Rheem Australia Pty Ltd

ABN 21 098 823 511

SERVICE INSTRUCTIONS

HSI Heavy Duty Gas

TM011

Issued: March 06

Revision: AG
Issued: Nov 15

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INTRODUCTION

The information provided in these instructions is based on the water heater being installed in accordance with AS/NZS 5601 and the Installation Instructions provided with each water heater.

Should you require further technical advice on a Rheem Heavy Duty Gas Water Heater, contact your nearest Rheem Service Department where genuine replacement parts are also available.

SAFETY WARNING

The purpose of this service manual is to provide sufficient information to allow a person with the skills as required by the Regulatory Authorities to carry out effective repairs to a Rheem Gas Heavy Duty Water Heater in the minimum of time.

Safety precautions or areas where extra care should be observed when conducting tests outlined in this service manual are indicated by print in ***bold italics*** and/or a warning symbol. Take care to observe the recommended procedure.

'Live' testing to be conducted. Personal Protective Clothing (PPE) shall be worn and an RCD shall be installed between the power point and 3 pin cord of the boiling water unit to reduce the risk of electric shock.

Isolate power before conducting the indicated test.

Hot surface or liquid. Personal Protective Clothing (PPE) shall be worn to reduce the risk of scalding.

General warning symbol. Observe instructions accompanying symbol.

If the supply cord is damaged, it must be replaced by the manufacturer or its service agent or a similarly qualified person in order to avoid a hazard.

When conducting repairs to a gas appliance the gas train including injector sizes must not be altered or modified in any way.

HEATER MODEL IDENTIFICATION

All identification numbers are designed to convey detailed information about the heater to which it is attached. For example the model number consists of 7 digits and 1 letter.

6	2	1	265	N	0

6 – Heavy Duty

2 - Internal
3 - External

0 - Pilot
1 - Electronic Ignition

Capacity in Litres

N - Natural Gas
P - Propane
B - Butane Gas

0 - No Reference

Note: Model number, serial number and date of manufacture must be quoted in all correspondence.

SPECIFICATIONS

All Models

Specification		Model			
		621265	**631265**	**621275**	**631275**
Supply Voltage		240 VAC ± 10% 50 Hz			
Capacity - Litres		265	265	275	275
T&PR Valve Rating - kPa		1000	1000	1000	1000
Maximum Inlet Water Pressure (kPa) (1)	With ECV	680	680	680	680
	Without ECV	800	800	800	800
Minimum Inlet Gas Pressure (kPa)	Natural Gas	1.13	1.13	1.13	1.13
	LP & Butane Gas	2.75	2.75	2.75	2.75
	Town Gas	0.75	0.75	0.75	0.75
Maximum Inlet Gas Pressure (kPa)		3.5	3.5	3.5	3.5
Anodes	Qty X Length (mm)	3 x 1150	3 x 1150	3 x 1153	3 x 1153
Flue Baffle	Dia x Length (mm)	38 x 600	Not fitted	76 x 550 (2)	76 x 845
Water Connections	Inlet / Outlet	RP1¼/32	RP1¼/32	RP1¼/32	RP1¼/32
	T&PR Valve	RP¾/20	RP¾/20	RP¾/20	RP¾/20
Gas Inlet Connection		RP¾/20	RP¾/20	RP¾/20	RP¾/20
Burner Injector (mm)	LP Gas	2.90	2.90	3.80	3.80
	Natural Gas	4.80	4.80	6.50	6.50
	Butane Gas	2.50	2.50	3.20	3.20
	Town Gas	8.60	8.60	10.50	10.50
Burner Pressure (kPa)	LP & Butane Gas	2.50	2.50	2.65	2.65
	Natural Gas	0.85	0.85	0.90	0.90
	Town Gas	0.32	0.32	0.50	0.50
Thermal Input (MJ)		110	110	200	200

(1) Where the mains water supply pressure exceeds the values shown an approved pressure limiting valve is required.

(2) 845mm on models manufactured before 08/06/2010.

Models Manufactured Before 02/11/2001

Specification		Model			
		621265	**631265**	**621275**	**631275**
Mechanical Thermostat	Temp Setting	70ºC (adjustable 50ºC ~ 80ºC) (3)			
	Differential	5ºC ± 3ºC			
	ECO Cut out Temp	78 ~ 84ºC			
	ECO Cut in Temp	60ºC manual reset			
High Limit ECO	Cut out Temp	75ºC			
	Cut in Temp	61ºC auto reset			

(3) Recirculation is required for a mechanical thermostat temperature setting of more than 75ºC.

Models Manufactured From 02/11/2001

Specification		Model			
		621265	**631265**	**621275**	**631275**
Electronic Thermostat	Max Temp Setting	82ºC (AKO) 80°C (Eliwell IC902)			
	Min Temp Setting	60ºC			
	Differential	2ºC			
ECO	Cut out Temp	78 ~ 84ºC			
	Cut in Temp	60ºC manual reset			
Temperature Sensor Set (4)		2 x NTC thermistors			

(4) For temperature sensor set temperature/resistance values refer to 'Temperature Sensor Set' on page 49.

BMS Module Specifications

Specification	Value
Supply Voltage	240 VAC ± 10% 50 Hz
Max Load Current on Volt Free Relay Contact	1A @ 240 VAC (AC1)
Operating Temperature Range	-30°C ~ +70°C
Relative Humidity	90% RH, Non-condensing
PCB Battery	CR2032 3V lithium
PCB Fuse	100mA 250V

BMS module can only be fitted to models with an electronic controlling thermostat (models manufactured from 02/11/01).

PREVENTATIVE MAINTENANCE

For peak performance it is suggested that the water heater be inspected prior to the winter period where light to medium hot water usage occurs, and six monthly where medium to heavy usage occurs.

1. Check for discharge from the T&PR valve. Whilst the burner is off there should be no discharge of water. When the burner is operating, a small discharge of water may be evident. Operate the valve-easing lever to ensure the valve opens and resets properly. Always open and close the valve gently. The T&PR valve should be replaced at 5 yearly intervals.
2. Check the combustion chamber and burner for signs of scale deposits. Remove and clean if necessary.
3. Check the main burner pressure is as stated on the Rating Plate. Remember to replace the test point screw.
4. Check main burner flame to ensure all parts ignite readily and that the flame is blue with little or no yellowing of the tips. If necessary adjust the interrupter screw to eliminate yellowing without inducing a harsh noisy blue flame.
5. Check the drain cock is not leaking.
6. Check for sludge build up and if necessary drain and flush tank.
7. Inspect and if necessary replace anodes (hard water areas only).
8. Check for signs of excessive corrosion on the jacket.
9. Check operation of auxiliary equipment if fitted i.e. circulator.
10. Warn customer of the danger of using flammable materials or aerosol spray packs near the water heater. Aerosols and harsh chemicals can cause premature failure of water heater components.

LIGHTING INSTRUCTIONS

HSI Heavy Duty Gas Water Heaters utilise an automatic ignition system.

1. Switch on power and gas supplies to the water heater.
2. When the controlling thermostat determines heating is required the ignition sequence will commence automatically.

Note: Should the unit fail to light after 3 or 4 ignition attempts (depending on type of ignition module fitted), the electronic control system will enter lockout mode and no further ignition attempts will occur.

PRODUCT CHANGES

IGNITION MODULE CHANGE HISTORY

Pactrol P25 Ignition Control Module

631275 Models: As of September 2015 all 631275 HD gas storage models will be fitted with a Pactrol P25 'F' HSI FMV ignition module, part number 052192.

This Pactrol ignition module is a direct replacement for the White Rodgers 50A72-178 module and will be supplied as a spare part to suit any 631275 models manufactured from 01/04/05.

All Models (except 631275 manufactured from 01/04/05): As of September 2015 all heavy duty gas storage models (except 631275 manufactured from 01/04/05) will be fitted with a Pactrol P25 'F' HSI AMV ignition module, part number 052193.

This Pactrol ignition module is a direct replacement for the White Rodgers 50A72-298 module and will be supplied as a spare part to suit any existing HD gas storage model (except 631275 models manufactured from 01/04/05).

Note: The Pactrol P25 module is mounted in an identical manner to the White Rodgers module and no adjustments are required to be made in order to retro-fit the Pactrol in place of an existing White Rodgers module. However when fitting a Pactrol module into an existing 621275 heater the viewing window in the heater front cover will be obstructed by the new Pactrol module therefore it is advisable to replace the front cover (part number 108335) along with Pactrol module in 621275 heaters produced before 18/09/15.

The modified features of the Pactrol P25 module compared to the White Rodgers are:

- The Pactrol P25 module does not display specific fault codes for fault conditions.
- 2 ignition retries (a total of 3 attempts), with a 5-minute delay between each attempt.
- Gas valve circuit check – module will enter 'lockout' mode if a resistance is not detected through the gas valve circuit. **NOTE**: On 631275 models if the lower access door is removed the door switch breaks the gas valve circuit which will result in a lockout condition.
- No check of igniter circuit is conducted. If igniter is open circuit the module will progress through sequence of operation and will lockout after 3 ignition attempts.
- Volatile memory. Turning the power off and on at the power point will reset both models of ignition module. A reset button is also fitted on the ignition module.

White Rodgers Ignition Control Module (All Models Except 631275 Manufactured From 01/04/05)

The White Rodgers ignition control module, model number 50A72-298, was fitted to all models manufactured from 25/02/02 to September 2015 (except for 631275 models where it was fitted up until 01/04/05).

The 50A72-298 was a direct replacement of the original 50A72-208 ignition control module.

The additional features of the 50A72-298 compared to the 50A72-208 were:

- 3 ignition retries (a total of 4 attempts), with a 5-minute delay between each attempt.
- Volatile memory. Turning the power off and on at the power point will now reset the ignition module. A reset button is also fitted on the ignition module.
- With the exception of ignition failure (1 flash lockout) the ignition module will enter a 'wait' mode when a fault is detected and will automatically reset if the fault clears.

White Rodgers Ignition Control Module (631275 Models Manufactured From 01/04/05)

The White Rodgers ignition control module, model number 50A72-178, was fitted to 631275 models manufactured from 01/04/05 up until September 2015.

The 50A72-178 replaced the 50A72-298 ignition control module that was in use up until 01/04/05. However this was not a direct replacement as the ignition control modules had differently configured wiring loom plugs to prevent installation of the incorrect module.

The 50A72-178 ignition control module offered the following additional features:

- An internal method of checking the pressure switch position (position proving). The ignition control module also supplies power to the combustion fan rendering the relay and its associated wiring obsolete.
- Two additional fault codes (2 flash and 3 flash) both relating to the pressure switch position. All other fault codes remain the same as the earlier ignition module.
- A 30 second delay before energising the fan motor, eliminating fan run on problems associated with power brown outs (refer to 'Fan Run on' page 47).

To overcome fan run on problems it was possible to convert a 631275 fitted with a 50A72-298 ignition module to use a 50A72-178 ignition module. For further details refer to Technical Bulletin TB05 011.

CONTROLLING THERMOSTAT CHANGE HISTORY

Eliwell IC902 Thermostat (All Models)

An Eliwell IC902 electronic thermostat is fitted to all models manufactured from 29/04/11. This thermostat is suitable for use as a direct replacement on any existing HD Gas unit with an AKO thermostat however the Eliwell parameter configuration differs to that of the AKO's. For more information refer to 'Eliwell IC902 Controlling Thermostat' on page 31.

Revised AKO Electronic Controlling Thermostat (All Models)

A revised AKO electronic thermostat was fitted to all models manufactured from 21/07/08 to 28/04/2011. The revised AKO electronic thermostat was a direct replacement for the previously used AKO electronic thermostat. For more information refer to 'AKO Controlling Thermostat' on page 34.

AKO Electronic Controlling Thermostat (All Models)

An AKO electronic thermostat replaced the Robertshaw mechanical thermostat, allowing for more accurate temperature and differential control. This change affected all models manufactured from 02/11/01 to 21/07/08 but does not affect spare parts as mechanical and electronic thermostats are not interchangeable.

This change includes the addition of a temperature sensor set comprised of two temperature sensors (thermistors) mounted in pockets at the same heights as the inlet and outlet water connections of the water heater. The sensors are utilised to detect the water temperature at the top and bottom of the tank. A small electronic circuit board installed in the sensor wiring offsets the cold sensor reading to provide the average water temperature of the entire tank.

The electronic thermostat features an external LED display indicating the water temperature, or in the event of certain failures, an error code.

For more information refer to ‘AKO Controlling Thermostat’ on page 34.

OTHER CHANGE HISTORY

Weather Sealing Upgrade (631275 Models Only)

Two weather sealing kits have been introduced for 631275 models.

- Part Number 290118: 631275 Weather Sealing Kit (to suit models manufactured from 09/02/05.
- Part Number 290119: 631275 Weather Sealing Kit (to suit models manufactured pre 09/02/05.

Both kits contain the necessary components and installation instructions required to perform a weather sealing upgrade which should be performed if the heater is located in an external position and experiences problems during or after heavy periods of rain.

Note: 631275 models manufactured from 15/04/14 have the weather sealing kit components installed as standard.

Igniter/Flame Rod Assembly Change (631275 Models Only)

Igniter/flame rod assemblies fitted to 631275 models manufactured from 15/04/14 have a weatherproof plug installed as part of the heater's weather sealing upgrade (refer to opposite illustration for weatherproof plug identification).

The igniter/flame rod assembly on heaters manufactured prior to this date may have also been replaced with a type having a weatherproof plug by the installation of a 'Weather Sealing Kit' (refer to 'Weather sealing Upgrade' on page 8).

Weatherproof plugs are not compatible with non weatherproof plug sockets and if replacing an igniter/flame rod assembly, it is imperative that the correct type of assembly is procured to match the heater's existing wiring loom plug socket. Both assembles are available as spare parts.

Part number 071419: Igniter/flame rod assembly with weatherproof plug.

Part number 071420: Igniter/flame rod assembly with non weatherproof plug.

Flue Baffle Shortened (621275 Models Only)

The flue baffle has been shortened from 845mm to 550mm on 621275 models manufactured from 8/06/2010.

Flue Damper Plug & Flue Damper Wiring Loom (621275 Models Only)

A 4 pin plug socket was introduced on the rear of the flue damper on all 621275 models manufactured from 01/11/09. At the same time the flue damper wiring loom was changed to include a 4 pin plug. This change also affects flue dampers and flue damper wiring looms supplied as spare parts from 1/11/09.

Viewing Windows (All Models)

Viewing windows have been added to all models manufactured from 21/07/08 to facilitate viewing of the burner and ignition module LED without the need to remove any covers.

Flue Damper Fuse (621275 Models Only)

A replaceable 1.6 amp fuse has been added to the flue damper control circuit on all 621275 models manufactured from 11/05/04. This change also affects flue dampers supplied as spare parts from 11/05/04.

In the event the gas valve or ignition module suffers a major electrical failure the fuse will blow protecting the flue damper control circuit from any resulting short circuit or power surge.

Limit Thermostat (All Models)

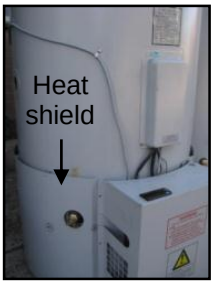
The auto reset upper limit thermostat has been deleted and replaced with a manual reset ECO thermostat located below the lower temperature sensor pocket. This change affects all models manufactured from 02/11/01. Both parts are available as spare parts and are **NOT** interchangeable due to having different electrical/temperature specifications.

Access Door (631275 Models Only)

A small indentation has been added to the access door to provide a more positive action on the door switch on 631275 models manufactured from 02/11/01. This modification is to overcome intermittent contact resulting in fan run on without burner operation.

PRODUCT SAFETY RECALL & REWORK (621275P0 & 621275N0 Models Only)

621275N0 and 621275P0 models manufactured from 01/07/08 to 20/11/09 were recalled due to the possibility of excessive jacket temperatures occurring under extended operating conditions.



Affected models are being located and reworked in the field by removing the plastic pipe seal, relocating the power supply cord and fitting an external heat shield (refer to photo opposite). A rework kit (part number 108700) is available and includes rework installation instructions.

If a 621275NO or 621275PO model manufactured from 01/07/08 to 20/11/09 is found to not have a heat shield installed, immediately remove any combustible materials within the proximity of the water heater and take steps to ensure no one comes into contact with the water heater. Once this is done phone 1800 063 018 between the hours of 8:00am and 8:00pm AEDST and Rheem will arrange to undertake on-site service modifications free of charge.

OPERATION (models fitted with Pactrol ignition module)

Heat Mode

1. When the storage cylinder water temperature is below set temperature the controlling thermostat contacts close (call for heat).

   621265 and 631265 – Power supplied to ignition control module.

   621275 – Power supplied to flue damper relay coil. The relays pair of normally closed contacts open, de-energising the flue damper motor allowing the damper to open via a spring mounted on the flue damper shaft. The limit switch contacts close once the damper has rotated to the fully opened position supplying power to the ignition control module. Note: During standby (thermostat contacts open) the flue damper is held closed by power being applied to the flue damper motor.

   631275

   Manufactured Before 01/04/05 – Combustion fan and relay coil energised. Proving switch contacts on pressure switch close when combustion pressure is achieved supplying power to ignition control module via relay contacts.

   Manufactured From 01/04/05 – Power supplied to ignition control module. The ignition module checks (position proves) that the pressure switch is open and if so energises the combustion fan motor. The ignition control module checks that the pressure switch has closed and if so operation continues from step 2.

2. Hot surface igniter warm up period commences; 20 seconds duration.

3. At completion of the warm up period the gas valve is energised which opens allowing gas to the burner where ignition occurs.

   Note: A door switch is wired in series with the gas valve on 631275 models. The gas valve will not operate if the access door is not in place.

4. Flame is detected. This period is known as the igniter activation period (I.A.P) however it is normally referred to as the ignition proving time.

5. The igniter is de-energised at the conclusion of the I.A.P (which is 3 seconds) or proof of flame.

6. Thermostat contacts open when set temperature is achieved.

   621265 and 631265 – Gas valve is de-energised cutting supply of gas to the burner.

   621275 – Relay coil is de-energised. The relays pair of normally closed contacts close supplying power to the flue damper motor which operates and closes the damper. As the damper starts to close; the limit switch contacts open, de-energising the gas valve which closes cutting the supply of gas to the burner.

   631275

   Manufactured Before 01/04/05 – Combustion fan and relay de-energised. Proving switch contacts on pressure switch open when the pressure drops below required combustion pressure. Gas valve is de-energised cutting supply of gas to the burner.

   Manufactured After 01/04/05 – The gas valve is de-energised which closes, cutting the supply of gas to the burner. At the same time the combustion fan is de-energised and the resulting drop in air pressure causes the pressure switch contacts to open.

Retry Mode

If flame is not sensed during the Ignition Activation Period (3 seconds):

1. The gas valve is de-energised.
2. The system waits 5 minutes to allow for the escape of unburnt gas.
3. The normal ignition sequence is retried.
4. The igniter energisation period remains at 20 seconds.
5. The ignition control module will enter ‘lockout mode’ and the reset light will be illuminated if burner ignition is unsuccessful after 2 retries (a total of 3 ignition attempts).

Recycle Mode (Within a Thermostat Cycle)

If flame is established then lost after the I.A.P i.e. after flame was sensed:

1. The gas valve is de-energised.
2. The system waits 5 minutes to allow for the escape of unburnt gas.
3. The normal ignition sequence is started

Note: Infinite recycles are allowed during any one thermostat cycle.

Normal Mode

After flame has been sensed, the ignition control module enters the normal operating loop where the following inputs are continuously checked.

- Ignition control module internal safety (software) check.
- Ignition control module polarity check.
- Gas valve circuit check.
- Flame detection check.
- Air pressure switch check (631275 models only).

Lockout or Wait Mode

Any time the ignition control module detects a fault, internally or externally, the module will shut down heater operation and enter either ‘lockout’ or ‘wait’ mode depending on the fault detected.

A ‘lockout’ condition is indicated by the illumination of the reset button. A ‘lockout’ requires a manual reset to be performed. A manual reset can be performed by pressing and holding down the ignition control module reset button for approximately 3 seconds then releasing or cycling power supply.

There is no external display to indicate that the ignition module has entered a ‘wait’ mode’. The ignition control module will automatically reset once the ‘wait’ mode fault clears or is rectified (repaired).

Safety Features

If the ignition control module is energised and flame is detected when the gas valve is de-energised, the ignition control module enters the ‘safety wait mode’.

If the gas valve is energised 3 consecutive times and flame is not sensed within the I.A.P, the ignition control module will enter ‘ignition failure ‘lock out’, and reset button will be illuminated.

In the event of a flame failure during a heating cycle the gas valve is closed in 0.9 seconds.

If the presence of flame is not detected within 3 seconds of the gas valve being energised the gas valve will be de-energised.

OPERATION (models fitted with White Rodgers ignition module)

Heat Mode

1. When the storage cylinder water temperature is below set temperature the controlling thermostat contacts close (call for heat).

   621265 and 631265 – Power supplied to ignition control module.

   621275 – Power supplied to flue damper relay coil. The relays pair of normally closed contacts open, de-energising the flue damper motor allowing the damper to open via a spring mounted on the flue damper shaft. The limit switch contacts close once the damper has rotated to the fully opened position supplying power to the ignition control module. Note: During standby (thermostat contacts open) the flue damper is held closed by power being applied to the flue damper motor.

   631275

   Manufactured Before 01/04/05 – Combustion fan and relay coil energised. Proving switch contacts on pressure switch close when combustion pressure is achieved supplying power to ignition control module via relay contacts.

   Manufactured From 01/04/05 – Power supplied to ignition control module. The ignition module checks (position proves) that the pressure switch is open and if so energises the combustion fan motor. The ignition control module checks that the pressure switch has closed and if so operation continues from step 2.

2. Hot surface igniter warm up period commences; this can be up to 20 seconds.

3. At completion of the warm up period the gas valve is energised which opens allowing gas to the burner where ignition occurs.

   Note: A door switch is wired in series with the gas valve on 631275 models. The gas valve will not operate if the access door is not in place.

4. Flame is detected. This period is known as the igniter activation period (I.A.P) however it is normally referred to as the ignition proving time.

5. The igniter is de-energised at the conclusion of the I.A.P (which is 2.50 seconds) or proof of flame.

6. Thermostat contacts open when set temperature is achieved.

   621265 and 631265 – Gas valve is de-energised cutting supply of gas to the burner.

   621275 – Relay coil is de-energised. The relays pair of normally closed contacts close supplying power to the flue damper motor which operates and closes the damper. As the damper starts to close; the limit switch contacts open de-energising the gas valve which closes cutting the supply of gas to the burner.

   631275

   Manufactured Before 01/04/05 – Combustion fan and relay de-energised. Proving switch contacts on pressure switch open when the pressure drops below required combustion pressure. Gas valve is de-energised cutting supply of gas to the burner.

   Manufactured After 01/04/05 – The gas valve is de-energised which closes cutting the supply of gas to the burner. At the same time the combustion fan is de-energised and the resulting drop in air pressure causes the pressure switch contacts to open.

Retry Mode

If flame is not sensed during the Ignition Activation Period:

1. The gas valve is de-energised.
2. The system waits 5 minutes to allow for the escape of unburnt gas.
3. The normal ignition sequence is retried.
4. The igniter energisation period remains at 20 seconds with the ignition control module re-entering ‘learn mode’.
5. The ignition control module will enter ‘retry lock out’, **1 flash**, if burner ignition is unsuccessful after 3 retries (a total of 4 ignition attempts).

Recycle Mode (Within a Thermostat Cycle)

If flame is established then lost after the I.A.P, i.e. after flame was sensed:

1. The gas valve is de-energised.
2. The normal ignition sequence is started
3. No increase in igniter warm up time.
4. The ignition control module will enter ‘retry lock out’, **1 flash**, if burner ignition is unsuccessful after 3 retries.

Note: Infinite recycles and 3 ignition retries (a total of 4 ignition attempts) are allowed during any one thermostat cycle.

Normal Mode

After flame has been sensed, the ignition control module enters the normal operating loop where the following inputs are continuously checked.

- Ignition control module internal safety (software) check.
- Ignition control module polarity check.
- Flame detection check.
- Igniter circuit check.
- Power supply frequency check (Hertz).
- Air pressure switch check (631275 models only).

Lockout or Wait Mode

Any time the ignition control module detects a fault, internally or externally, the module will enter either a ‘lockout’ or ‘wait’ mode depending on the fault detected.

The ignition control module LED will emit a series of flashes to indicate the fault (refer to ‘Ignition Module Fault Codes’ on page 51 for more information). The LED will flash on for ¼ second and off for ¼ second with a 2 second delay occurring between each group of flashes. Note: The LED will stay on continuously for approximately 1 second when first energised.

With the exception of ignition retry lockout (1 flash) the ignition control module will automatically reset if the fault clears or is rectified (repaired). Ignition retry ‘lockout’ requires a manual reset to be performed.

A manual reset can be performed by turning the power off and then on again at the power point, or by pressing and holding down the ignition control module reset button for approximately 1 second then releasing.

Note: If the fault continues to exist i.e. an open circuit igniter, the module will immediately re-enter the lockout or wait mode and display the relevant fault code.

Safety Features

If the ignition control module is energised and flame is detected when the gas valve is de-energised, the ignition control module enters the ‘safety wait mode’, **5 flashes**.

