil-fired heating equipment.

⚠ WARNING



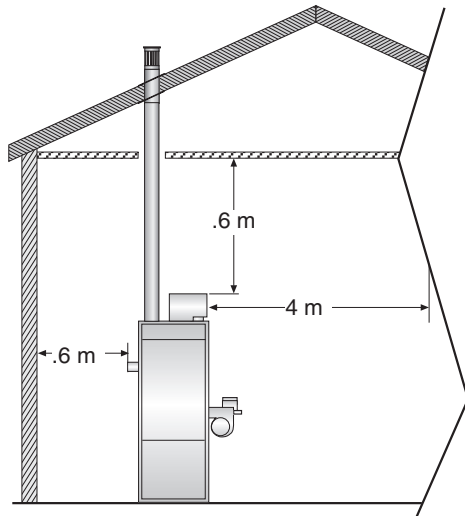
Fire Hazard

Some objects can catch fire or explode when placed close to heater.

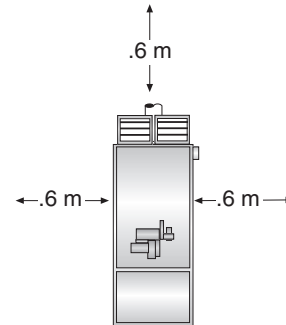
Keep all flammable objects, liquids and vapours the required clearances to combustibles away from heater.

Failure to follow these instructions can result in death, injury or property damage.

Installation Clearances



Clearances to Combustibles



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Roberts-Gordon, LLC
1250 William Street
P.O. Box 44
Buffalo, NY 14240-0044 USA

Telephone: 716.852.4400
Fax: 716.852.0854
Toll Free: 800.828.7450

Installation Code and Annual Inspections:

All installations and service of ROBERTS GORDON® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Roberts-Gordon and conform to all requirements set forth in the ROBERTS GORDON® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. To help facilitate optimum performance and safety, Roberts-Gordon recommends that a qualified contractor annually inspect your ROBERTS GORDON® equipment and perform service where necessary, using only replacement parts sold and supplied by Roberts-Gordon.

For installations at elevations above 2000' (610 m), the appliance shall be derated 4% for each 1000' (305 m) of elevation above sea level.

Further Information: Applications, engineering and detailed guidance on systems design, installation and equipment performance is available through ROBERTS GORDON® representatives. Please contact us for any further information you may require, including the Installation, Commissioning, Operation and Service Manual.

This product is not for residential use.

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