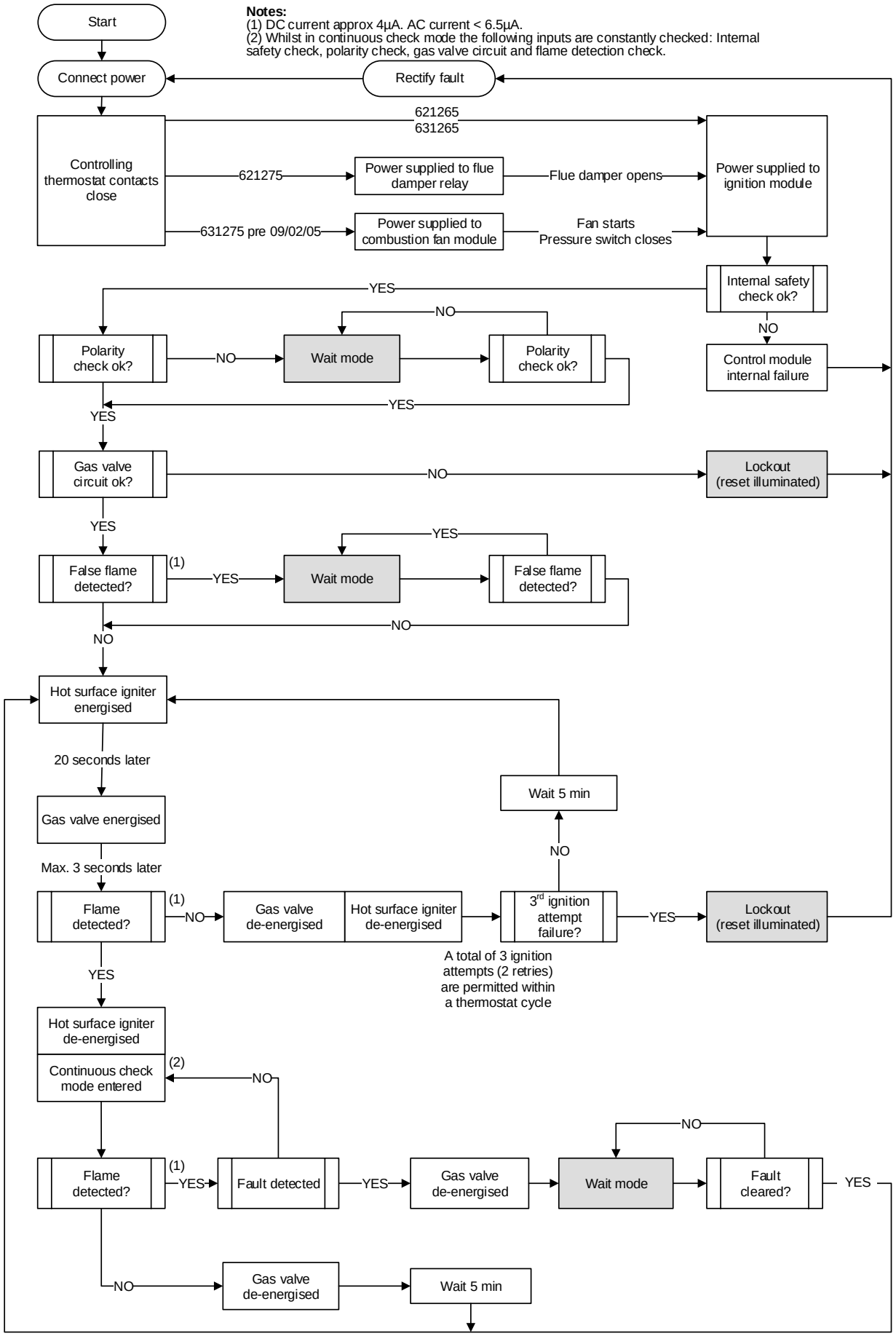
If the gas valve is energised 4 consecutive times and flame is not sensed within the I.A.P, the ignition control module will enter ‘retry lock out’, **1 flash**.

In the event of a flame failure during a heating cycle the gas valve is closed in 0.9 seconds. If flame is not detected within 2.5 seconds from the commencement of the trial for ignition period the gas valve is closed.

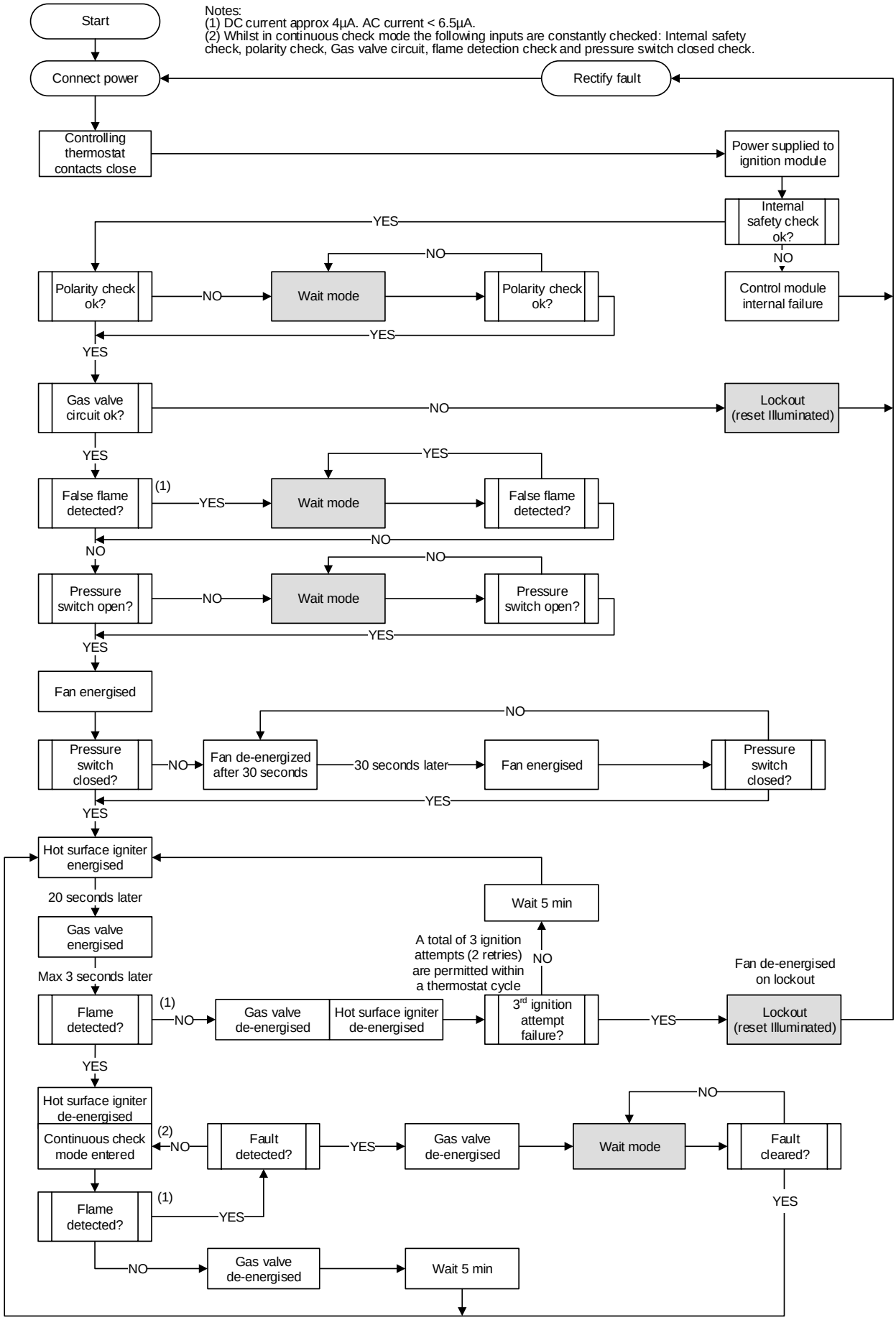
Learn Mode

At each unsuccessful ignition attempt the ignition control module increases the voltage to the hot surface igniter to increase the heat on the next ignition attempt. Eventually the ignition control module learns the point at which ignition occurs successfully.

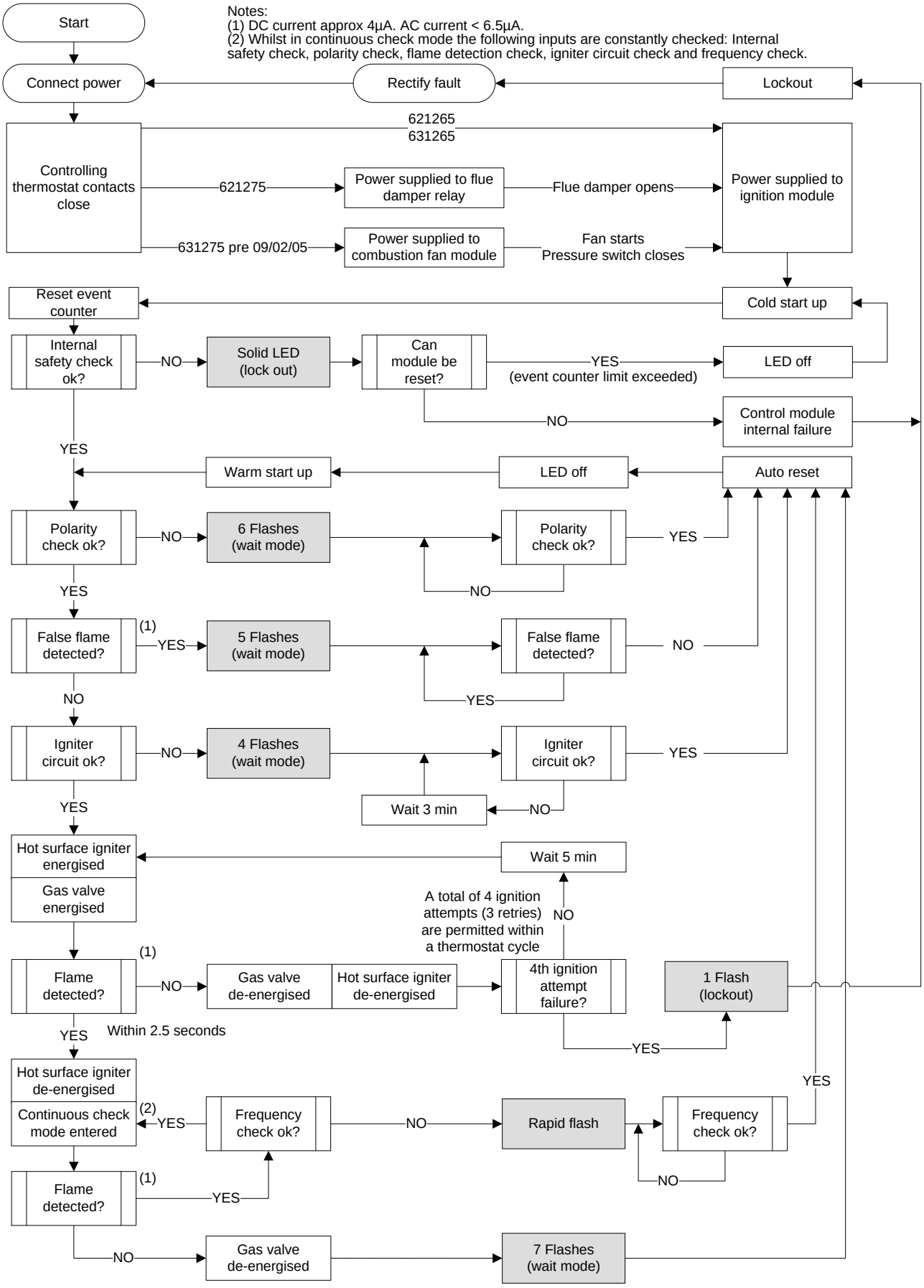
Heating Cycle Flow Chart –models fitted with Pactrol P25 ‘F’ HSI AMV ignition module – suitable for 621265, 631265, 621275 (& 631275 before 01/04/05)



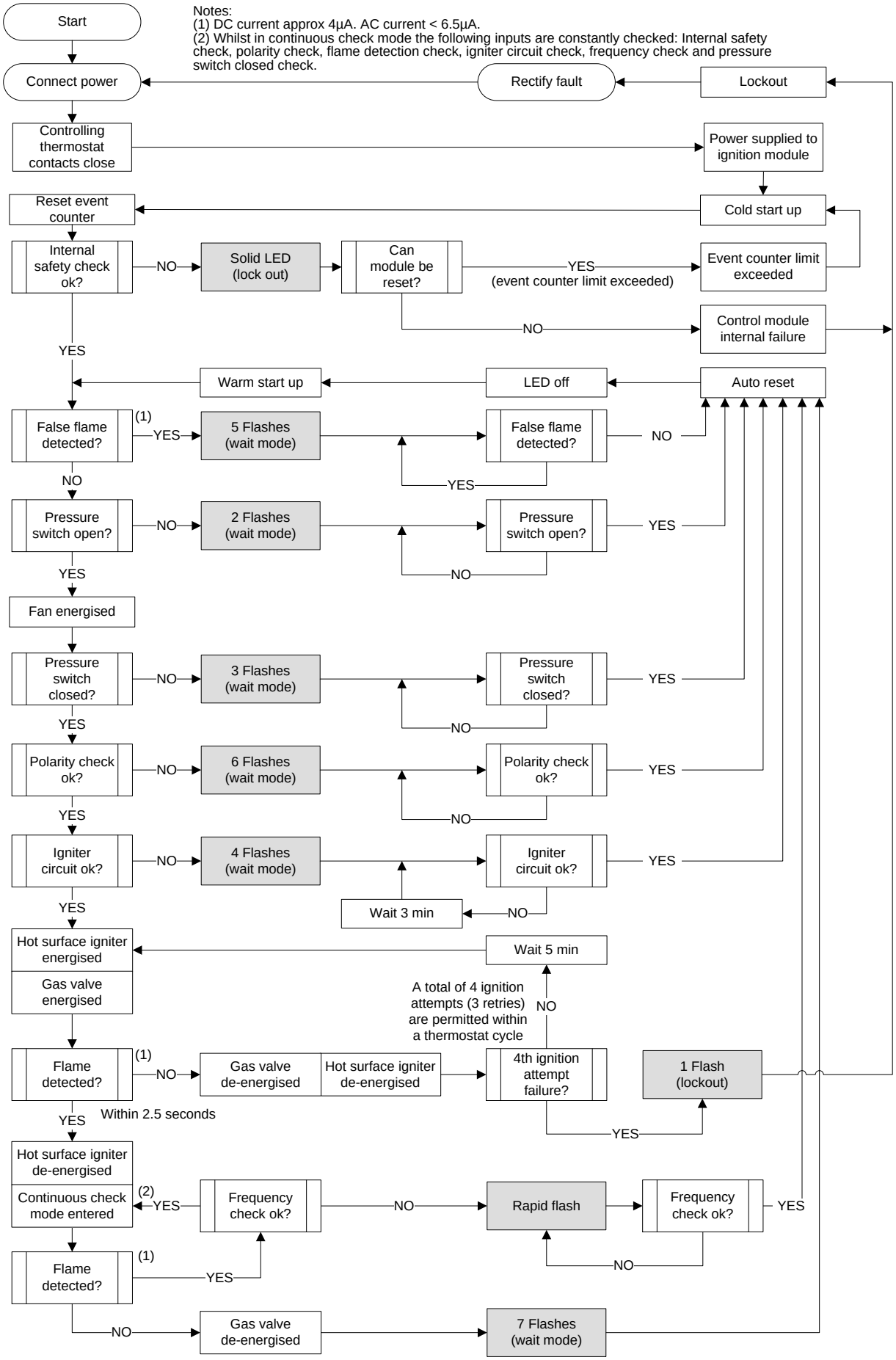
Heating Cycle Flow Chart - models fitted with Pactrol P25 'F' HSI FMV ignition module – suitable for 631275 models manufactured from 01/04/05



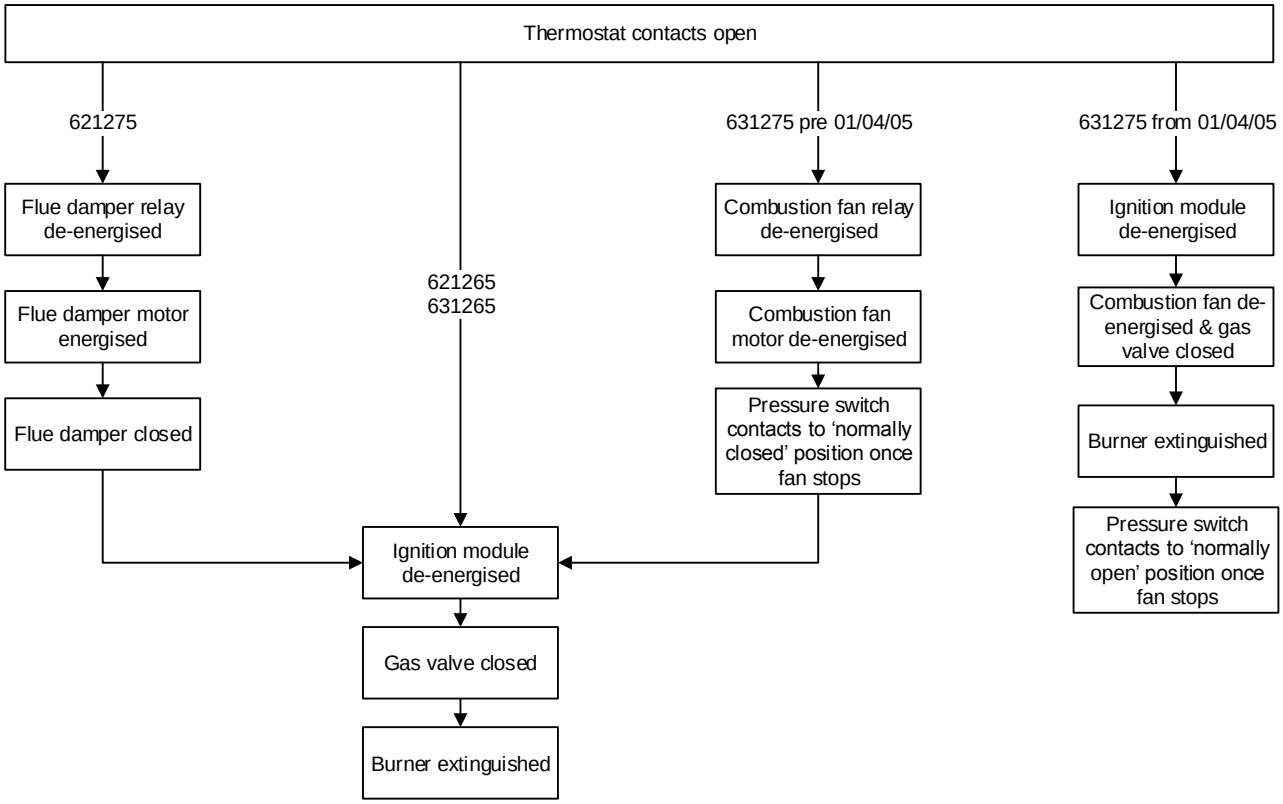
Heating Cycle Flow Chart – models fitted with W/Rodgers ignition module 50A72-298 – suitable for 621265, 631265, 621275 (& 631275 before 01/04/05)



Heating Cycle Flow Chart - models fitted with W/Rodgers ignition module 50A72-178 – suitable for 631275 models manufactured from 01/04/05

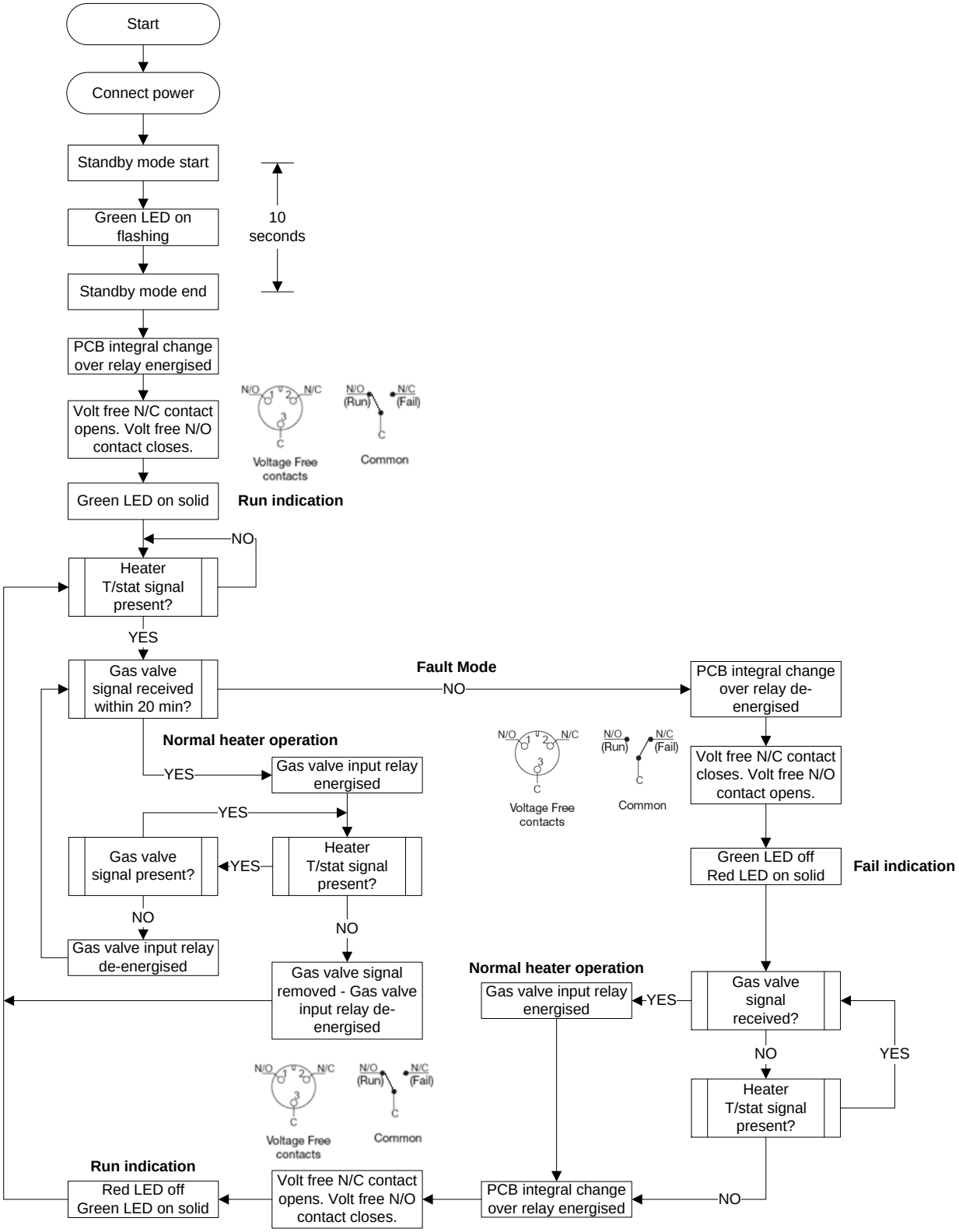


Burner Extinction Cycle Flow Chart - All Models



BMS Module Operational Flow Chart

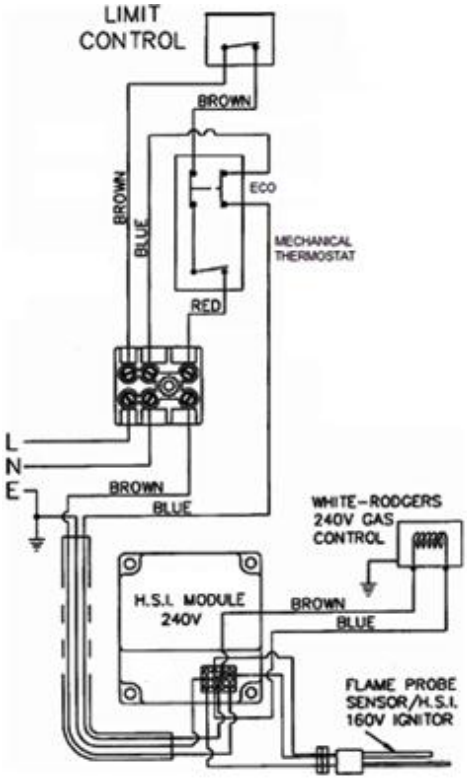
The BMS module is optional and may not be fitted.



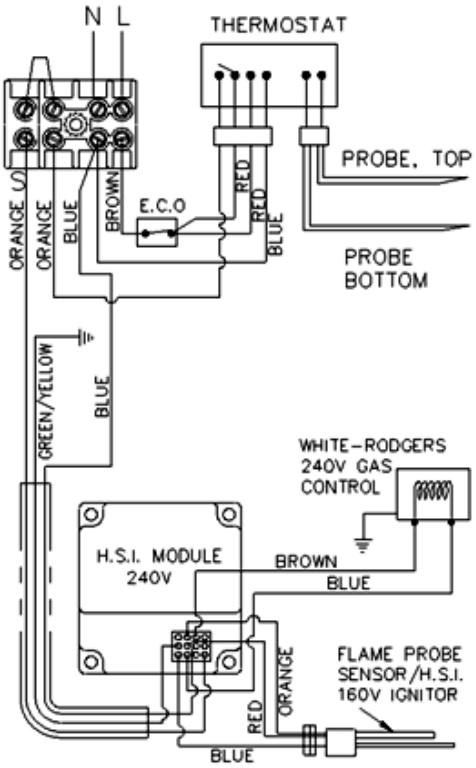
WIRING DIAGRAMS

Heater Wiring Diagrams – 621265 & 631265 Models

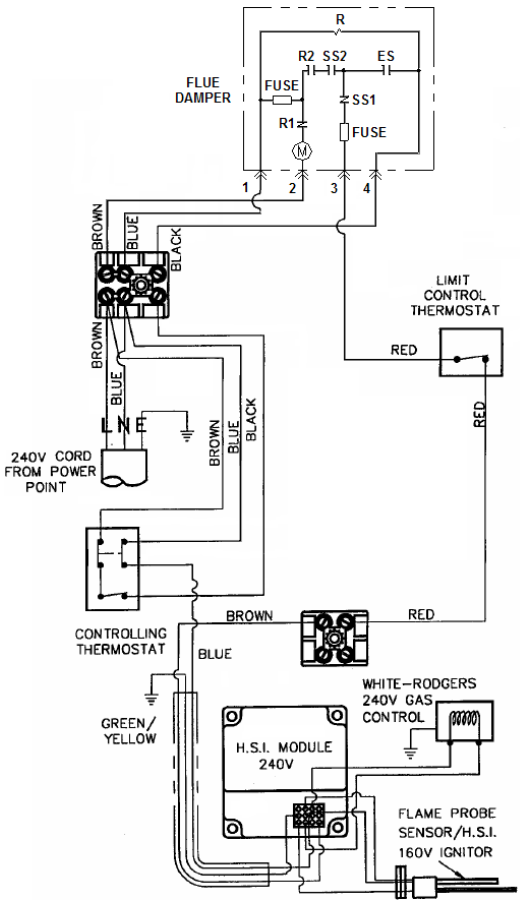
Manufactured Before 02/11/01

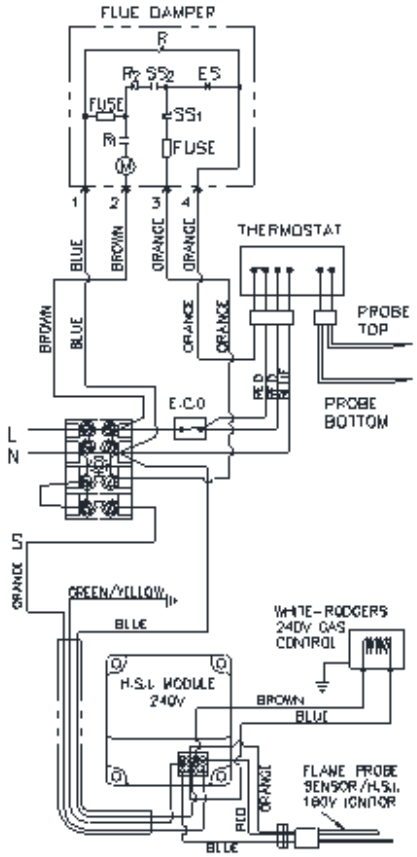


Manufactured From 02/11/01



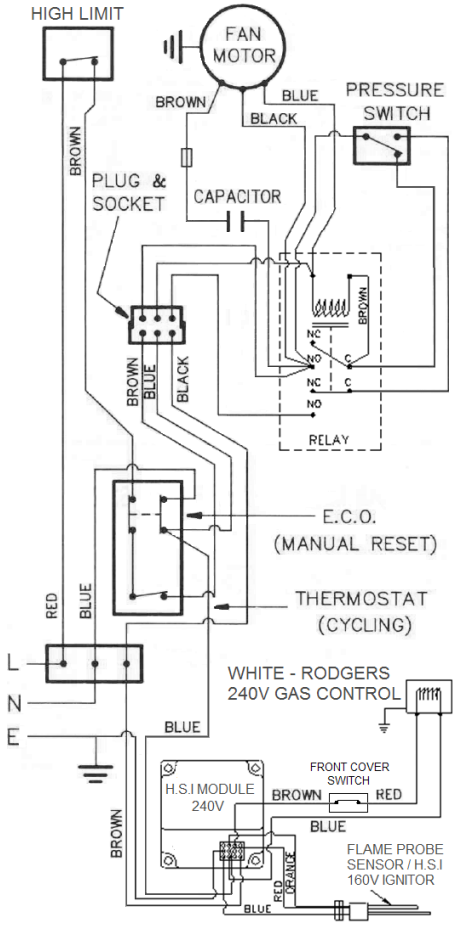
Heater Wiring Diagrams – 621275 Models



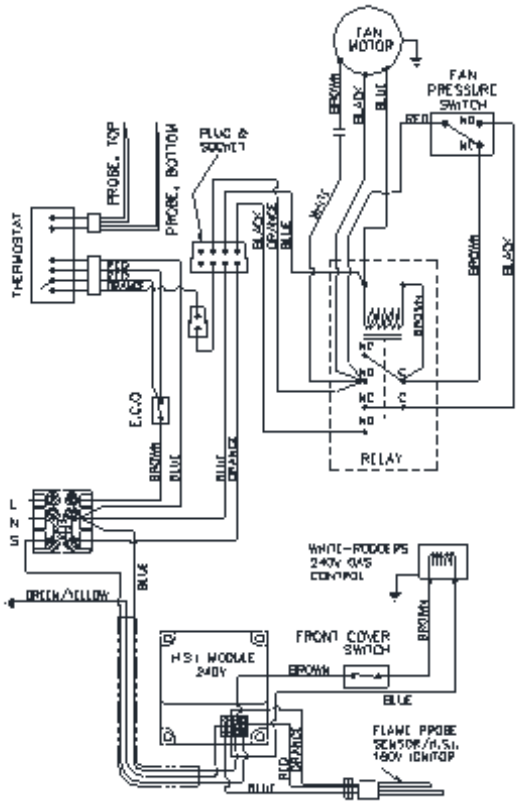


Heater Wiring Diagrams – 631275 Models

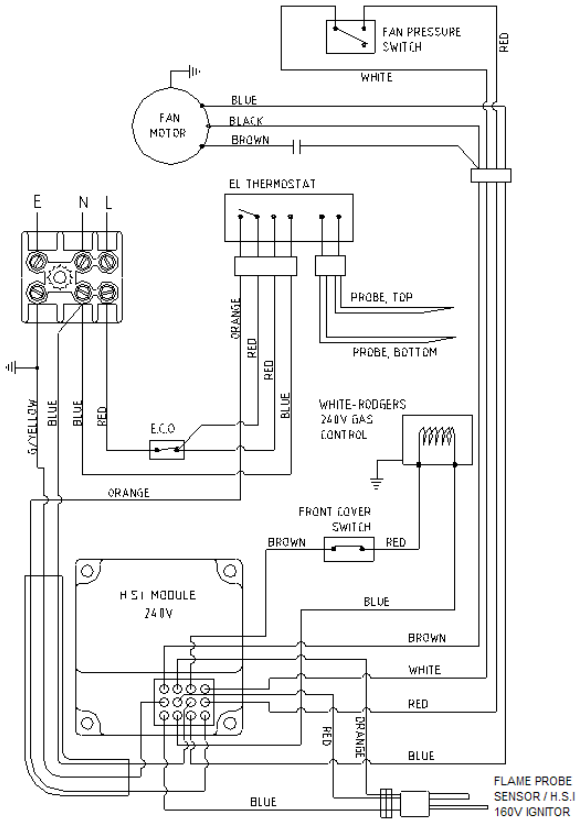
Manufactured Before 02/11/01



Manufactured From 02/11/01 to 31/03/05

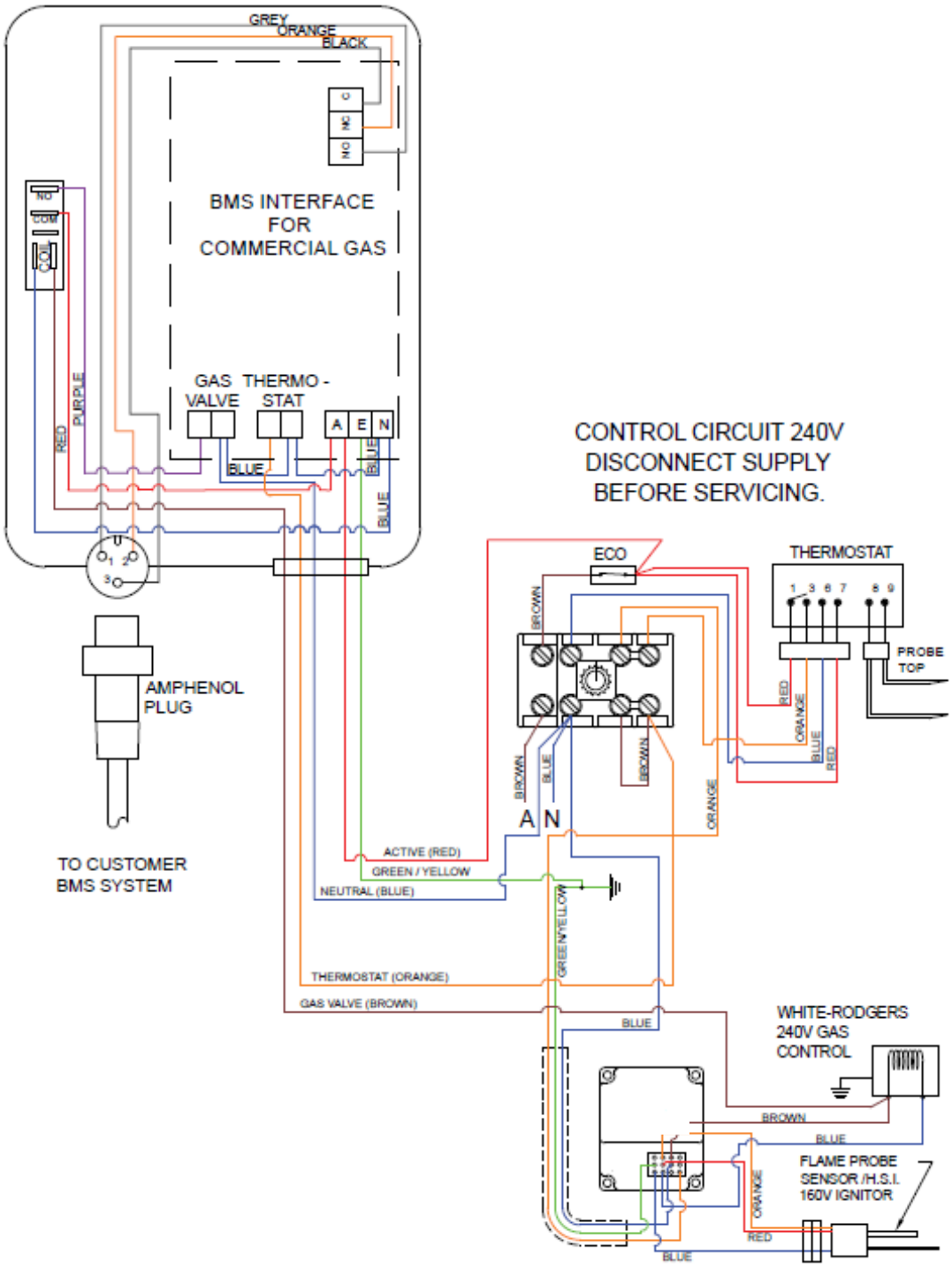


Manufactured From 01/04/05



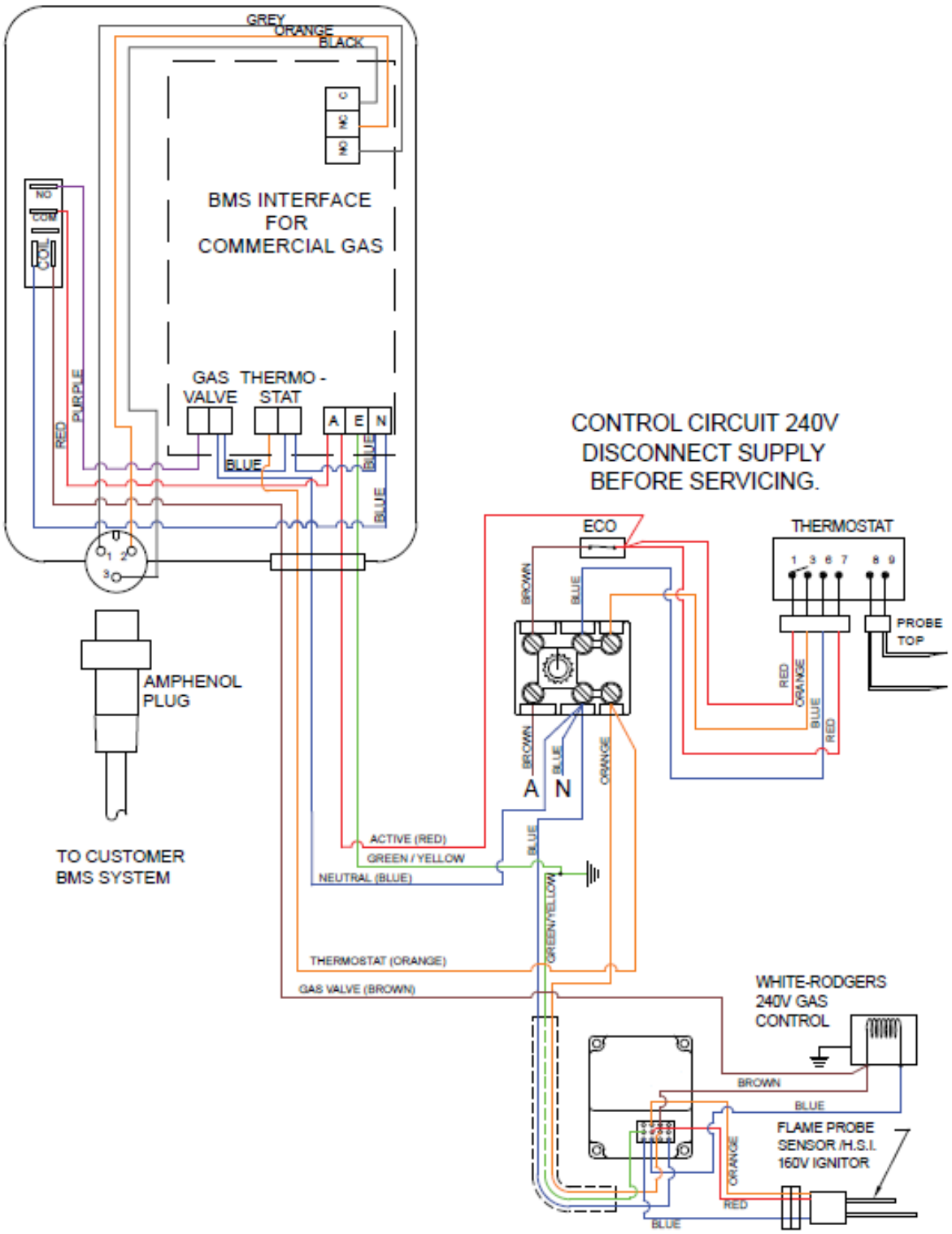
Heater Wiring Diagram with BMS Module – 621265 Models

Note: BMS module can only be fitted to models with an electronic controlling thermostat (models manufactured from 02/11/01).



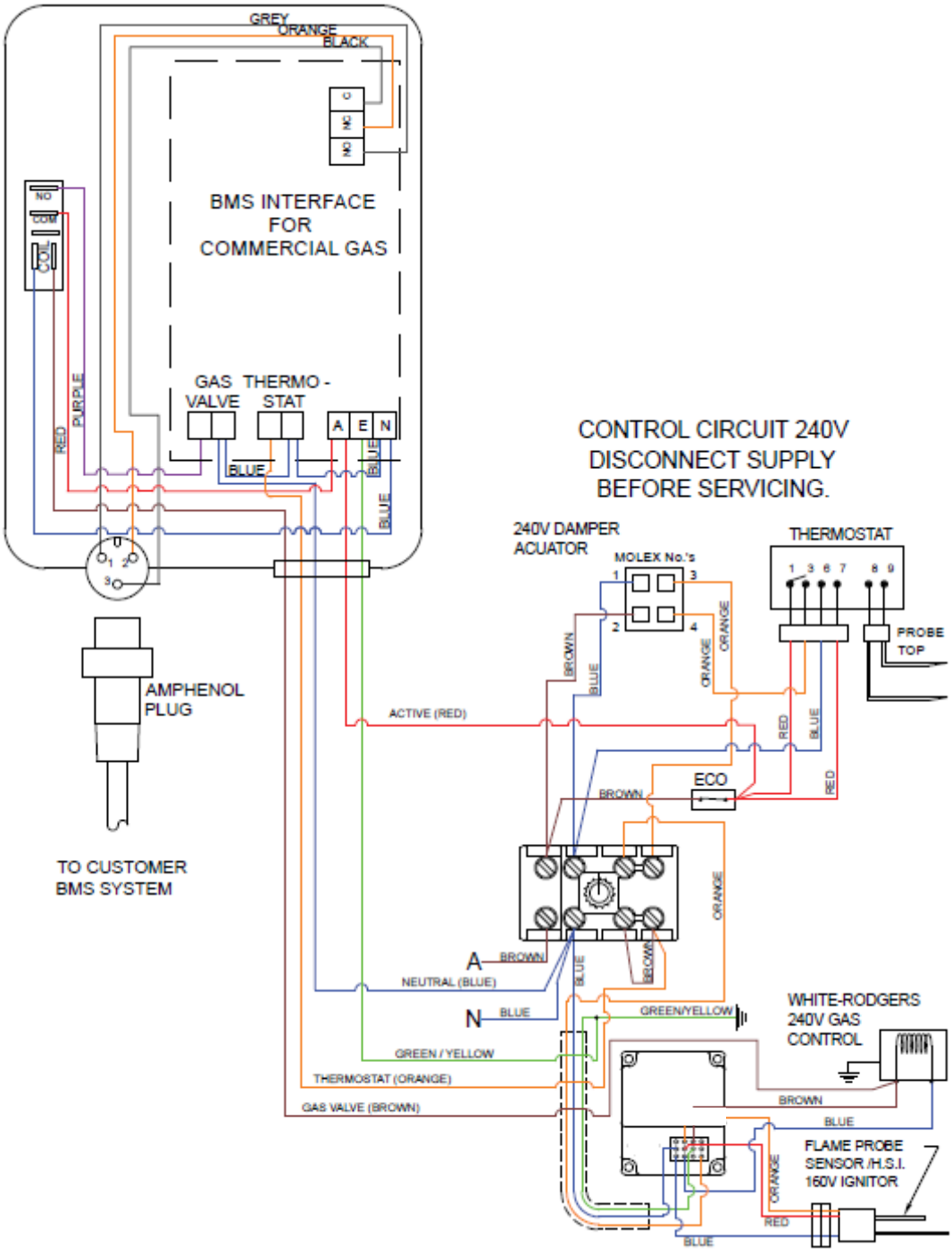
Heater Wiring Diagram with BMS Module – 631265 Models

Note: BMS module can only be fitted to models with an electronic controlling thermostat (models manufactured from 02/11/01).



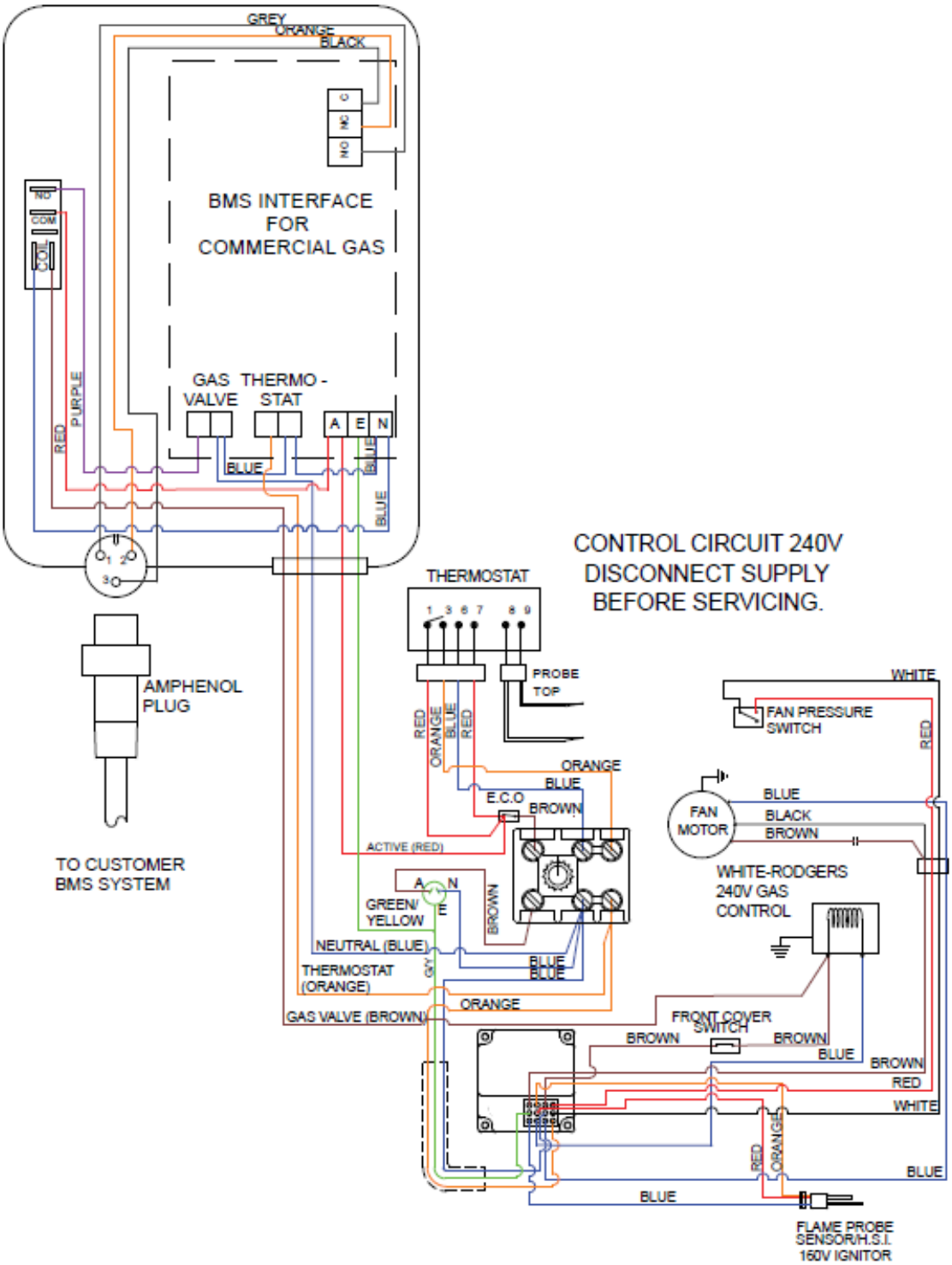
Heater Wiring Diagram with BMS Module – 621275 Models

Note: BMS module can only be fitted to models with an electronic controlling thermostat (models manufactured from 02/11/01).



Heater Wiring Diagram with BMS Module – 631275 Models

Note: BMS module can only be fitted to models with an electronic controlling thermostat (models manufactured from 02/11/01).



COMPONENTS AND THEIR FUNCTION

Gas Valve: The gas valve is a White Rodgers model 36C90H-408 220/240 volt AC double solenoid valve suitable for use with electronic controllers.

An insulated one-shot thermal fuse is incorporated into one of the solenoid leads to act as a cut out in the event of excessive heat spillage from the combustion chamber. The thermal fuse will open circuit at temperatures of 90ºC to 100ºC.

Ignition Control Module: The ignition control module controls operation of the burner ignition sequence. Each step of the sequence is timed by the ignition control module. In the event of a malfunction the ignition control module will enter either a 'wait' or 'lock out' mode.

Note: All heavy duty gas storage models manufactured from September 2015 utilise a Pactrol P25 ignition module. This module does not include specific fault codes to assist with fault diagnosis whereas the White Rodgers modules used previously did include fault codes that were indicated by a series of LED flashes (refer to 'White Rodgers Ignition Control Module Fault Codes' on page 51 for further details).

Controlling Thermostat: The controlling thermostat supplies power to the ignition control module, flue damper relay coil or combustion fan (depending upon model) when a call for heat is required. Depending upon date of manufacture the controlling thermostat may be a mechanical type or an electronic type.

Models manufactured from 29/04/2011 utilise an Eliwell IC902 electronic thermostat which is an electronic device that facilitates the programming of appliance operating parameters and determines if a call for heat is required based on these parameters and the resistance value of the temperature sensor set (refer to 'Eliwell IC902 Controlling Thermostat on page 31).

Models manufactured from 02/11/2001 to 28/04/2011 utilise an AKO electronic thermostat which is an electronic device that facilitates the programming of appliance operating parameters and determines if a call for heat is required based on these parameters and the resistance value of the temperature sensor set (refer to 'AKO Controlling Thermostat on page 34).

Models manufactured before 02/11/2001 utilise a Robertshaw mechanical thermostat which has a bi-metallic strip that is sensitive to temperature. The bi-metallic strip closes a set of contacts when a call for heat is required and opens the contacts when the detected temperature reaches the set point. (refer to 'Mechanical Controlling Thermostat' on page 37).

Temperature Sensor Set (models with electronic thermostat only): The temperature sensor set is comprised of two NTC (negative temperature coefficient) thermistors which form the hot and cold sensors. The resistance value of the temperature sensor set will change according to the detected temperatures. The controlling thermostat uses the average water temperature derived from the overall resistance value of the sensor set to determine if a call for heat is required. Refer to 'Testing the Temperature Sensor Set' on page 49 for more information.

Burner Assembly: The burner assembly is where gas combustion occurs. Gas enters the burner from the gas valve via the burner feed pipe. The gas is passed through an injector into the burner and mixed with air. As the air/gas mixture exits the burner it is ignited. The resulting heat and combustion gasses travel up through a central tube in the storage cylinder where the heat is transferred to water held in the storage cylinder. The combustion gasses exit the water heater via the flue terminal.

Flue Damper (621275 ONLY): The flue damper is a spring loaded motorised butterfly flap installed on the top of the primary flue which is designed to minimise heat loss through the flue system during standby. The butterfly flap is not pierced as the HSI heavy-duty range does not utilize a standing pilot.

Prior to the ignition sequence commencing the flue damper is rotated to the open position, two limit switches, 1 primary and 1 safety, are incorporated into the flue damper to 'prove' the damper is open. The flue damper is motor driven closed. A spring mounted on the shaft opens the damper when the damper motor is de-energised.

A replaceable 1.6 amp fuse is mounted on the damper enclosure to protect the damper PCB from damage should the gas control and ignition control module fail.
Igniter and Flame Probe: The igniter rod is manufactured from Silicon Nitrate. When power is applied, the rod glows to ignite the gas. This system is known as hot surface ignition (HSI)

The flame rod is manufactured from Canthal-D and forms part of the flame proving system. A small electric current is passed from the ignition module to the flame rod and then through the flame to earth. This is known as flame rectification.

Note: The flame proving system will only work when the water heater is connected to a correctly polarised and earthed neutral mains supply.

Over Temperature Energy Cut Out (ECO): A temperature sensing device that automatically cuts off the power supply to the controlling thermostat to prevent excessive water temperature occurring.

Models with a mechanical thermostat have an auto reset ECO (named high limit or limit control on wiring diagrams) located behind the upper access cover. The ECO contacts will open when a temperature of 75ºC is detected and will automatically reset (close contacts) when the detected temperature drops to 61ºC.

Models with an electronic thermostat have a manual reset ECO mounted behind the lower access cover. The ECO contacts will open when a temperature of 78 ~ 84ºC is detected. This ECO will not reset automatically, however it can be manually reset once temperatures have fallen to a safe level (60ºC or less) by pressing and releasing the ECO's reset button.

Anode (sacrificial): A metal alloy electrode which, by galvanic action, protects the inner cylinder from corrosion.

Temperature and Pressure Relief Valve (T&PR valve): A valve designed to provide automatic relief by discharging water in case of excessive temperature, pressure or both.

Never fit a T&PR valve with a pressure rating greater than that indicated on the product-rating label, do NOT use reconditioned T&PR valves.

Delivery Tube (Dip Tube): A polypropylene tube fitted inside the water heater cylinder to conduct water from the highest point to the outlet connection. It also acts as a fitting liner.

Drain Valve: A plumbing device designed to facilitate draining of the water heater.

Inlet Diffuser: A device installed in the cold water inlet of the water heater to help control temperature stratification within the cylinder.

Flue Baffle: A baffle inserted into the water heater flue tube that slows the passage of flue gases to ensure maximum heat transfer to the stored water.

Draught Diverter (indoor models): A cowl installed at the top of the water heater between the primary flue and secondary flue to help prevent adverse draughts affecting gas burner operation.

Combustion Fan Assembly (631275 only): A fan and electric motor combination, installed in the air duct to provide sufficient primary air for combustion. The fan assembly is also comprised of a fan capacitor, pressure switch, and for models manufactured before 01/04/05 a relay.

When sufficient pressure is created by the combustion fan the pressure switch contacts close supplying power to the ignition control module (models manufactured before 01/04/05) or close a proving circuit in the ignition control module (models manufactured from 01/04/05).

The relay (if fitted) is interlocked electrically with the combustion fan and pressure switch as a safety measure to prevent operation of the gas burner in the event the pressure switch, combustion fan or both have failed.

The fan capacitor is utilised for starting and running the fan motor.

Pressure Switch (631275 only): A device sensitive to air pressure incorporating a micro-switch. Refer to ‘Combustion Fan’ above for more information.

Relay (631275 Manufactured before 01/04/05 only): An electric coil operating a pair of single throw contacts. Refer to ‘Combustion Fan’ above for more information.

Capacitor (631275 only): An electrical device utilised for starting and running the fan motor.

Door Switch (631275 only): The door switch is a normally closed micro switch wired in series with the gas valve and is a design code requirement to ensure the burner is shut down if the lower access cover is removed.

BMS Module: An optional electrical device utilised to provide heater run/fail status indication to the customer's BMS system. Refer to 'BMS Module' on page 43 for more information.

CONTROLLING THERMOSTAT

Depending upon the heater's date of manufacture there are three types of controlling thermostats which are as follows:

- Eliwell IC902 Electronic Thermostat (refer to 'Eliwell IC902 Controlling Thermostat' on page 31).
- AKO Electronic Thermostat (refer to 'AKO Controlling Thermostat' on page 34).
- Robertshaw Mechanical Thermostat (refer to 'Mechanical Controlling Thermostat' on page 37).

Eliwell IC902 Controlling Thermostat

Models manufactured from 29/4/2011 are fitted with an Eliwell IC902 thermostat. The new thermostat can be identified by a different facia as shown opposite.

The Eliwell IC902 thermostat has a different parameter configuration to the AKO thermostats previously used.

The Eliwell IC902 thermostat is the same size as the AKO and can be fitted without any need for modification to the panel cut out.

Eliwell IC902 Thermostat Parameters

Level 1	Parameter Level 2	Description	Setting
Machine Status Menu			
	SEt	Set Temperature	70[1]
	Pb1	Probe 1 Value	Current water temp
	CA1	Calibration Offset	16[1]
CP			
	di F	Differential	2
	OdO	Function Delay At Power Up	0
	dbi	Delay Between Cycles	0
	dOF	Delay After Switch Off	0
	dOn	Delay Of Regulator After Start Up	0
	OFt	Relay Disable Time (Faulty Probe)	1
	Ont	Relay Activation Time (Faulty Probe)	0
	HC	Heat/Cool Mode	H
	LSE	Minimum Set Point Value	60
	HSE	Maximum Set Point Value	80
FPr			
	UL	Upload To Copy Card	n
	dL	Download From Copy Card	n
CnF			
	HOO	Probe type selection	1
	TAb	Reserved	Information Only
	rEL	Device Version	
d1 S			
	LOC	Keyboard Locking	n
	dro	Temperature Display Mode	0
	CA1	Calibration Offset	16[1]
	ndt	Number Display With Decimal	n
	PA1	Password	0

[1] When changing the set point (SEt) the Calibration Offset Value (CA1) MUST also be changed.

The table below details the parameter settings for the thermostat set point. These parameters **MUST** be set correctly for the water heater to operate properly.

Temperature	**Parameter**				
Set Point (SEt)	(CA1)	(diF)	(HSE)	(LSE)	(HC)
60 - 64	14	2	80	60	H
65 - 69	15	2	80	60	H
70 - 74	16	2	80	60	H
75 - 79	17	2	80	60	H
80 - 81	18	2	80	60	H
82 (Recirculation required)	18	2	82	60	H

Adjusting the Water Temperature – Eliwell IC902 Thermostat

When adjusting the thermostat setting ('set point') it will also be necessary to alter the offset. The table opposite outlines the thermostat temperature and the corresponding offset.

Failure to adjust the offset will result in incorrect outlet water temperature.

Temperature ºC	Offset (CA1)
60 – 64	14
65 – 69	15
70 – 74	16
75 – 79	17
80 – 81	18
82 **(Recirculation required)**	18

Note: During the programming process if a button is not pressed for 15 seconds the thermostat will revert to the temperature display saving the last value displayed for the parameter. It will be necessary to reprogram the parameter if the setting was incorrect.

Adjusting Set Point (SEt) & Calibration Offset (CA1) – Eliwell IC902 Thermostat

1. Press and release the **'set'** button to enter the machine status menu, 'SEt' will be displayed.
2. Whilst SEt is displaying press the **'set'** button, the current set point value will be displayed i.e. 70.
3. Press the up (▲) button to increase the value or the down (▼) button to decrease the value.
4. Press the **'set'** button to accept the new value, 'SEt' will be displayed.

   *If no further adjustment is to be made press the **'fnc'** button* to *exit the machine status menu; the current water temperature will be displayed, otherwise continue with this procedure.*
5. Press the up (▲) button once, 'CA1' will be displayed.
6. Whilst CA1 is displaying press the **'set'** button, the current Calibration Offset value is displayed i.e. 16.
7. Press the up (▲) button to increase the value or the down (▼) button to decrease the value.

   The setting MUST match that shown in the table on page 32 for the corresponding set point temperature selected at step 4 i.e. if the Set Point at step 5 is 60, then the Calibration Offset value must be set to 14.
8. Press the **'set'** button to accept the new value, 'CA1' will be displayed.
9. Press the **'fnc'** button to exit the machine status menu; the current water temperature will be displayed.

Adjusting all Other Parameters – Eliwell IC902 Thermostat

To adjust a parameter it will be necessary to know where the parameter resides in the thermostats menu so it can be navigated to. The 'Thermostat Parameter Table' on page 31 details the thermostat menu and where each parameter resides within the menu.

Adjusting the Differential (di F) – Eliwell IC902 Thermostat

The differential (di F) is the first parameter located in the CP menu.

1. Press and hold the **'set'** button for 5 seconds; 'CP' will be displayed. Release the **'set'** button.
2. Whilst 'CP' is displaying press and release the **'set'** button, the first parameter in the CP menu will be displayed, in this case 'di F'.
3. Whilst 'di F' is displaying press and release the **'set'** button, the current Differential value is displayed i.e. 2
4. Press the up (▲) button to increase the value or the down (▼) button to decrease the value.
5. Press and release the **'set'** button to accept the new value, 'di F' will be displayed.
6. Press and release the **'fnc'** button; 'CP' will be displayed.

Adjusting the Lower Set Point (LSE) – Eliwell IC902 Thermostat

The Lower Set Point (LSE) is the 9th parameter located in the 'CP' menu.

1. Press and hold the **'set'** button for 5 seconds; 'CP' will be displayed. Release the **'set'** button.
2. Whilst 'CP' is displaying press and release the **'set'** button, the first parameter in the CP menu will be displayed, in this case 'di F'.
3. Whilst 'di F' is displaying press the down (▼) button eight (8) times; 'LSE' will be displayed.
4. Whilst 'LSE' is displayed press and release the **'set'** button; the current Lower Set Point value is displayed i.e. 60.
5. Press the up (▲) button to increase the value or the down (▼) button to decrease the value.
6. Press and release the **'set'** button to accept the new value, 'LSE' will be displayed.
7. Press and release the **'fnc'** button 'CP' will be displayed.

   *If no other adjustment is to be made press the **'fnc'** button* to *exit; the current water temperature will be displayed, otherwise continue navigating to and adjusting each parameter as required.*

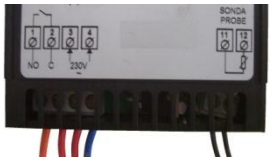
Fault Codes – Eliwell IC902 Thermostat

In the event of a sensor failure, a 2 digit code may be displayed on the thermostat LED to indicate the fault. Refer to 'Eliwell IC902 Thermostat Fault Codes' on page 47.

AKO Controlling Thermostat

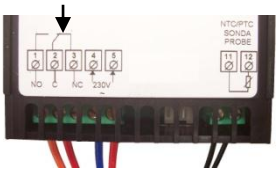
Models manufactured from 02/11/2001 to 28/04/2011 utilise an AKO electronic thermostat which is an electronic device that facilitates the programming of appliance operating parameters and determines if a call for heat is required based on these parameters and the resistance value of the temperature sensor set.

Models manufactured from the 21/7/08 have a revised AKO thermostat fitted. The revised thermostat can be identified by having a different facia as shown opposite.



Early Thermostat

Additional N/C terminal



Revised Thermostat

AKO Thermostat Parameters

The AKO thermostat has parameters that control water heater operation. Under normal conditions, including a power outage, the parameter settings do not require adjustment.

Parameter settings should be checked and may require adjustment after replacing a thermostat, changing the 'set point', or if the delivered water temperature deviates significantly from that displayed on the thermostat.

The table below details all parameters available and the factory settings for these parameters whilst the table on page 35 details parameters specific to HSI Heavy Duty Gas Water Heater operation. Parameters **MUST** be set correctly for the water heater to operate correctly.

Menu Level			Description	Factory Setting
Level 1	Level 2	Level 3		
Display shows tank temp in ºC (normal operating status) or fault code	**rE**		**Control**	
		SP	Set point temperature	70
		C0	Sensor calibration (offset)	16
		C1	Differential	2
		C2	Set point upper limit	82
		C3	Set point lower limit	60
		C4	Relay protection delay type	0
		C5	Protection delay time	0
		C7	Relay time on	0
		C8	Relay time off	1
		EP	Exit parameter level	
	CnF		**General Status**	
		P0	Type of operation	1
		P1	Function delay at power up	0
		P2	Allocation of set point password	0
		P3	Initial parameters	0
		P5	Address	0
		P7	Temperature display mode	0
		P9	Sensor type	0
		EP	Exit parameter level	
	tid		**Access and Information**	
		L5	Allocation of parameter password	0
		L6	Parameter transfer	0
		PU	Program version	Information only
		Pr	Program revision	Not adjustable
		EP	Exit parameter level	
	EP		**Exit Parameter Level**	

Note Early model AKO thermostats do not have a menu level 2 or level 3 parameters 'P9' & 'SP'.

Parameters Specific to HSI Heavy Duty Gas Water Heater Operation			
Parameter	Description	Range	
		MIN	MAX
C0	**Temperature Probe Calibration (Offset)** This setting is added to or subtracted from the detected tank temperature and the adjusted value is displayed as the actual tank temperature.	-20ºC	+20ºC
C1	**Differential** This setting is subtracted from the thermostat 'set point' with the new value determining the thermostat 'cut in' temperature after completion of a heating cycle.	1ºC	20ºC
C2	**Maximum 'Set Point' Limiter** The 'set point' cannot be adjusted above this value. The 'AH' (alarm high) temperature alarm is activated if the detected temperature rises above this value.	xxºC	85ºC
C3	**Minimum 'Set Point' Limiter** The 'set point' cannot be adjusted below this value. The 'AL' (alarm low) temperature alarm is activated if the detected temperature falls below this value.	-50ºC	xxºC
P0	**Type of operation (Heat/Cool)** Selects thermostat operation for cooling or heating applications 0 = Cooling (Differential above 'set point') 1 = Heating (Differential below 'set point')	0	1
P2	**Block Programmed Parameters** Prevents parameters from being altered 0 = No (Parameters can be altered) 1 = Yes (Parameters cannot be altered)	0	1
EP	**Exit Parameter Level** Exits programming parameter level and locks in changes made to parameters.	-	-

Adjusting the Thermostat Set Point – All AKO Thermostats

When adjusting the thermostat set point it will also be necessary to alter the parameters shown in the table below according to new set point temperature.

Failure to correctly adjust these parameters will result in incorrect outlet water temperature and/or incorrect heater operation.

Temperature Set Point	Parameter				
	(C0)	(C1)	(C2)	(C3)	(P0)
60 - 64	14	2	80	55	1
65 - 69	15	2	80	60	1
70 - 74	16	2	80	65	1
75 - 79	17	2	85	70	1
80 - 81	18	2	85	75	1
82 (Recirculation required)	18	2	85	75	1

Note: During any programming procedure if a button is not pressed for 25 seconds, or the program is not exited via the EP parameter, the thermostat display will revert to show the current tank temperature without modifying the program. If this occurs it will be necessary to reprogram the thermostat.

1. Press and hold the down button (▼) for 5 seconds. The current set point temperature will be displayed in ºC. Release the button.

2. Press and release the down button (▼) to decrease the set point or press and release the up button (▲) to increase the set point. Each press and release of the down or up button changes the set point in 1º increments.
3. Once the required set point temperature has been selected, press and hold the down button (▼) and up button (▲) simultaneously. The display will revert to the current tank temperature at which time the buttons can be released completing the programming procedure.
4. Check and adjust level 3 parameters C0, C1, C2, C3 & P0 according to previous table for new set point value. Refer to following procedures for level 3 parameter adjustments.

Adjusting Level 3 Parameters – Early AKO Thermostats

Note: Early model AKO thermostats do not have a menu level 2 or level 3 parameters 'P9' & 'SP'. All Level 3 parameters are entered directly from level 1.

1. Press and hold the down button (▼) and up button (▲) simultaneously for 10 seconds. The third level parameter group will be accessed and 'C0' will be displayed. Release the buttons.
2. Press and release the up button (▲) until the required third level parameter is displayed. Note: if parameter 'C0' is required do not perform this step as 'C0' will already be displayed.
3. Press and hold the down button (▼) and up button (▲) simultaneously. The previously selected parameters current setting will be displayed. Release the buttons.
4. Press and release the down button (▼) to decrease the setting or press and release the up button (▲) to increase the setting.
5. Once the required setting has been selected, press and hold the down button (▼) and up button (▲) simultaneously. The display will revert back to the relevant (previously selected) parameter at which time the buttons can be released.
6. Press and release the down button (▼) or up button (▲) until 'EP' (exit parameter level) is displayed.
7. Press and hold the down button (▼) and up button (▲) simultaneously. The display will revert to the current tank temperature at which time the buttons can be released completing the programming procedure for the selected parameter.

Adjusting Level 3 Parameters – Revised AKO Thermostat

Note: Level 3 parameters are entered from level 2 headings (rE, Cnf, & tid).

1. Press and hold the down button (▼) and up button (▲) simultaneously for 10 seconds. The second level parameter group will be accessed and 'rE' will be displayed. Release the buttons.
2. Press and release the up (▲) button until the required second level parameter is displayed. Note: if parameter 'rE' is required do not perform this step as 'rE' will already be displayed.
3. Press and hold the down button (▼) and up button (▲) simultaneously. The third level parameter group for the selected second level parameter will be accessed. Release the buttons.
4. Press and release the up button (▲) until the required third level parameter is displayed (if not already displayed).
5. Press and hold the down button (▼) and up button (▲) simultaneously. The previously selected parameters current setting will be displayed. Release the buttons.

6. Press and release the down button (▼) to decrease the setting or press and release the up button (▲) to increase the setting.
7. Once the required setting has been selected, press and hold the down button (▼) and up button (▲) simultaneously. The display will revert back to the relevant (previously selected) parameter at which time the buttons can be released.
8. Press and release the down button (▼) or up button (▲) until 'EP' (exit parameter level) is displayed.
9. Press and hold the down button (▼) and up button (▲) simultaneously. The display will revert to the second level parameter originally selected. Release the buttons.
10. Press and release the down button (▼) or up button (▲) until 'EP' (exit parameter level) is displayed again.
11. Press and hold the down button (▼) and up button (▲) simultaneously. The display will revert to the current tank temperature at which time the buttons can be released completing the programming procedure for the selected parameter.

Fault Codes – All AKO Thermostats

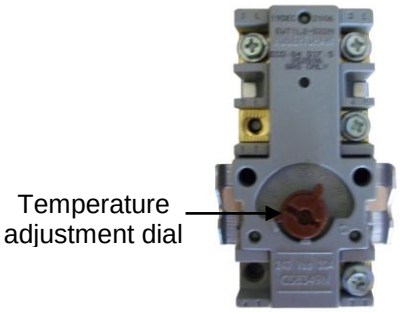
AKO thermostats will display fault codes for certain fault conditions. Refer to 'AKO Thermostat Fault Codes' on page 47 for fault codes and their meanings.

Mechanical Controlling Thermostat

Models manufactured before 02/11/2001 utilise a Robertshaw mechanical thermostat which has a bi-metallic strip that is sensitive to temperature. The bi-metallic strip closes a set of contacts when a call for heat is required and opens the contacts when the detected temperature reaches the set point.

Set point temperature is dial adjustable from 50ºC ~ 80ºC and the differential is set at 5ºC ± 3ºC.

Note: Recirculation is required for a mechanical thermostat set temperature of more than 75ºC.

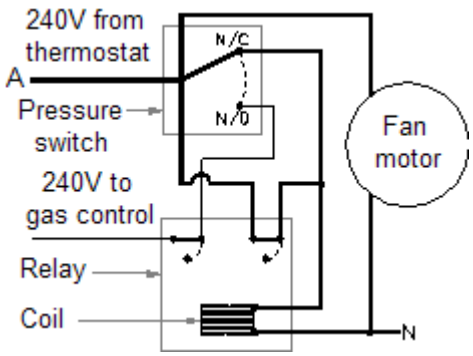


COMBUSTION FAN, PRESSURE SWITCH AND RELAY - 631275 MODELS

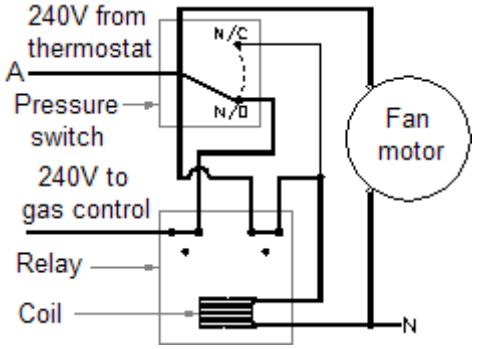
The combustion fan, relay (models manufactured before 01/04/05) and pressure switch are fitted to 631275 models only. These components are all located in the fan module which is mounted in the air duct on the front of the water heater.

The combustion fan provides the primary air under pressure required for successful combustion. The pressure switch and relay are electrically interlocked to ensure the combustion fan is running at sufficient speed and pressure before a trial for ignition is attempted. The following diagrams illustrate the sequence of operation.

When the thermostat contacts close power is supplied to the fan motor and to the relay coil via the normally closed contact of the pressure switch. The relay closes 2 sets of contacts. The first set of contacts latch the relay coil so that power is maintained to the relay coil when the pressure switch moves from the normally closed to normally open position. The second set of contacts close the circuit to the ignition module, however power is not available at this stage.



Once sufficient air pressure is achieved the pressure switch contacts move from the normally closed to the normally open position. Power is then supplied through the relay contacts to the ignition module allowing the ignition sequence to commence. Power is maintained to the relay coil via the latching circuit.



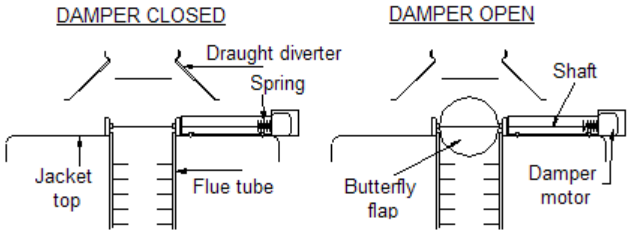
631275 models manufactured from 01/04/05 do not have a relay but utilise a different ignition module which eliminates the need for the relay.

This new ignition module utilises an internal method of checking the pressure switch position (position proving) and also supplies power to the combustion fan thus rendering the relay and its associated wiring obsolete. For more information refer to the ‘Product Changes’ section on page 7 and the wiring diagram on page 23.

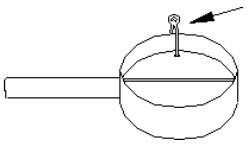
FLUE DAMPER - 621275 MODELS

The flue damper is screwed to the jacket top of the water heater. The damper consists of an actuator and butterfly flap that controls the exit of flue gases from the primary flue into the draught diverter and secondary flue.

When the water heater is on standby the butterfly flap is closed to prevent the flow of air up the flue tube. When the burner is operating the butterfly flap is open, allowing the free flow of combustion products from the water heater to the draught diverter and into the secondary flue.



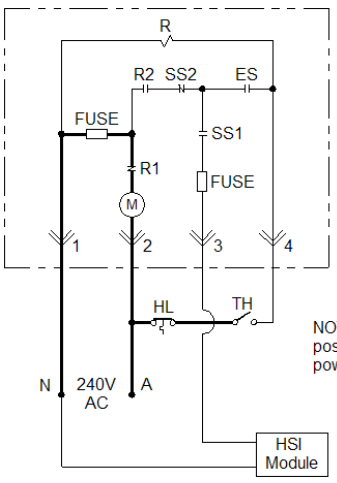
NOTE: The butterfly flap is secured in the closed position with a spring clip at the time of manufacture to prevent damage during transport and handling. This clip must be removed during installation. Failure to remove the spring clip will prevent the water heater from operating correctly and will cause an over temperature condition to occur.



Flue Damper Operating Sequence

Flue Damper Closing Operation: When the thermostat contacts 'TH' are open the flue damper is held closed by power being applied to the damper motor via contact 'R1'. Relay contacts 'R2' and end switch contacts 'ES' are open preventing power from entering the relay or ignition module circuit.

Flue Damper Schematic



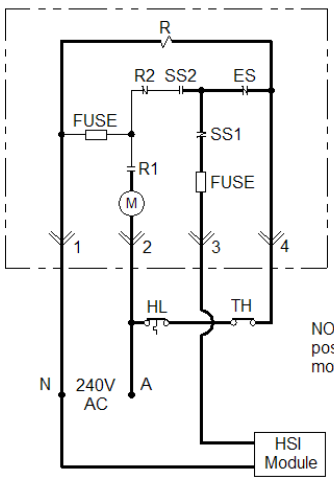
Legend

M - Damper motor
R - Relay coil
R1 - N/C relay contacts
R2 - N/O relay contacts
ES - End switch
SS1 - N/C safety switch contact
SS2 - N/O safety switch contact
HL - High limit
TH - Thermostat controlling contact

NOTE: Circuit shown with damper in closed position (TH closed - no call for heat) with power supplied to damper motor.

Flue Damper Opening Operation: When the thermostat contacts 'TH' close power is supplied to the relay coil 'R', this causes contacts 'R1' to open cutting power to the flue damper motor, allowing the damper to open under spring tension. Once the flue damper is completely open end switch 'ES' and safety switch 'SS1' contacts close allowing power to the ignition module.

Flue Damper Schematic



Legend

M - Damper motor
R - Relay coil
R1 - N/C relay contacts
R2 - N/O relay contacts
ES - End switch
SS1 - N/C safety switch contact
SS2 - N/O safety switch contact
HL - High limit
TH - Thermostat controlling contact

NOTE: Circuit shown with damper in open position (TH closed - call for heat). Damper motor de-energised.

Flue Damper - Bypass

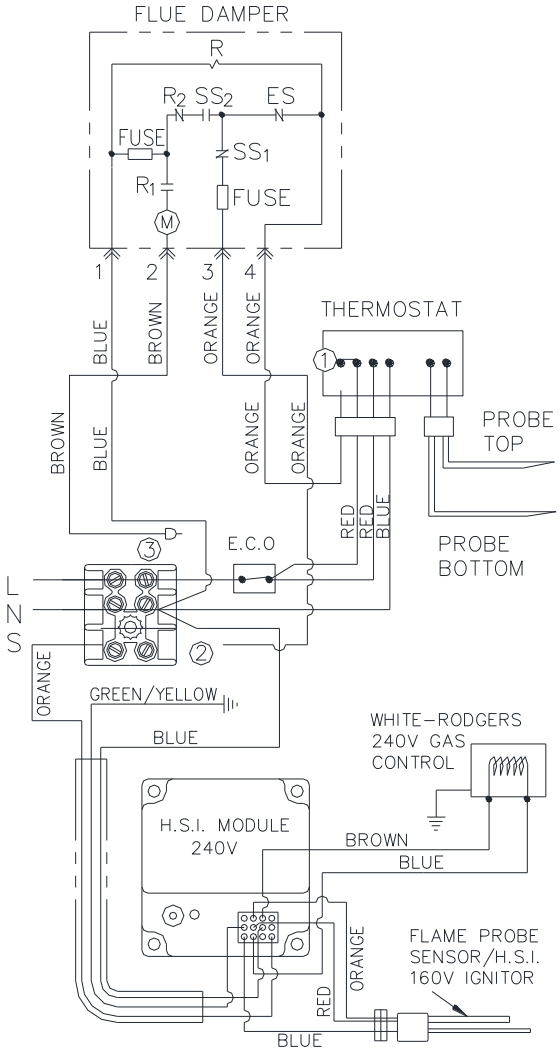
If a flue damper has failed and a replacement is not on hand, the water heater can be wired to operate temporarily with the flue damper bypassed until a replacement is obtained.

A replacement flue damper should be fitted as a matter of urgency.

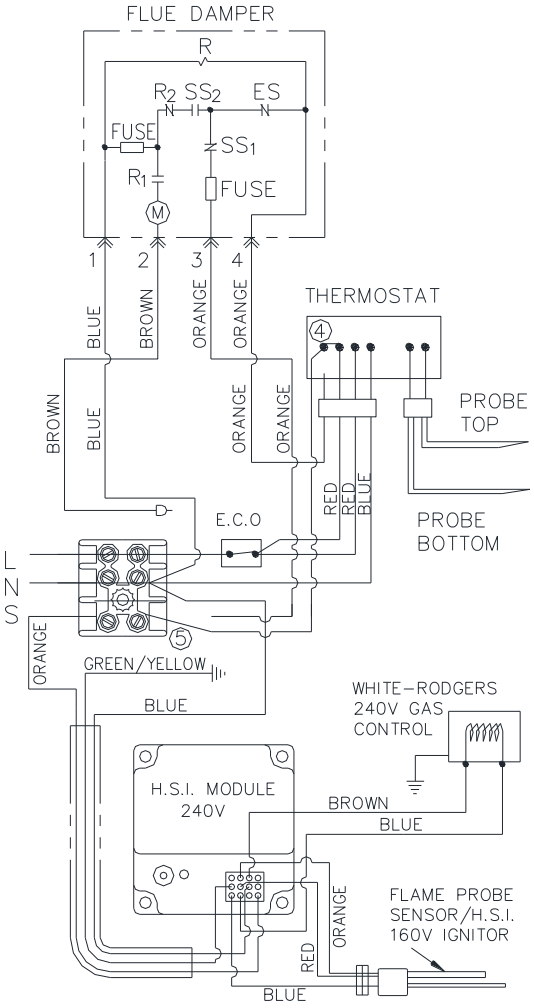
To bypass the flue damper electrically so the water heater will operate with the flue damper in the open position use the following procedure and wiring diagrams shown below.

1. ***Isolate power and remove 3 pin plug from power point.***
2. Remove lower access panel.
3. Disconnect orange wire from thermostat (refer to wiring diagram 1 circled point 1).
4. Disconnect orange switch wire from terminal block (refer to wiring diagram 1 circled point 2).
5. ***Disconnect brown active wire to flue damper from terminal block and terminate using a closed end connector*** (refer to wiring diagram 1 circled point 3).
6. Run a temporary wire from thermostat (refer to wiring diagram 2 circled point 4) to terminal block (refer to wiring diagram 2 circled point 5).
7. Replace cover and restore power.

Wiring Diagram 1



Wiring Diagram 2

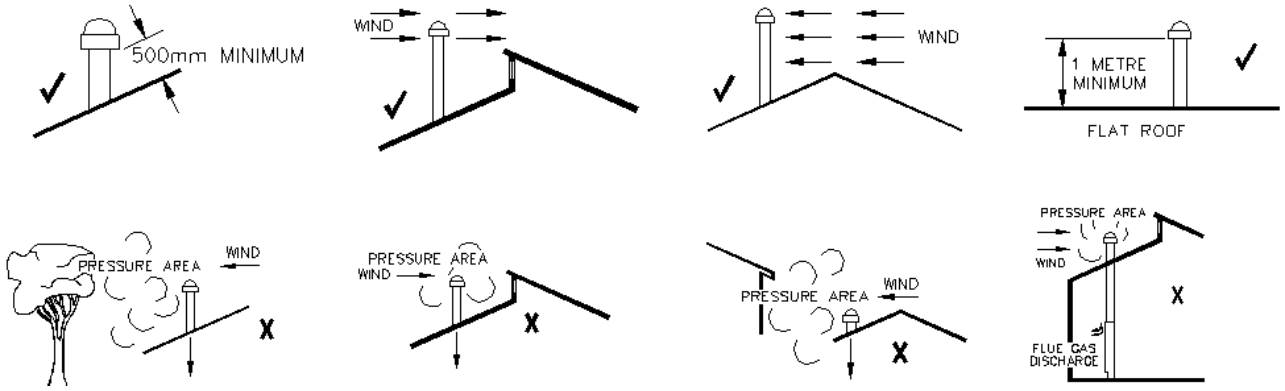


Indoor Models

Reverse flow (down draught) in the flue occurs when pressure at the flue outlet (cowl) is greater than that inside the water heater.

In this condition, flue gases are discharged through the draught diverter into the room where the water heater is located. This is of no consequence where occasional wind conditions may cause small intermittent discharges, however in severe conditions excessive down draught can cause flame roll out from the combustion chamber, burner outage and sooting.

The location of the flue cowl is critical to the correct operation of the flue system. The diagrams below detail the correct and incorrect location of the flue outlet. In many cases the position of the flue cowl is a major contributor to repeated component failure i.e. the gas valve or the unreliable operation of the water heater generally.



Outdoor models

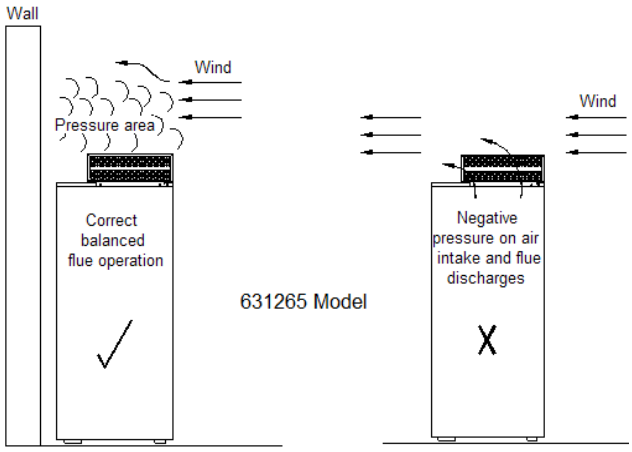
In practice it is almost impossible to achieve an exact balance between the pressure on the air inlet and flue outlet of a balanced flue terminal.

In order to avoid the possibility of reverse flueing the flue terminal design is always biased to provide slightly higher pressure on the air inlet. The flue terminal on outdoor water heaters has the air inlet towards the rear.

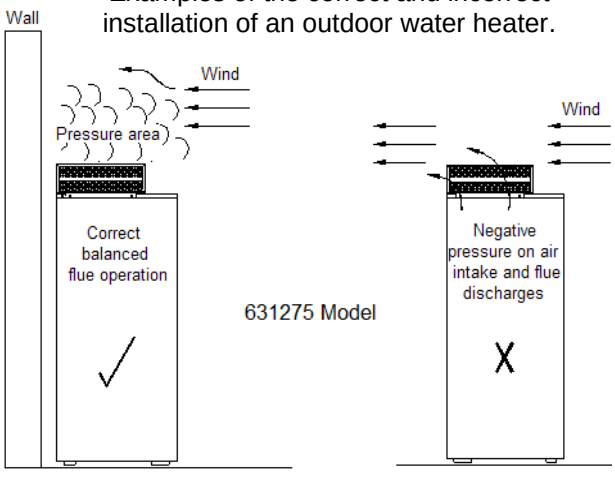
When the water heater is installed against an external wall, the pressure zone created by any wind will produce the required pressure imbalance for the flue terminal to operate correctly.

If the water heater is not installed against a wall, the pressures at the air inlet and flue outlet become unpredictable, resulting in the combustion system not operating correctly.

Specifically, there may be flame roll out from the combustion chamber, flame lift off from the burner, sooting of the primary flue and flue terminal and/or flame failure problems.



Examples of the correct and incorrect installation of an outdoor water heater.



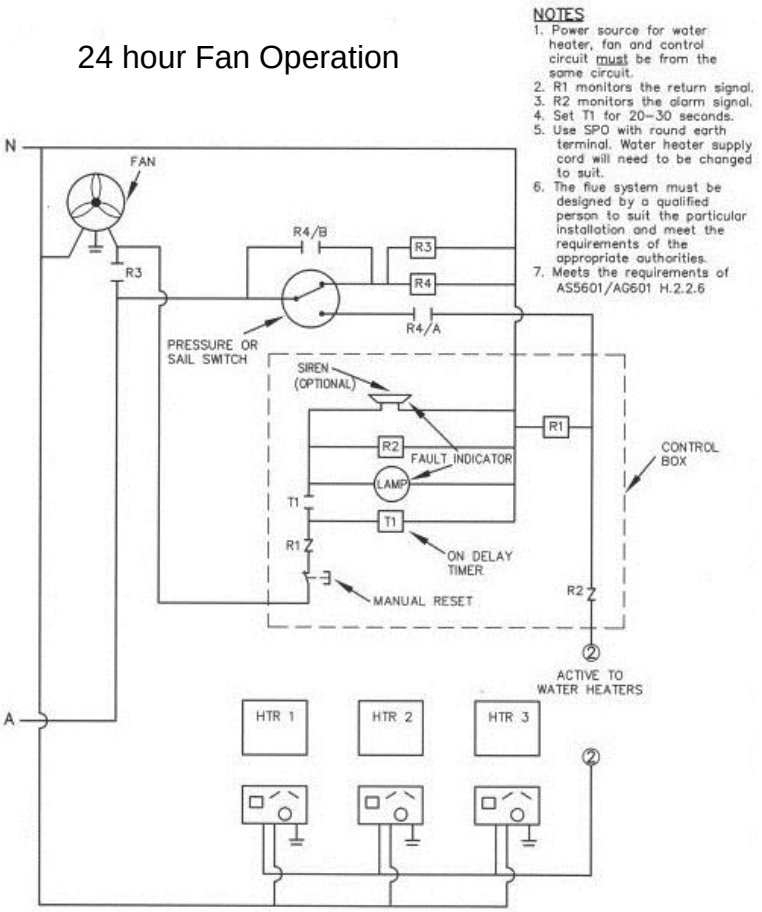
Power Flueing / Mechanical Ventilation

Where a fan is used to assist with the flueing (power flueing) or to provide sufficient primary air for combustion (mechanical ventilation) the fan must be electrically interlocked with the water heater(s) to prevent ignition in the event the fan fails.

This is generally done by the use of a contactor (relay) and a sail or pressure switch mounted in the flue to detect airflow.

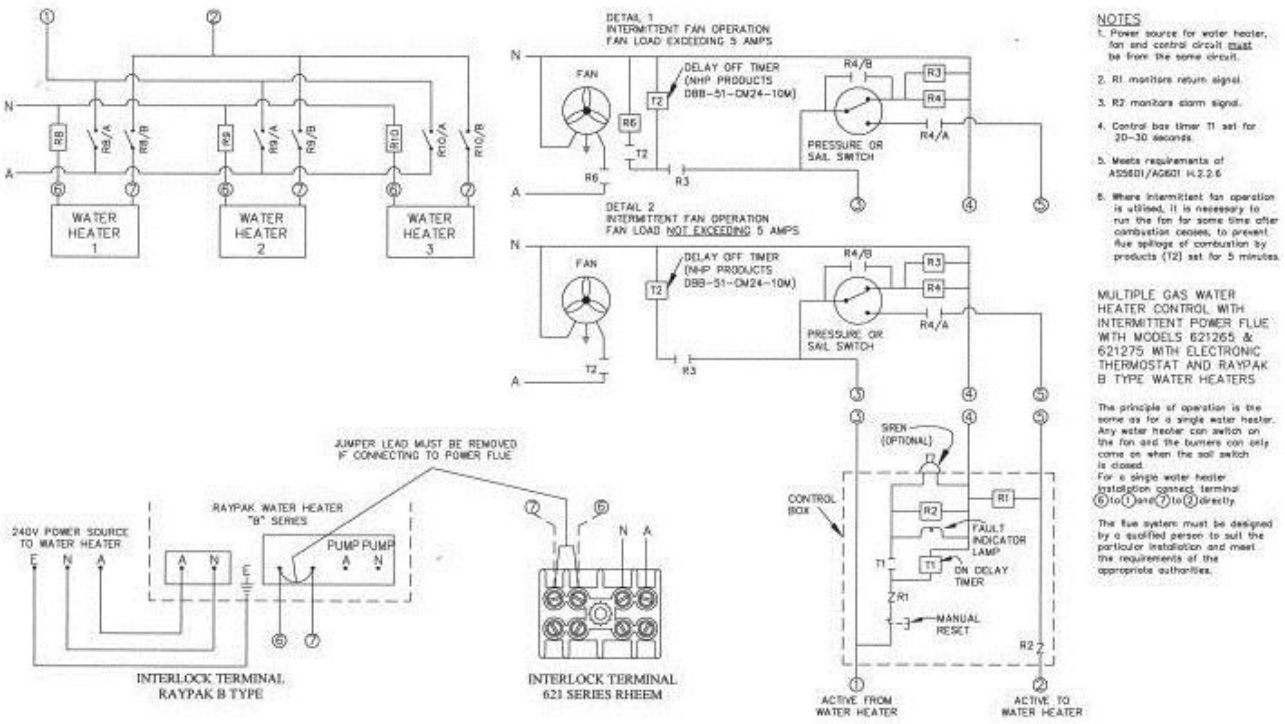
The diagrams opposite and below detail one method for interlocking a power flue system to the water heater(s), mechanical ventilation systems would also be wired in a similar manner.

24 hour Fan Operation



Where multiple water heaters are installed each **individual** water heater must be interlocked with the fan system. The diagrams below detail a common method of interlocking multiple water heaters to a power flue system

Intermittent Fan Operation



BMS MODULE

A BMS Module (part number 299239) can be fitted to HSI Heavy Duty Gas Water Heater models fitted with an electronic thermostat and is utilised to provide heater run/fail status indication to the customer's BMS system.

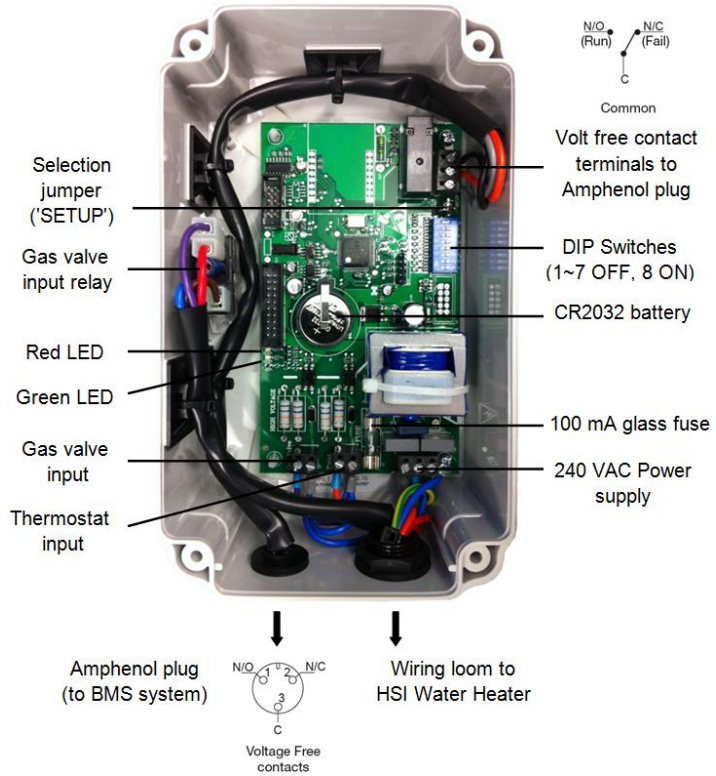
The BMS Module PCB has a green LED, a red LED and an integral change over relay with volt free contacts that are utilised to indicate the status of the water heater as follows:

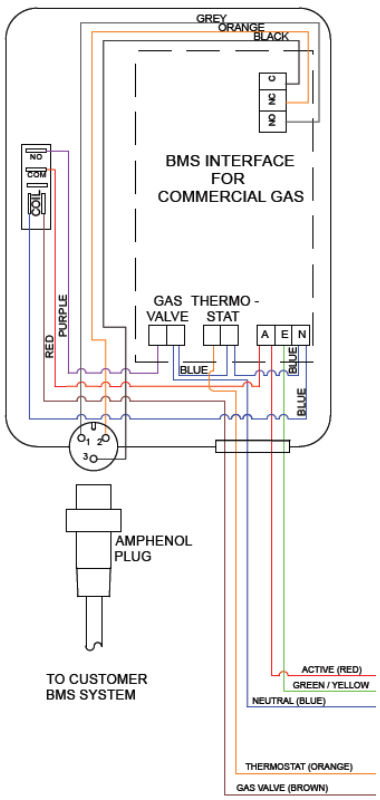
LED Status	Heater Status	Relay Status	Amphenol Plug Status
Green LED on Solid	Burner operating, set temp achieved or trialling for ignition	Energised	Pins 3 & 1 closed Pins 3 & 2 opened
Red LED on Solid	Heater has locked out due to 3 or 4 failed ignition attempts (depending on module fitted)	De-energised	Pins 3 & 1 opened Pins 3 & 2 closed

Operation: If the BMS Module does not receive a gas valve input from the heater within 20 minutes after the heater thermostat signal was detected, the BMS volt free contacts will switch over and the red LED will illuminate to indicate a fault condition. The 20 minute period allows for up to 3 ignition retries (a total of 4 ignition attempts) with a 5 minute wait period between each attempt. Also refer to BMS Module Operational Flow Chart on page 21.

The BMS module has the following additional components:

- Integral 100 mA glass fuse.
- DIP switches and selection jumper. DIP switches and selection jumper are for RS232 and RS485 Eprom programming which is not currently used for HSI Heavy Duty Gas Water Heaters i.e. DIP switch and selection jumper positioning does not affect BMS Module change over relay operation.
- CR2032 3V lithium battery. Utilised for back up of internal time clock for RS232 and RS485 connection which is not currently used for HSI Heavy Duty Gas Water Heaters i.e. battery is not required for operation with HSI Heavy Duty Gas Water Heaters.





Common Faults

When a complaint is lodged about the performance of a hot water system there are a number of causes that should be checked and eliminated. In an attempt to pinpoint the most likely cause it is important to discuss with the customer their reasons for the complaint, the duration of the problem, any change in circumstances or usage and recent weather conditions. This information in conjunction with the following listed common complaints will assist in locating the most likely cause. All procedures assume there is water flowing through the water heater.

Water hammer

A water heater will not cause water hammer, however valves associated with the water heater may be the source of the problem i.e. cold-water stopcock, non-return valve, T&PR valve or relief valve.

Most water hammer problems are associated with plumbing, hot and cold, or appliances i.e. solenoid valves, ball cocks, loose pipes, sharp angles in pipe work, faulty or worn valve parts or neighbouring equipment.

High water pressure areas will have more complaints of this nature and the use of a pressure-limiting valve (PLV) to reduce the household cold-water pressure will usually solve most problems.

Excessive hot water usage

The complaints of insufficient hot water and no hot water can on many occasions be attributed to hot water usage exceeding the capacity of the water heater to provide hot water.

When first attending a call of this nature it is essential to establish the probable hot water usage by querying the usage habits of the household and compare this with the potential delivery of the model water heater installed. It can then be established if the usage is within or outside the capacity of the model. The areas to look at for excessive usage are:

1. Automatic washing machines.
2. Showers exceeding 11 litres per minute for mixed water and 5 minutes in duration.
3. Two or more showers operating at the same time.
4. Change of occupancy or number of persons increased.
5. High water pressure area (excessive T&PR discharge).
6. Plumbing leaks.

Discoloured water

1. This may be the result of discoloured water entering from the cold water mains. Check if the cold water is also discoloured.
2. Brown coloured water will generally indicate that the anode has been depleted or the water heater is near the end of its useful life.
3. Milky coloured water is generally air in suspension and will disperse of its own accord. In very hard water areas where anode gassing occurs, milky water may be evident. The use of a blue anode should overcome this problem.

Hot water plumbing leaks

If hot water has not been used for a period of time, feeling the temperature of the hot water line may give an indication of water flow if the pipe is warm. The method of checking for plumbing leaks is as follows:

1. Turn off the stopcock on the cold water supply to the water heater.
2. Open a hot tap to ensure the flow of water stops. This will confirm the stopcock is operating correctly.
3. Turn off the hot tap.
4. Turn on the stopcock to make up the water pressure in the cylinder, and then turn the stopcock off again.
5. Wait approximately 5 minutes then do either of the following:
    a. With your ear close to the stopcock turn it on slightly and listen for any water passing. If there are no leaks, water should not pass.
    b. Open a hot tap while listening for any pressure release. If there is a pressure release there will be no leaks in the plumbing system.

Mixing or crossed connections

If an automatic dishwasher, washing machine, flick mixer tap, tempering valve or thermostatic mixing valve is installed there is always the possibility that the cold water could mix with the hot water through a faulty or incorrectly installed valve.

This is referred to as a cross connection. The complaints of insufficient hot water, water too cold or excessive discharge from the T&PR valve may be attributed to a cross connection. The method of checking for a cross connection is as follows:

1. Turn off the stopcock on the cold water supply to the water heater.
2. Open a hot tap. If water flow is persistent and cold a cross connection exists.

Incorrect Manifolding - Headers

Very often complaints surrounding insufficient hot water in commercial installations can be attributed to poor manifolding.

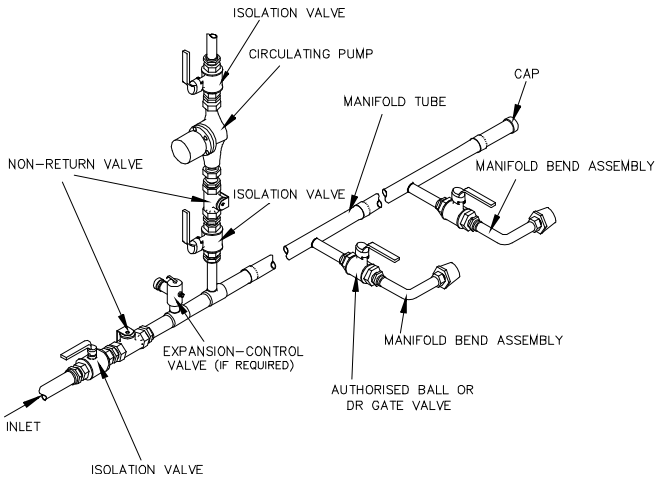
In order for the water heaters to operate simultaneously the water flow through all the cylinders must be the same to ensure the temperature drop is equal.

In a worst-case scenario of poor manifolding it is possible for 2 or 3 of the water heaters in a bank to almost never operate.

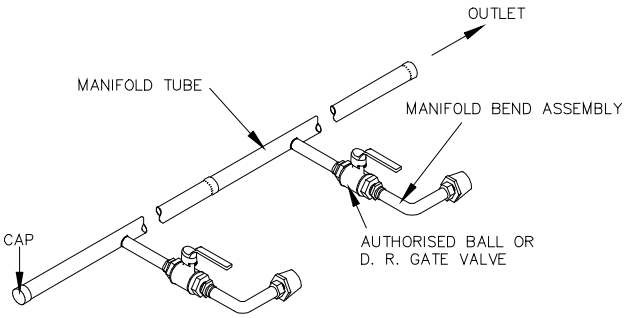
This results in an overall loss of heat input to the water moving through the building and can be confused as the installation being undersized or a malfunction of the water heaters.

The principle of Equa-Flow is to ensure the demand on each water heater in the bank is the same as any other. To achieve this, the following is necessary:

1. The **cold** water manifold must be designed to balance the flow to each unit i.e. each branch line must be the same diameter and length and be fitted with identical ball or gate valves



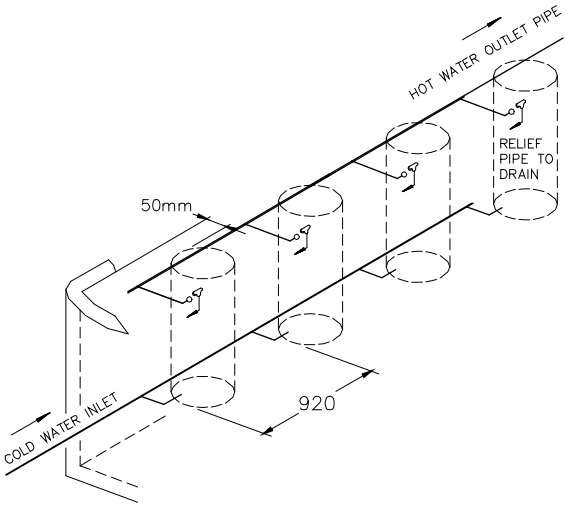
2. The **hot** water manifold must be designed to balance the flow from each unit i.e. each branch line must be the same diameter and length and be fitted with identical ball or gate valves.



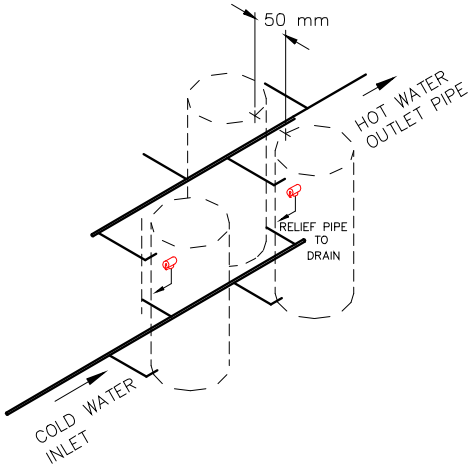
Manifolding - Types

1. All water heaters must be of the same size and capacity.
2. The first heater supplied from the cold (inlet) manifold must be the last heater supplying the hot (outlet) manifold (refer to examples opposite and below).

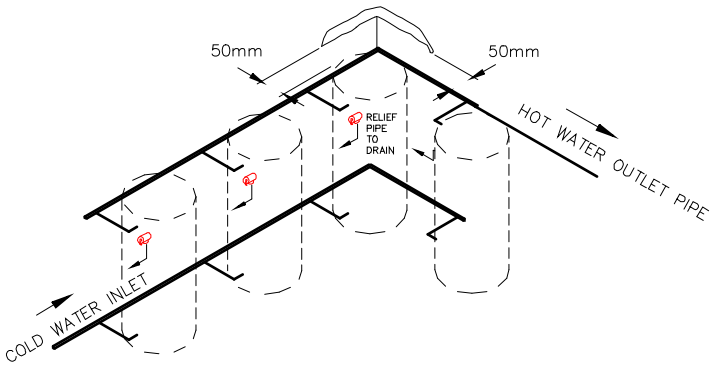
In Line Manifold



Back to Back Manifold

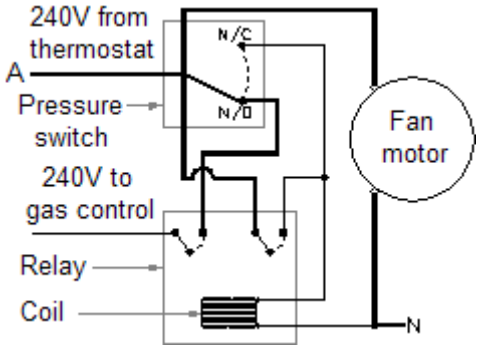


Angle Manifold



Fan 'Run On' – 631275 Models Manufactured Before 01/04/05

In the event of a very short interruption of power, known as a 'brown out' and usually lasting less than a second or so, the gas valve, ignition module and relay all open which results in the burner extinguishing, however the fan continues to coast, maintaining enough pressure for the pressure switch contacts to remain in the normally open position. When the power is restored the fan continues to run due to the thermostat being closed but power is not supplied to the relay coil resulting in the ignition sequence not restarting. The ignition module does not indicate a fault code in this event.



Eliwell IC902 Thermostat Fault Codes

In the event of a sensor failure, a 2 digit code may be displayed on the thermostat LED to indicate the fault.

Code	Fault	Possible Cause
E1	Temp sensor set open/short circuit	Replace sensor set.

AKO Thermostat Fault Codes

In the event of certain system faults the AKO thermostat display will show a 2 digit fault code. Available fault codes are as follows:

Code	Fault	Possible Cause
AL	Temperature below the minimum set point parameter C3	Ignition module in 'wait' or 'lock out' mode. Gas supply failure. Ancillary equipment failure i.e. power flue
AH	Temperature above the maximum set point parameter C2	Burner not shutting down. Stacking. Thermostat incorrectly programmed. Circulator not fitted for 82º setting.
AH88*	Hot sensor short circuit	Replace sensor set.
EE	Memory error	Replace thermostat.
E1	Temperature sensor set open circuit	Replace temperature sensor set.

* Display alternates between AH and 88.

Fault codes 'AL' and 'AH' are indicative only and the thermostat will operate as normal.

Fault code 'AH88' is indicative only however intermittent heater operation may occur and/or the water temperature may be higher than the thermostat 'set point' (due to incorrect sensor set reading).

Fault codes 'EE' and E1' will cause the thermostat contacts to open resulting in heater shut down.

A fault code will be automatically cleared when the fault is rectified.

Temperature variation

In some cases the actual water temperature may vary from that displayed on the thermostat despite the parameters being correctly programmed. This is most likely to occur in recirculated systems. In order to check the actual tank water temperature, the measurement:

1. **Must** be taken at the T&PR valve drain line.
2. The burner **must** be off for at least 5 minutes before the temperature measurement is taken.
3. Water should not be drawn from the system.

If the temperature deviates from that displayed on the thermostat by more than 2 degrees it will be necessary to custom set the offset parameter. When reprogramming the offset parameter (CA1 or C0 depending on thermostat fitted) it will be necessary to take into account the current 'offset' already programmed into the thermostat.

For example if the current 'set point' is 70 then the offset should currently be set at 16 (as shown on Parameter Table on page 35). If the displayed temperature is 70ºC but the actual measured water temperature is 75ºC then the offset will need to be increased by 5 (the difference between the displayed temperature and the measured temperature). Therefore the offset should be increased from 16 to 21 (16 + 5 = 21), **not set at 5**.

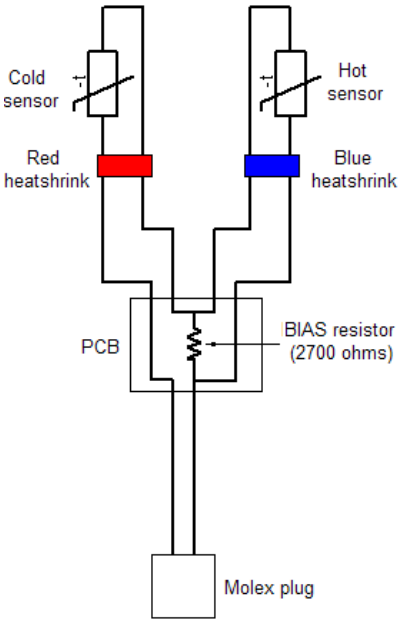
The same principal applies if the thermostat is reading high. If the displayed temperature is 70ºC but the actual measured water temperature is 65ºC then the offset will need to be decreased by 5 (the difference between the displayed temperature and the measured temperature). Therefore the offset should be decreased from 16 to 11 (16 – 5 = 11), **not set at 5**.

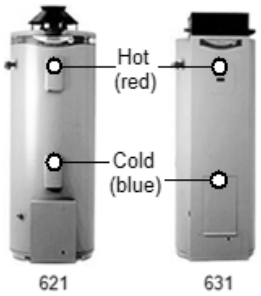
NOTE: If the displayed water temperature is 10º or more BELOW the measured water temperature and the thermostat offset is programmed correctly for the set point, conduct a sensor resistance test (refer to page 49). If the sensor set is faulty do NOT attempt to overcome the difference by adjusting the thermostat offset, replace the sensor set.

Testing the Temperature Sensor Set

The temperature sensor set consists of 2 NTC (negative temperature coefficient) thermistors, which form the hot and cold sensors.

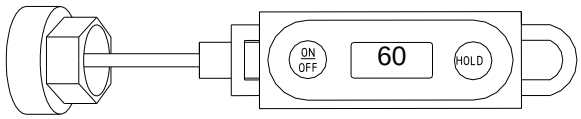
In order to achieve the average water temperature in the cylinder the cold sensor has an additional resistor connected in parallel to it (refer to the circuit diagram opposite), this resistor is mounted on a small circuit board insulated into the sensor wiring loom.

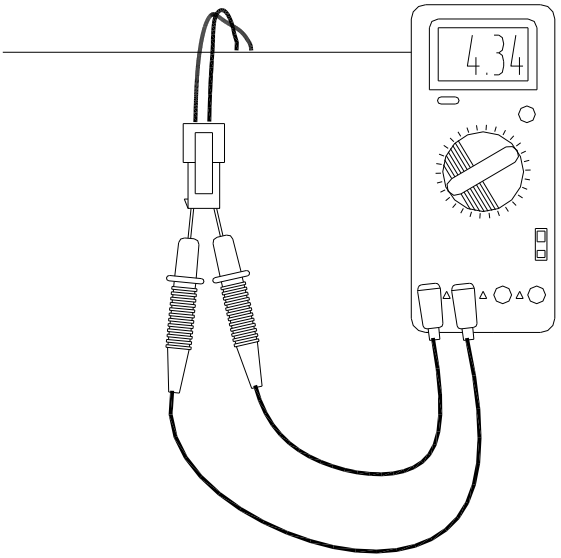




It is critical that the cold sensor (designated by BLUE heat shrink on the wiring) is always installed in the lower sensor pocket and the hot sensor (designated by RED heat shrink on the wiring) is always mounted in the top sensor pocket. Failure to do so will cause the heater to malfunction.

Sensor Set Test Procedure





Remove the hot and cold sensors from the sensor pockets and using a thermometer measure and note the temperature inside each pocket.

Using the Sensor Set Resistance Table & Formula on page 49 calculate the resistance.

Reinsert the hot and cold sensors into the pockets, wait 2 minutes then unplug the sensor set from the thermostat and using a multimeter set on x1000 resistance scale measure the resistance of the sensor set.

The measured value should be within 5% of the calculated value.

Sensor Resistance Table & Formula

In order to calculate the overall resistance of the sensor set it will be necessary to measure the temperature in the hot and cold sensor probes using a thermometer and then using the table opposite (applies to both sensors) and the formula on the following page, calculate the resistance.

ºC	Ohms	ºC	Ohms	ºC	Ohms
0	27280	35	6941	70	2229
5	22050	40	5828	75	1924
10	17960	45	4912	80	1669
15	14680	50	4161	85	1451
20	12090	55	3537	90	1266
25	10000	60	3021	95	1108
30	8313	65	2589	100	973

$$\text{Sensor set resistance} = \left(\frac{R1 \times R3}{R1 + R3}\right) + R2$$

Where:
R1 = cold sensor resistance, R2 = hot sensor resistance & R3 = Bias resistor (2700 ohms)

Example:

The measured temperature of the cold sensor pocket is 60º and the hot sensor pocket is 70º. From the table above the resistances for each sensor are 3021 ohms and 2229 ohms respectively, therefore

$$\text{Sensor set resistance} = \left(\frac{3021 \times 2700}{3021 + 2700}\right) + 2229$$

$$\text{Sensor set resistance} = \left(\frac{8156700}{5721}\right) + 2229$$

Sensor set resistance = 1425.75 + 2229 = **3654.75 ohms**

Sensor Fault Conditions – Models with Electronic Thermostat

Symptom	Possible Cause	Remedy
Thermostat displays E1	Hot sensor open circuit	Replace temperature sensor set
Thermostat alternates between AH & 88	Hot sensor short circuited	
Thermostat reads low	Cold sensor open circuit	
Thermostat reads high	Cold sensor short circuited	

Ignition Control Module Fault-Finding

The ignition control module continuously performs a self-check routine. Any time a fault is detected, internally or externally, the module will shut down heater operation and enter either a 'lockout' or 'wait' mode depending on the fault detected.

Pactrol: The Pactrol P25 ignition module does not include a specific fault code display to assist with identification of fault conditions. In order to determine current fault condition follow the 'General Fault Finding Flow Chart' shown on page 52.

White Rodgers: The White Rodgers ignition control module includes a LED that will emit a series of flashes or remain on solid to indicate the fault. The LED will flash on for ¼ second and off for ¼ second with a 2 second delay occurring between each group of flashes. Note: The LED will stay on continuously for approximately 1 second when first energised.

With the exception of ignition retry lockout (1 flash) the ignition control module will automatically reset if the fault clears or is rectified (repaired). Ignition retry 'lockout' requires a manual reset to be performed.

White Rodgers Ignition Control Module Fault Codes			
Flashes	Fault	Possible Cause	Action
1	Ignition retry lockout	Gas failure. Low gas pressure. Faulty gas valve.	Rectify fault and manually reset ignition module
2*	Pressure switch contacts not open when proving	Faulty pressure switch.	Auto reset when fault is rectified
3*	Pressure switch contacts not closed	Faulty fan. Faulty pressure switch.	
4	Faulty igniter / igniter sensing circuit	Faulty igniter. Poor connection in multi-pin plug Power spike	
5	Flame detected with gas valve de-energised	Faulty ignition control module. Faulty gas valve.	
6	Reversed polarity	Active and Neutral reversed.	
7	Flame sensing failure	AC leakage > than 6.5µA. High resistance to earth. Moisture. Low gas pressure.	

* These fault codes are only available on ignition control module 50A72-178 utilised in 631275 models manufactured between 01/04/05 and 09/15.

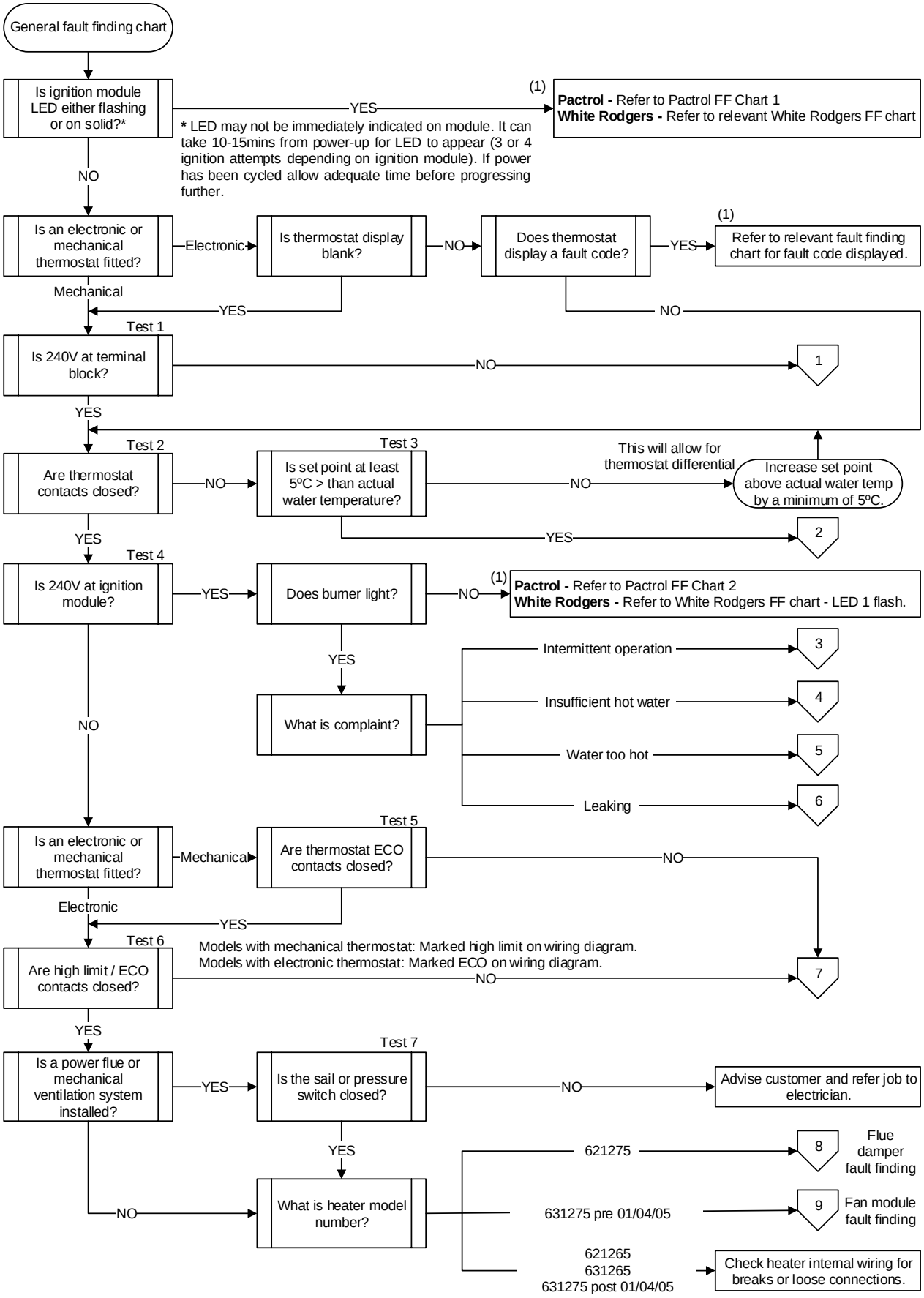
Flashes	Fault	Action
On solid	Ignition module failure or event counter limit exceeded	Reset module, if the LED remains on solid replace module

- If the module resets the event counter has been exceeded indicating there is a fault with the heater or the installation i.e. low gas pressure.

Flashes	Fault	Cause
Rapid flash	Frequency check failure (Hertz)	Poor supply frequency

- Check for large contactors, relays or electronic speed controllers in the plant room.

General Fault Finding Chart



(1) For fault finding chart index refer to page 53.

Fault Finding Chart Index

The following table lists all available fault finding charts and their relevant page numbers.

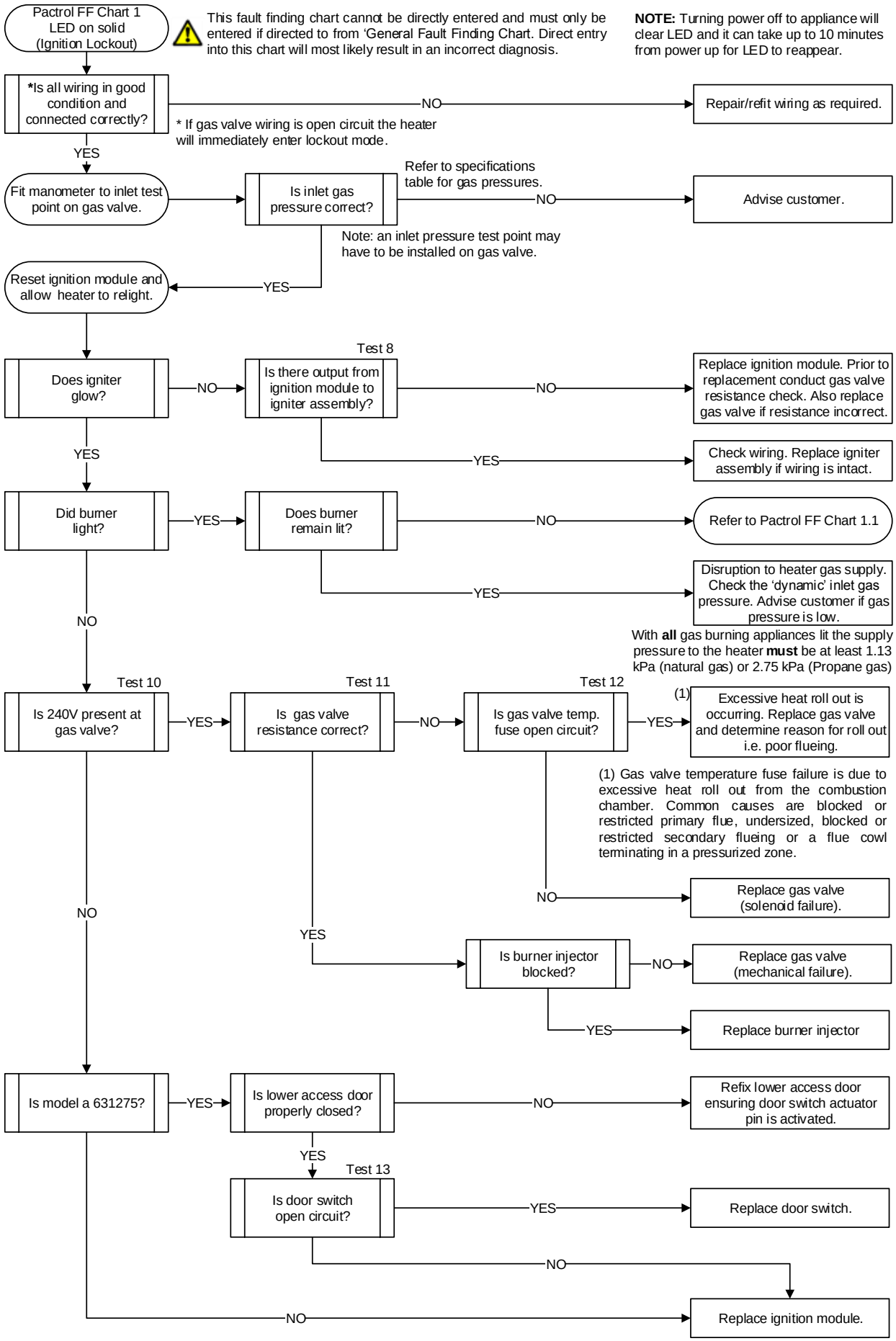
All fault finding charts in grey area of table cannot be directly entered and must only be entered if directed to from the 'General Fault Finding Chart' located on page 52. Direct entry into these fault finding charts will most likely result in an incorrect diagnosis.

All fault finding charts not highlighted grey may be directly entered.

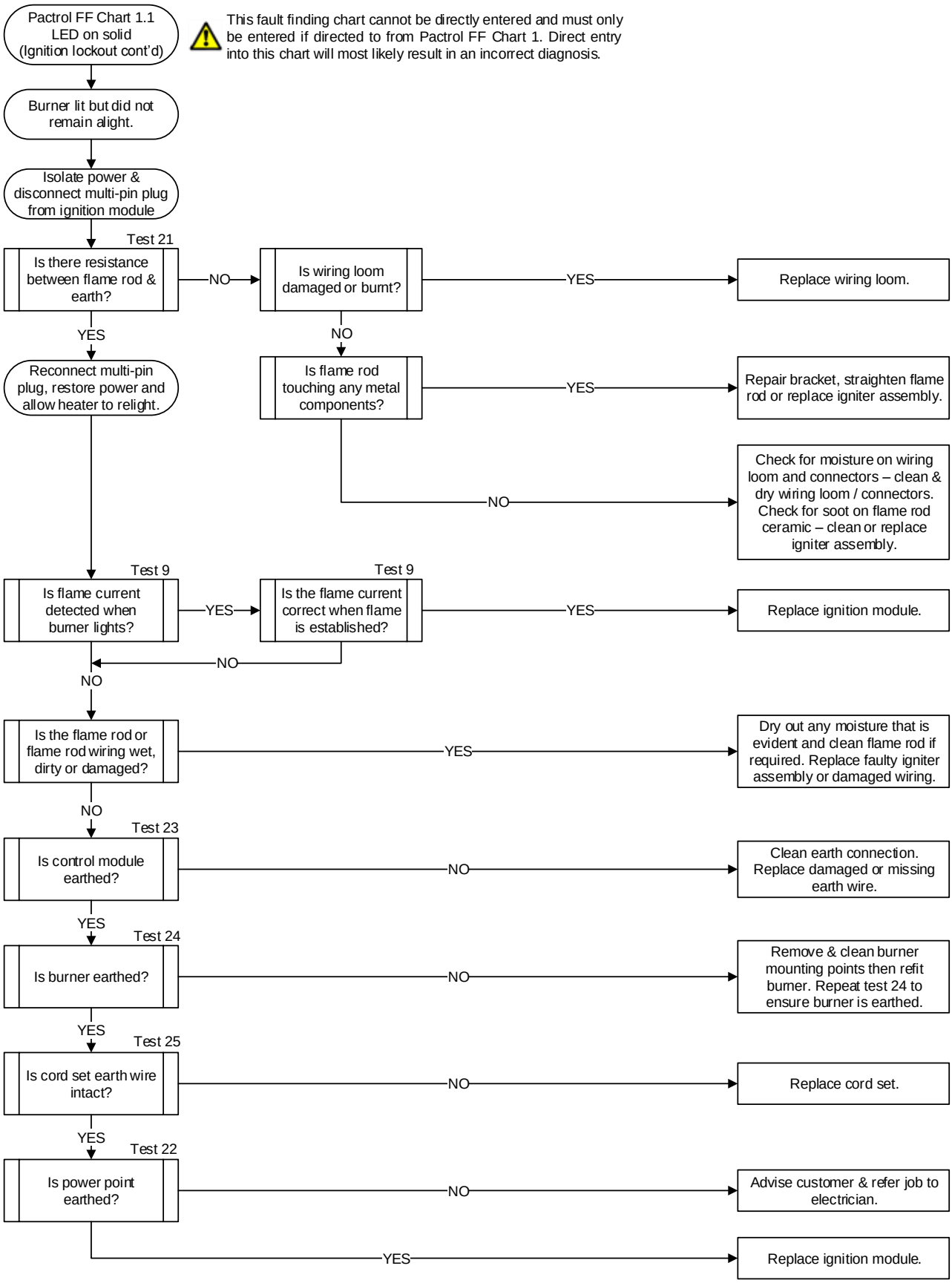
(1) If complaint is for 621275 model flue damper not closing after a call for heat has been satisfied (burner off) proceed directly to fault finding chart 10.

(2) For BMS Module fault finding proceed directly to fault finding chart 11.

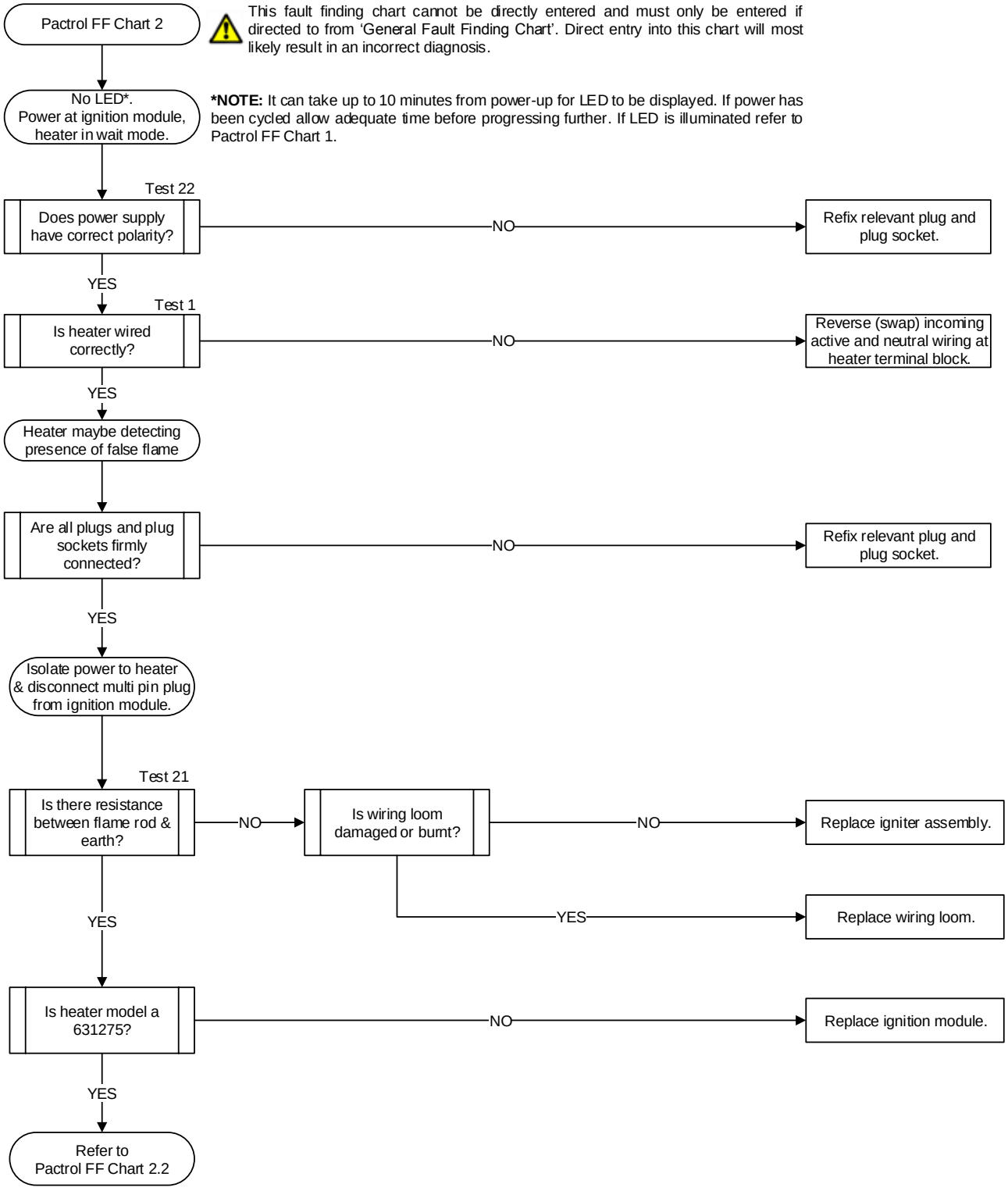
Fault Finding Chart – Pactrol FF Chart 1



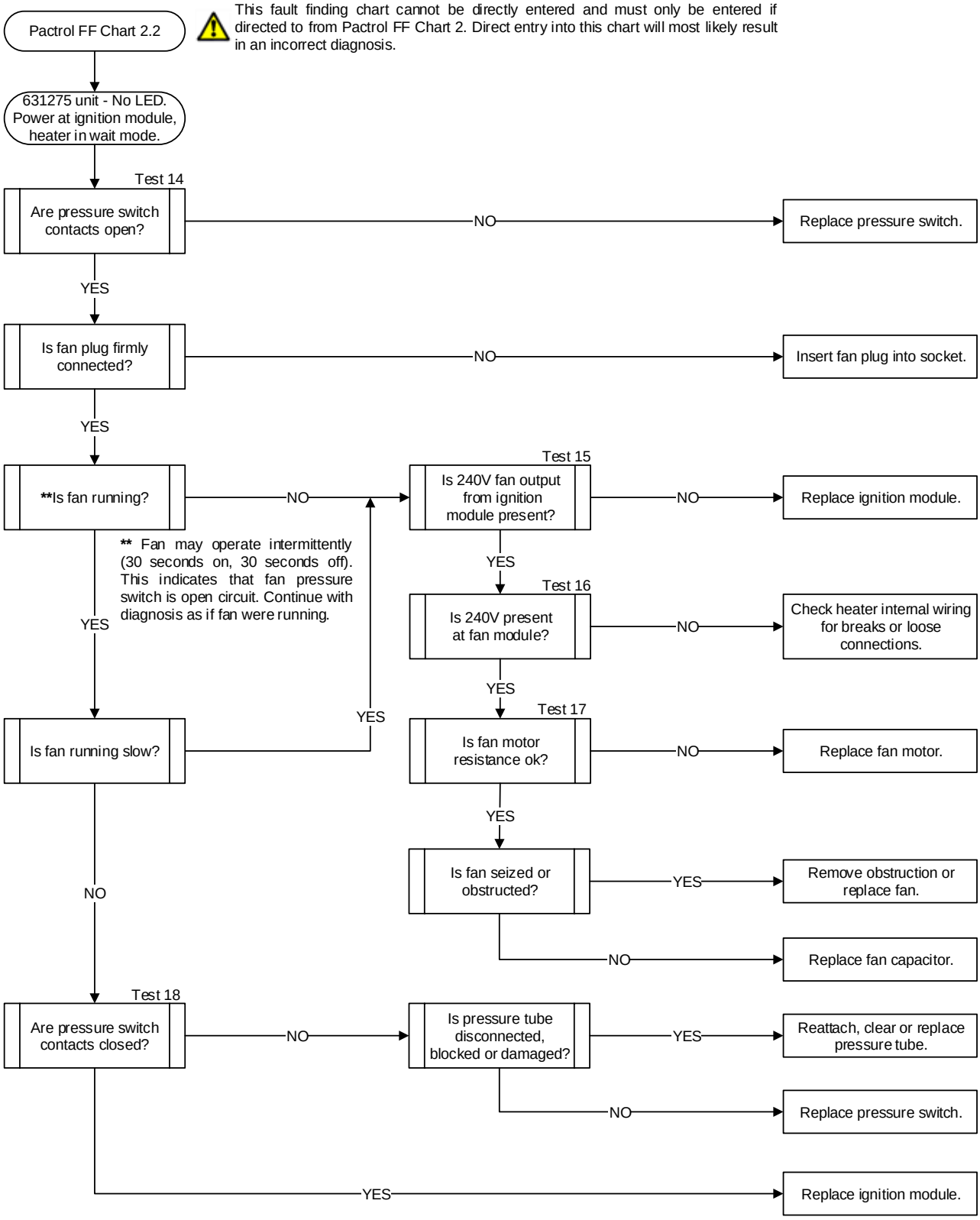
Fault Finding Chart – Pactrol FF Chart 1.1



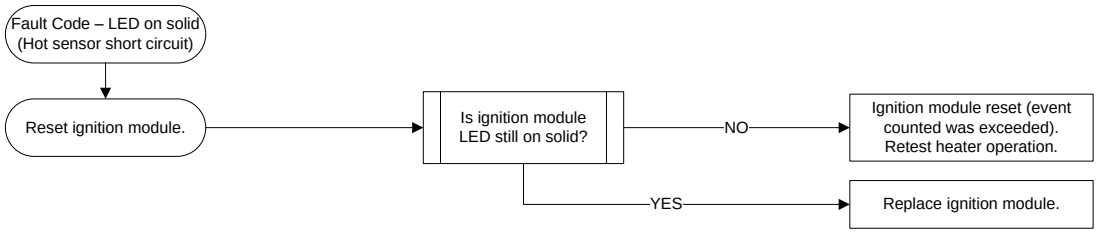
Fault Finding Chart – Pactrol FF Chart 2



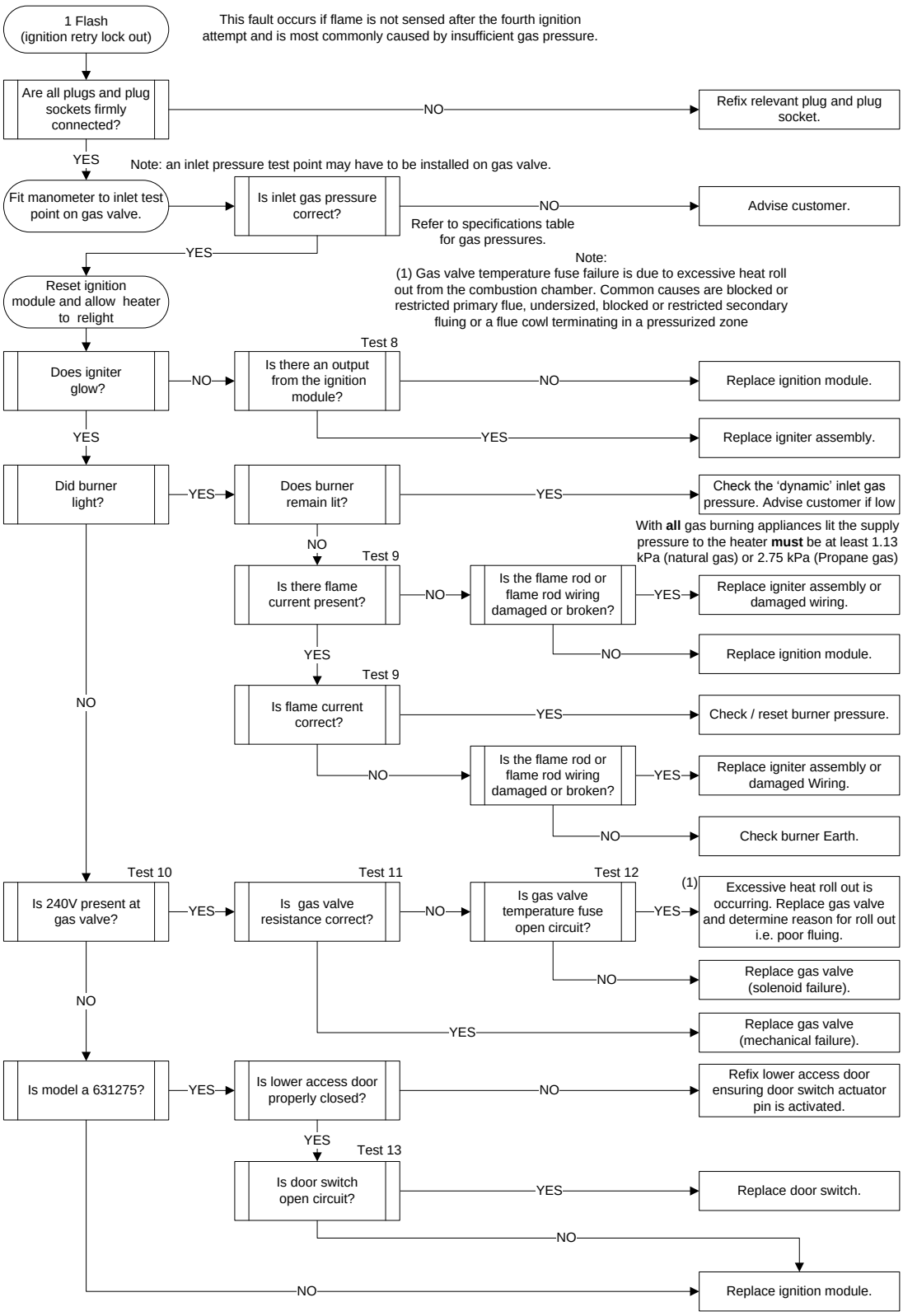
Fault Finding Chart – Pactrol FF Chart 2.2



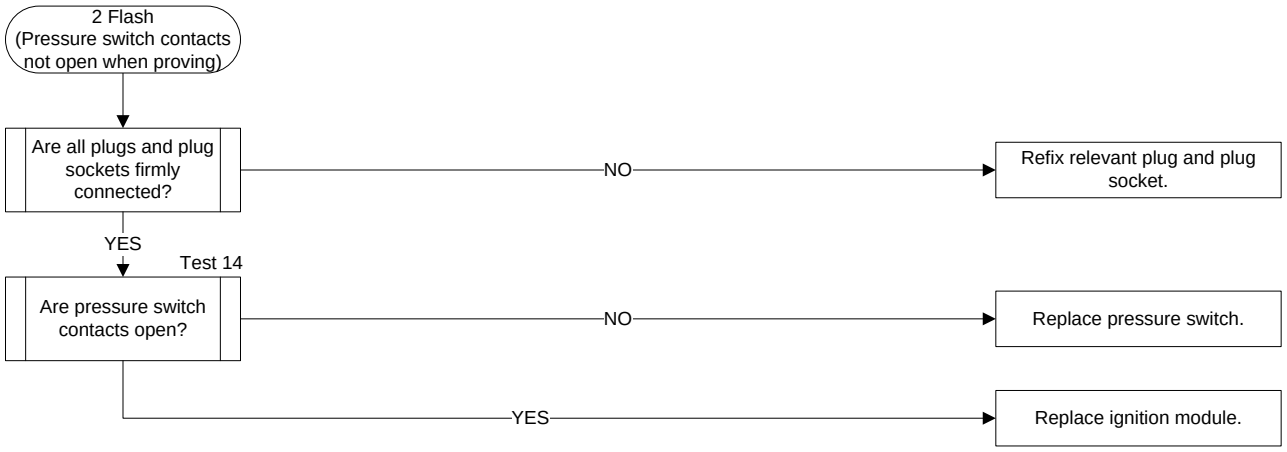
Fault Finding Chart – LED on Solid (White Rodgers Module)



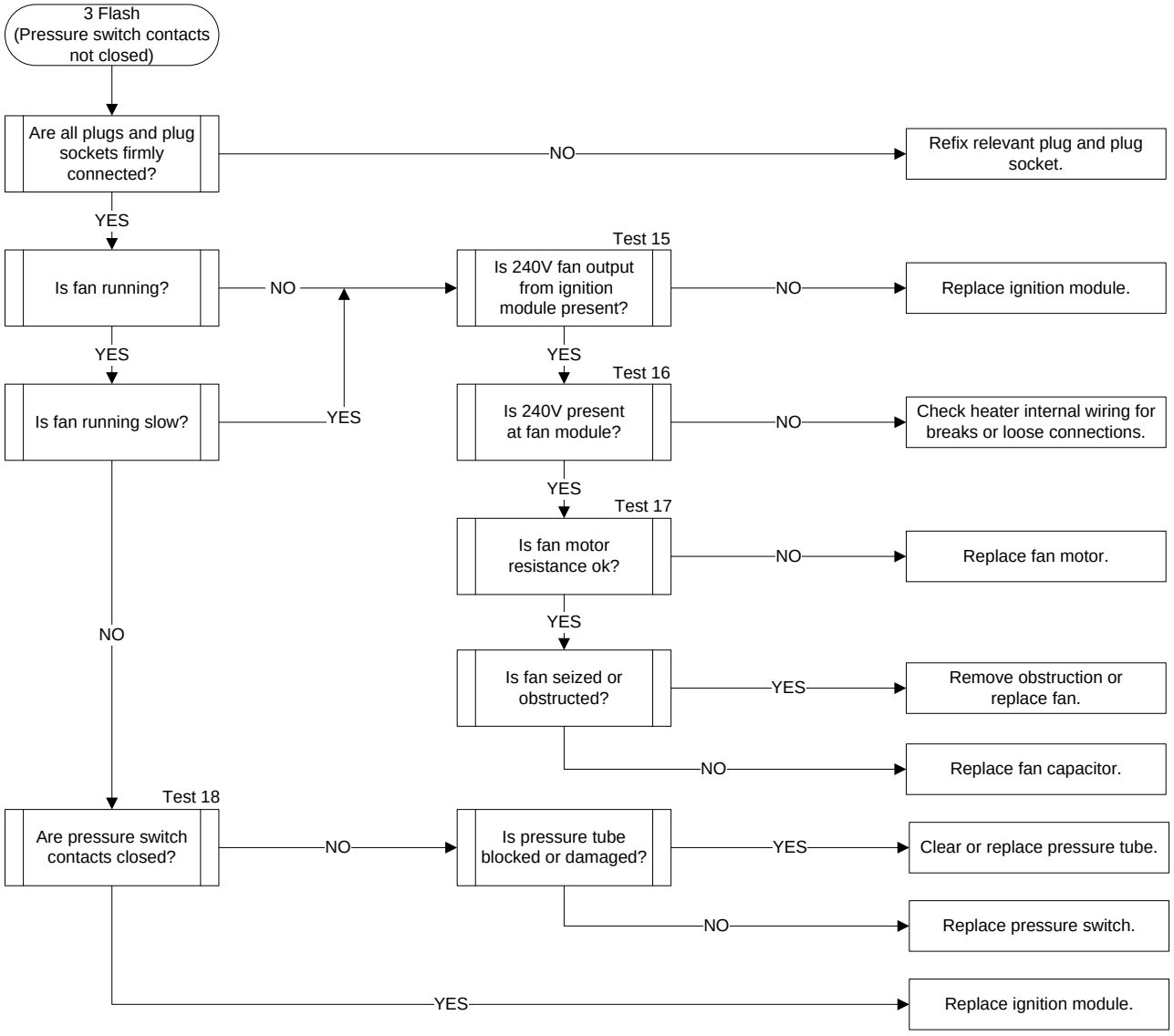
Fault Finding Chart – 1 Flash (White Rodgers Module)



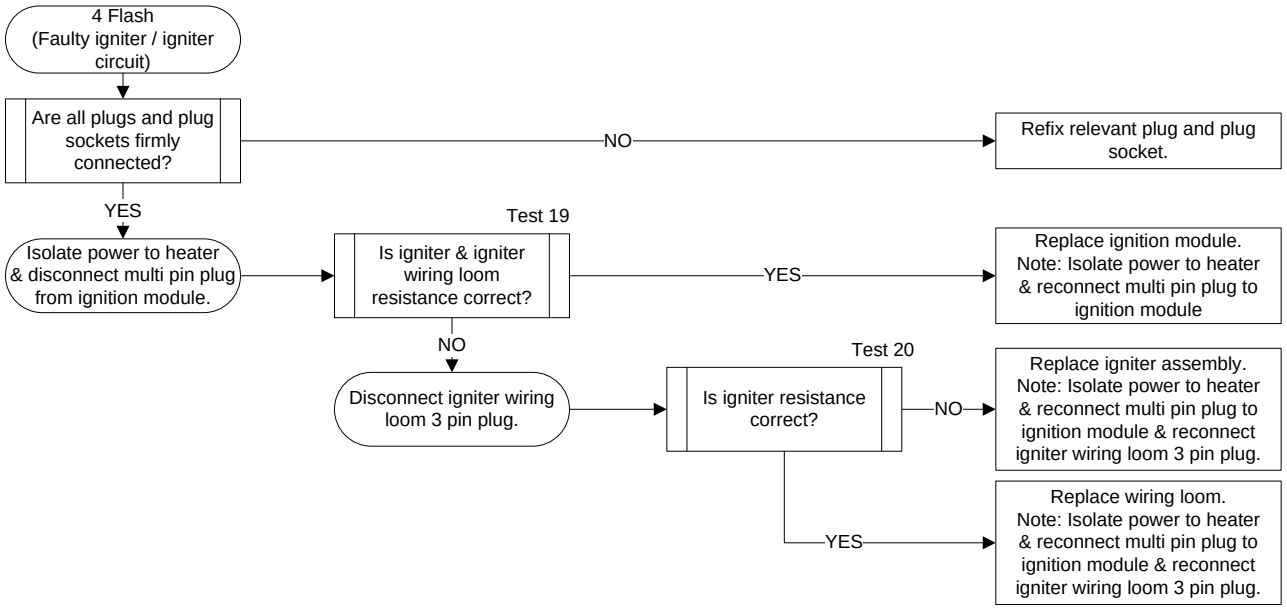
Fault Finding Chart – 2 Flash (White Rodgers Module)



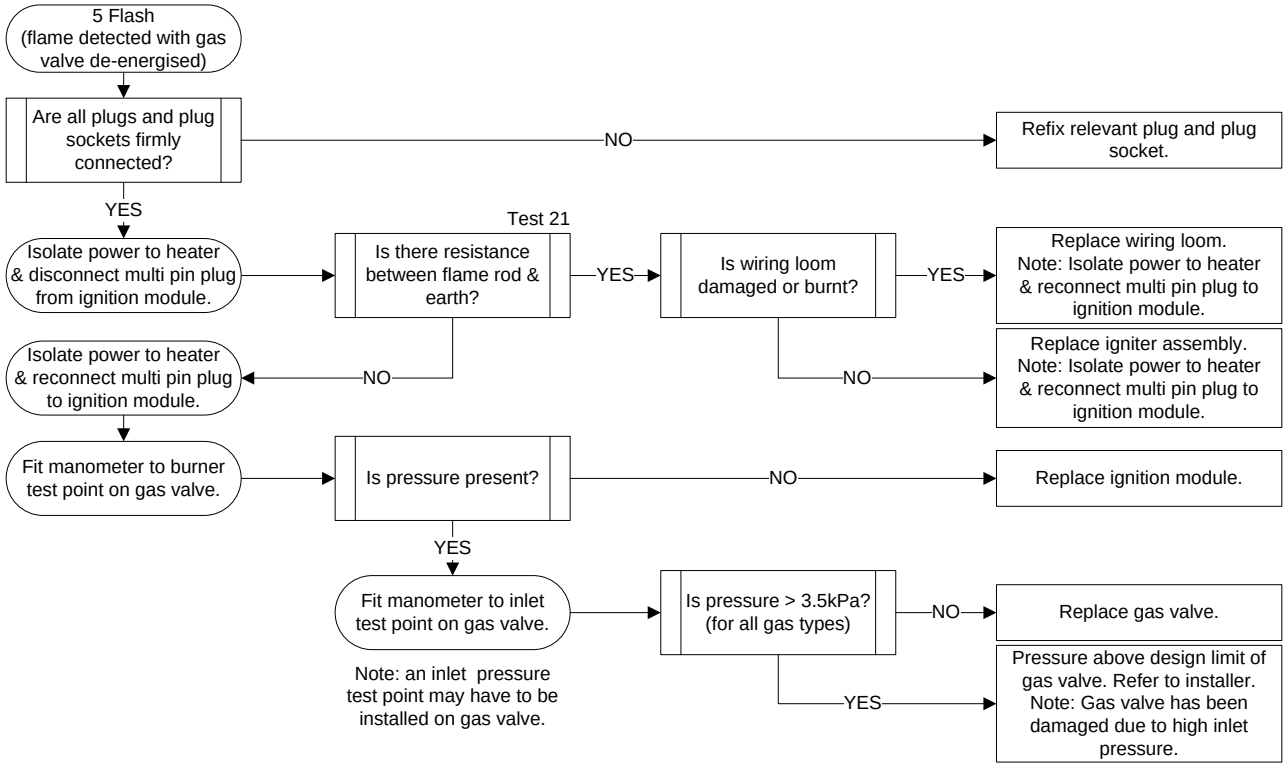
Fault Finding Chart – 3 Flash (White Rodgers Module)



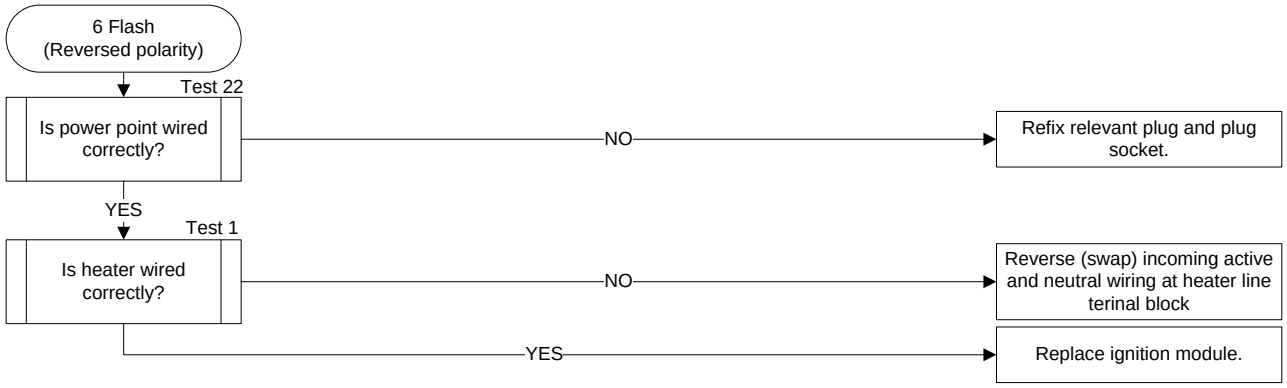
Fault Finding Chart – 4 Flash (White Rodgers Module)



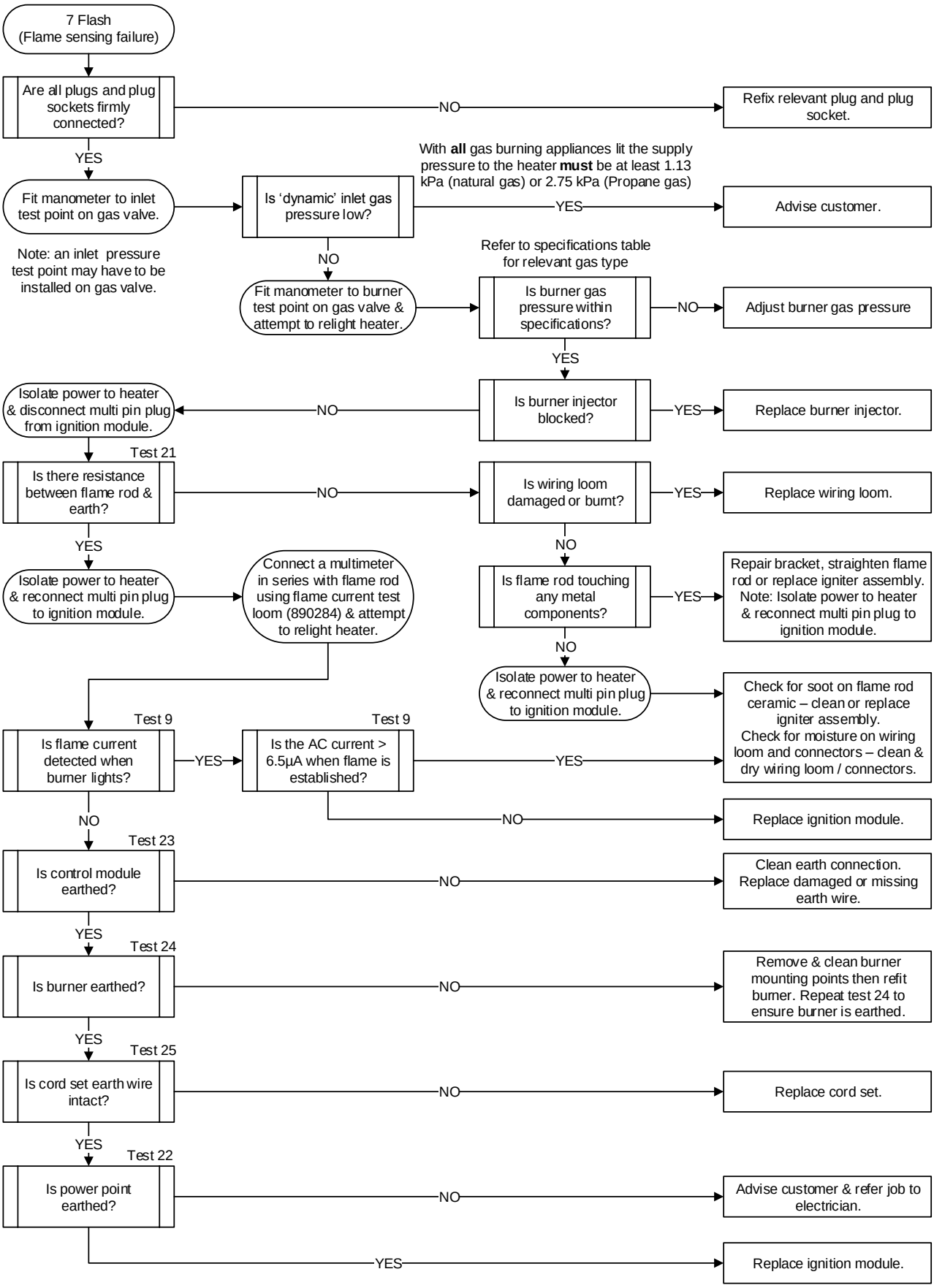
Fault Finding Chart – 5 Flash (White Rodgers Module)



Fault Finding Chart – 6 Flash (White Rodgers Module)

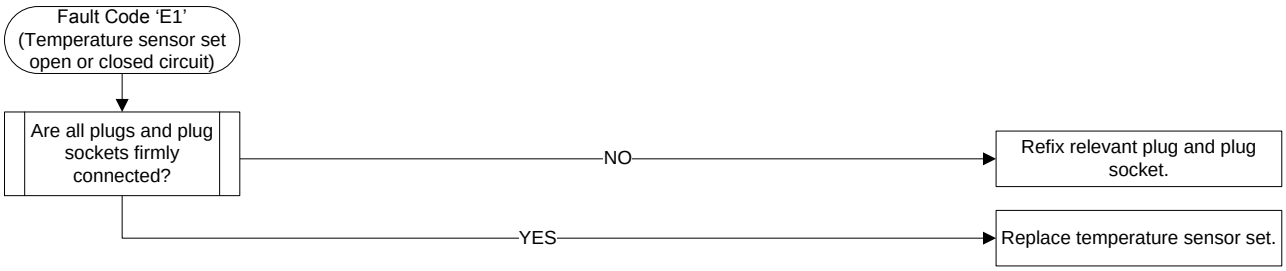


Fault Finding Chart – 7 Flash (White Rodgers Module)

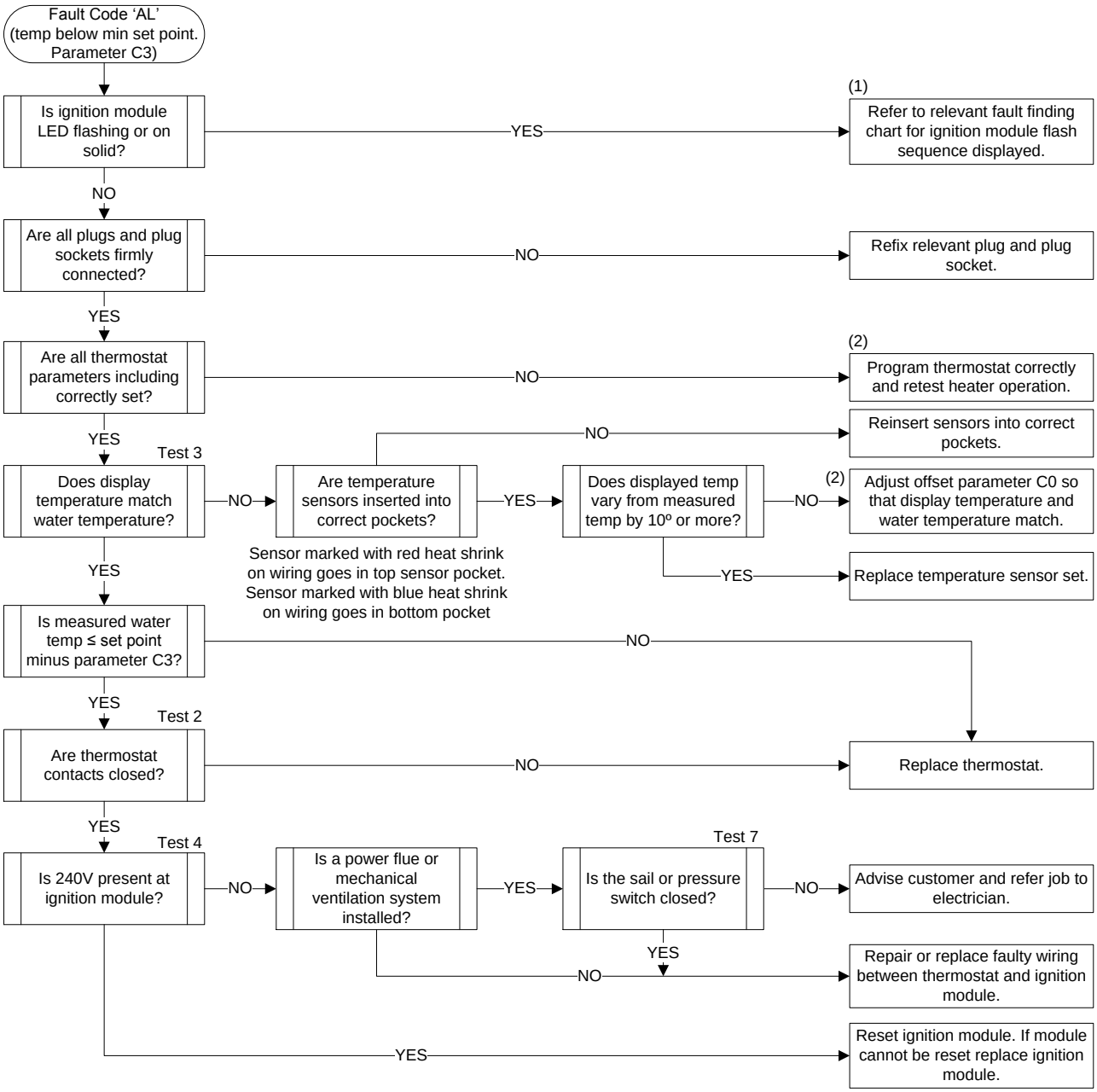


Fault Finding Chart – Rapid Flash (White Rodgers Module)

Fault Finding Chart – Eliwell IC902 Thermostat Fault Code 'E1'



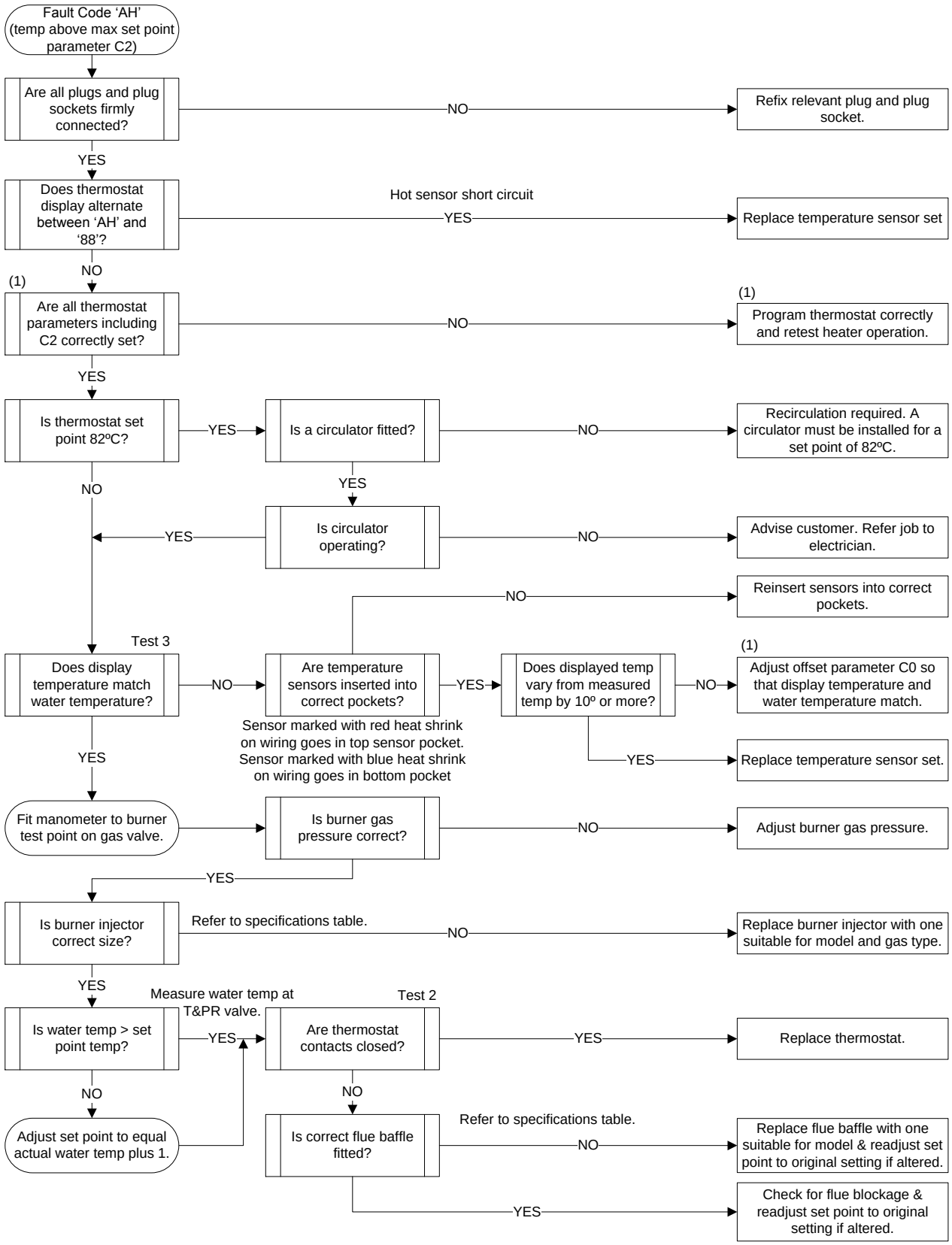
Fault Finding Chart – AKO Thermostat Fault Code 'AL'



(1) For fault finding chart index refer to page 53.

Fault Finding Chart – AKO Thermostat Fault Code ‘AH88’

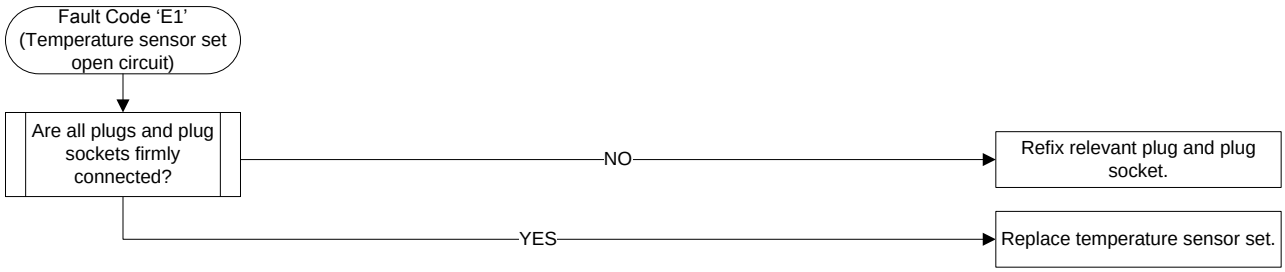
Fault Finding Chart – AKO Thermostat Fault Code ‘AH’



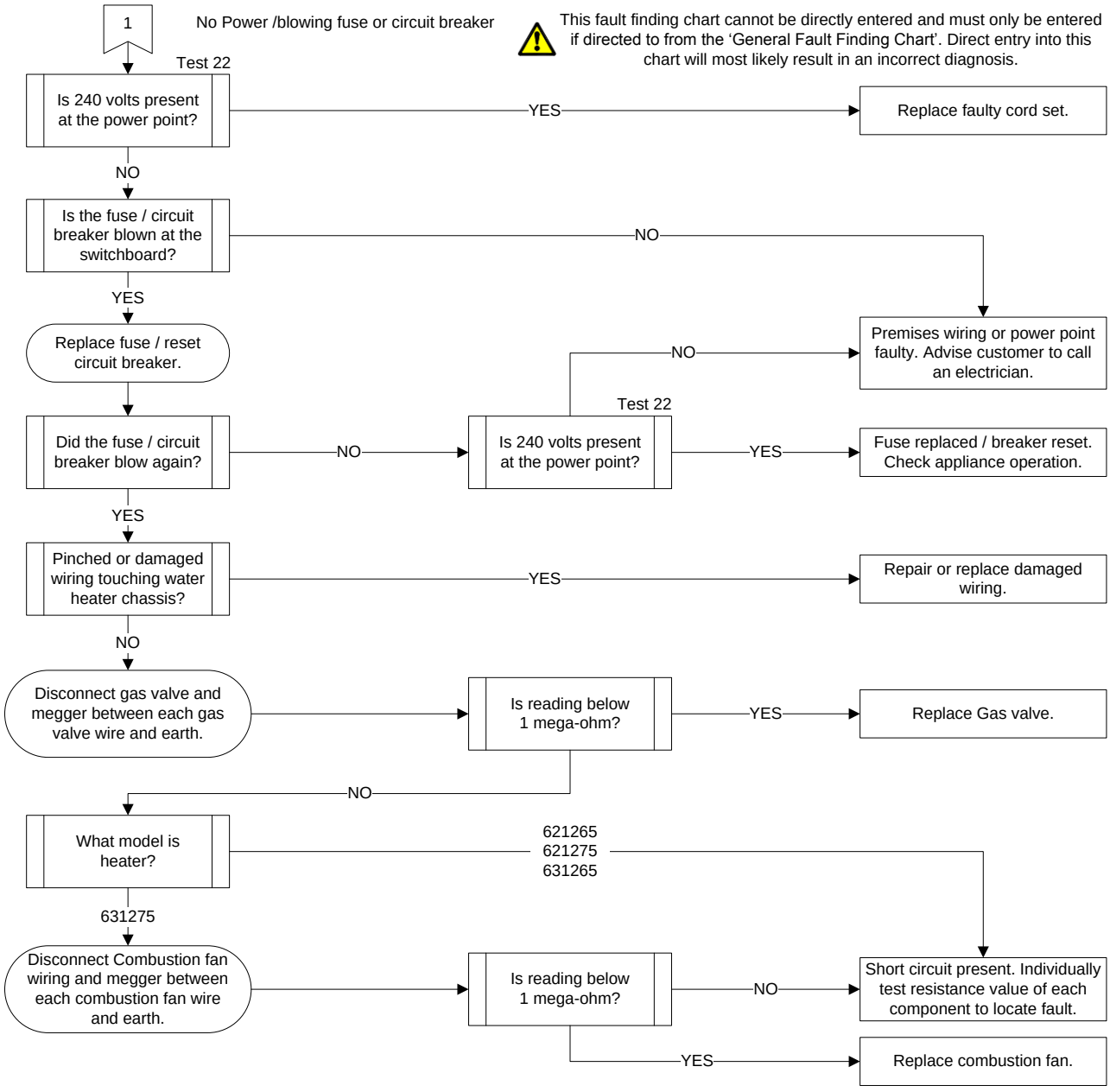
(1) For thermostat programming procedure refer to ‘AKO Controlling Thermostat’ on page 34.

Fault Finding Chart – AKO Thermostat Fault Code ‘EE’

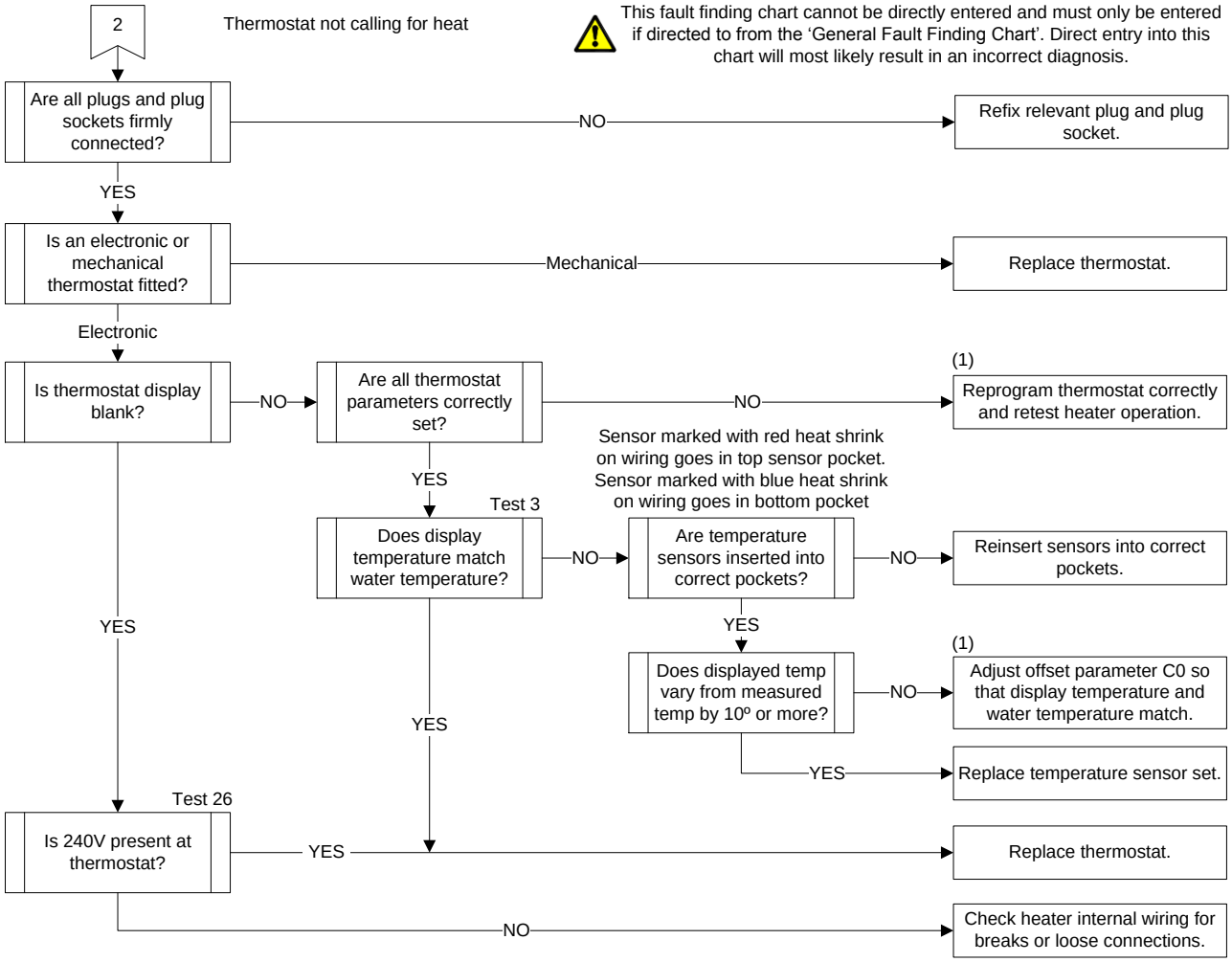
Fault Finding Chart – AKO Thermostat Fault Code ‘E1’



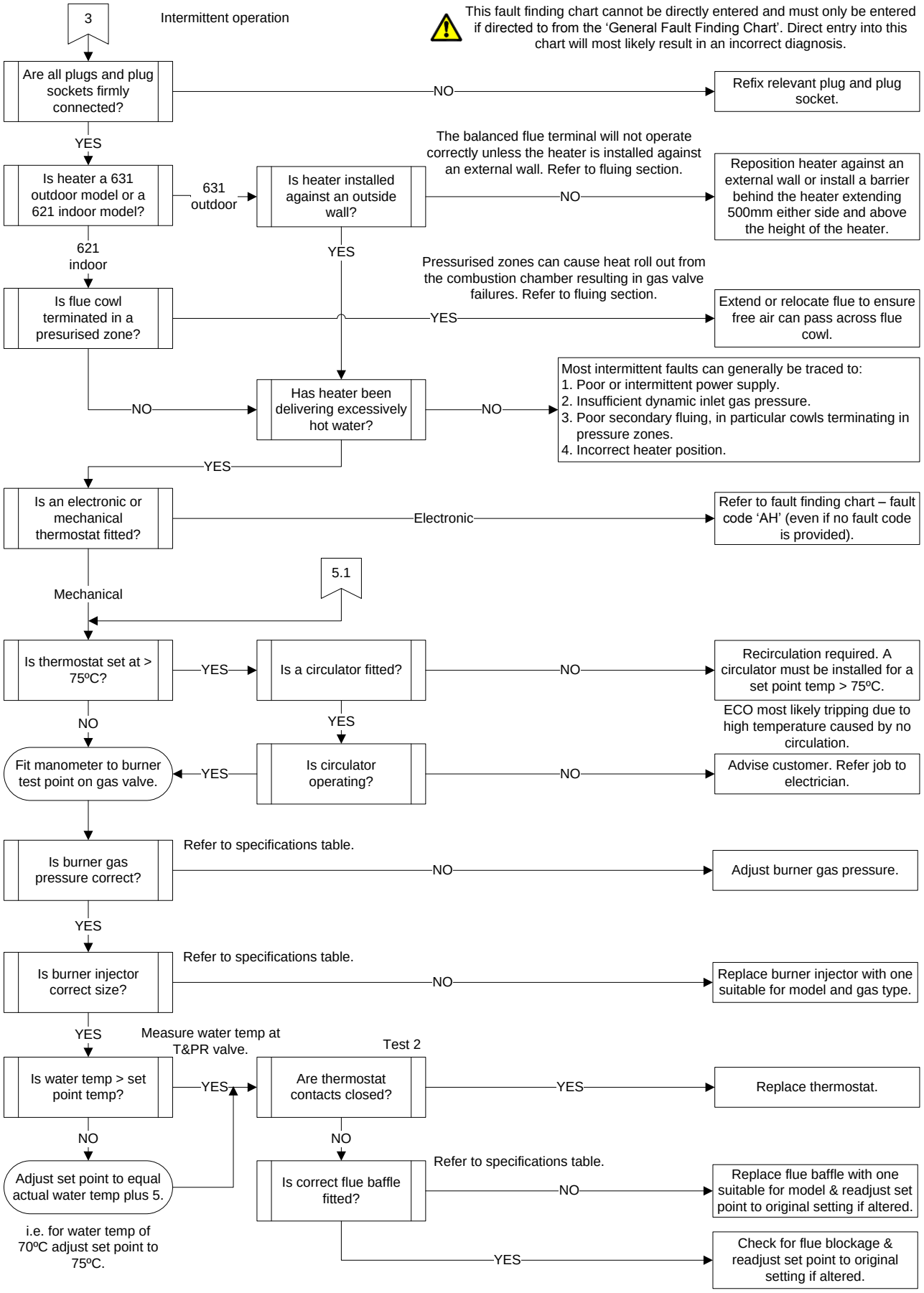
Fault Finding Chart 1



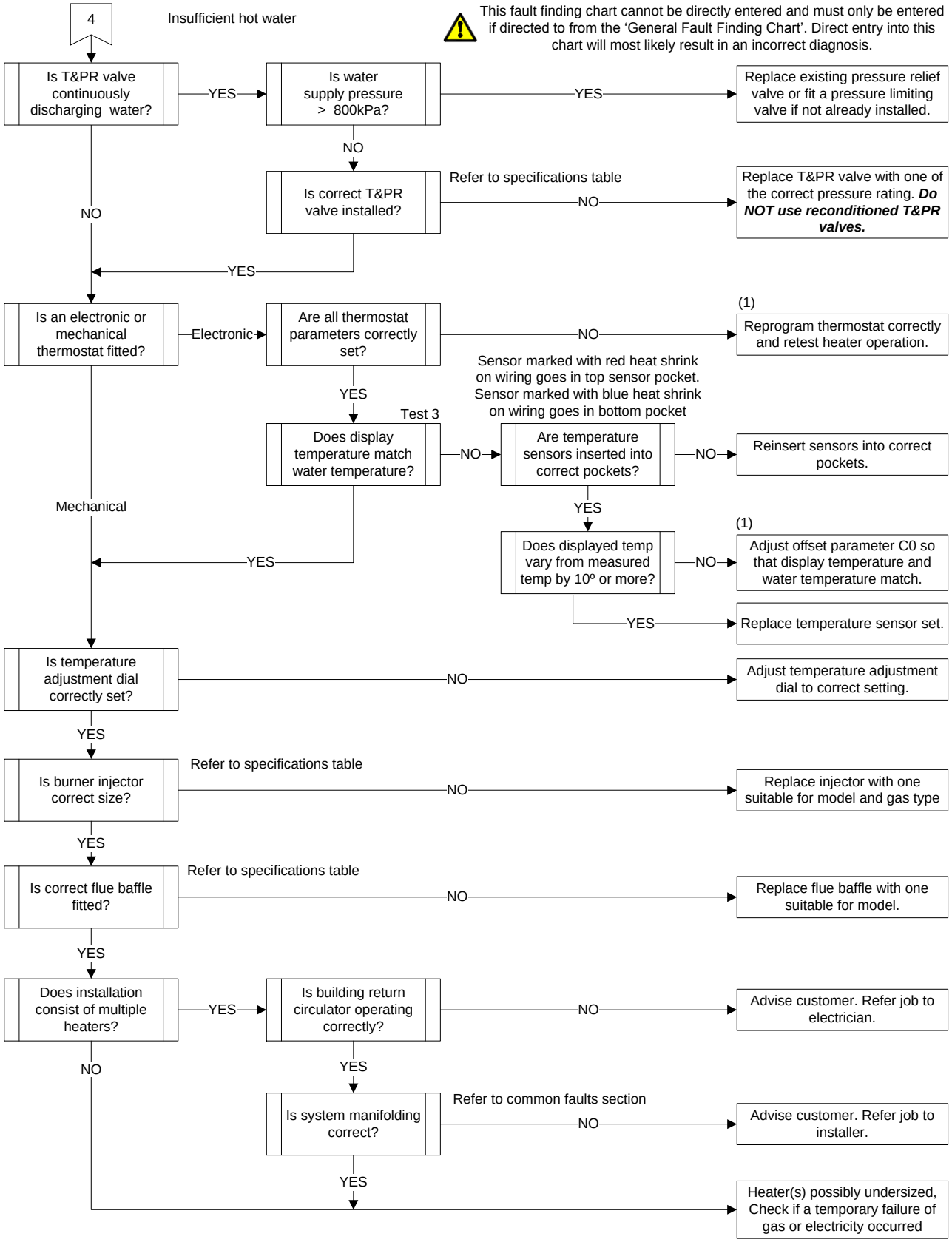
Fault Finding Chart 2



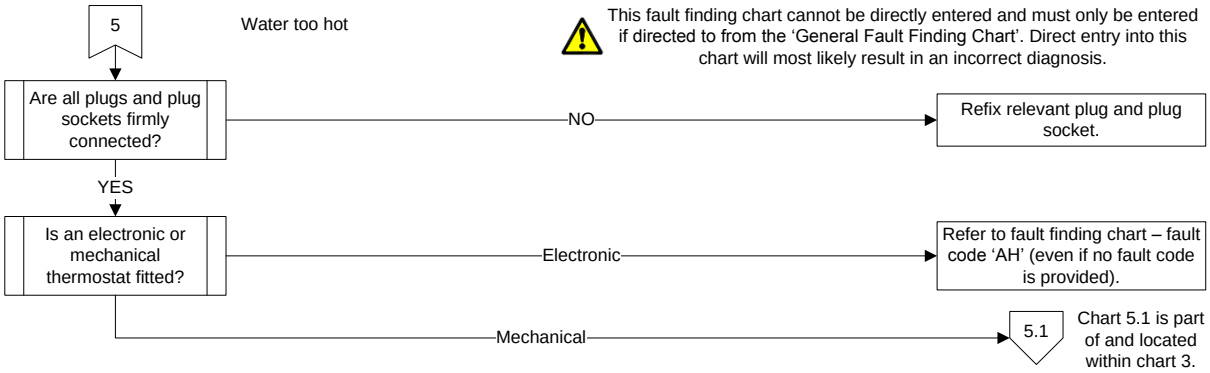
Fault Finding Chart 3



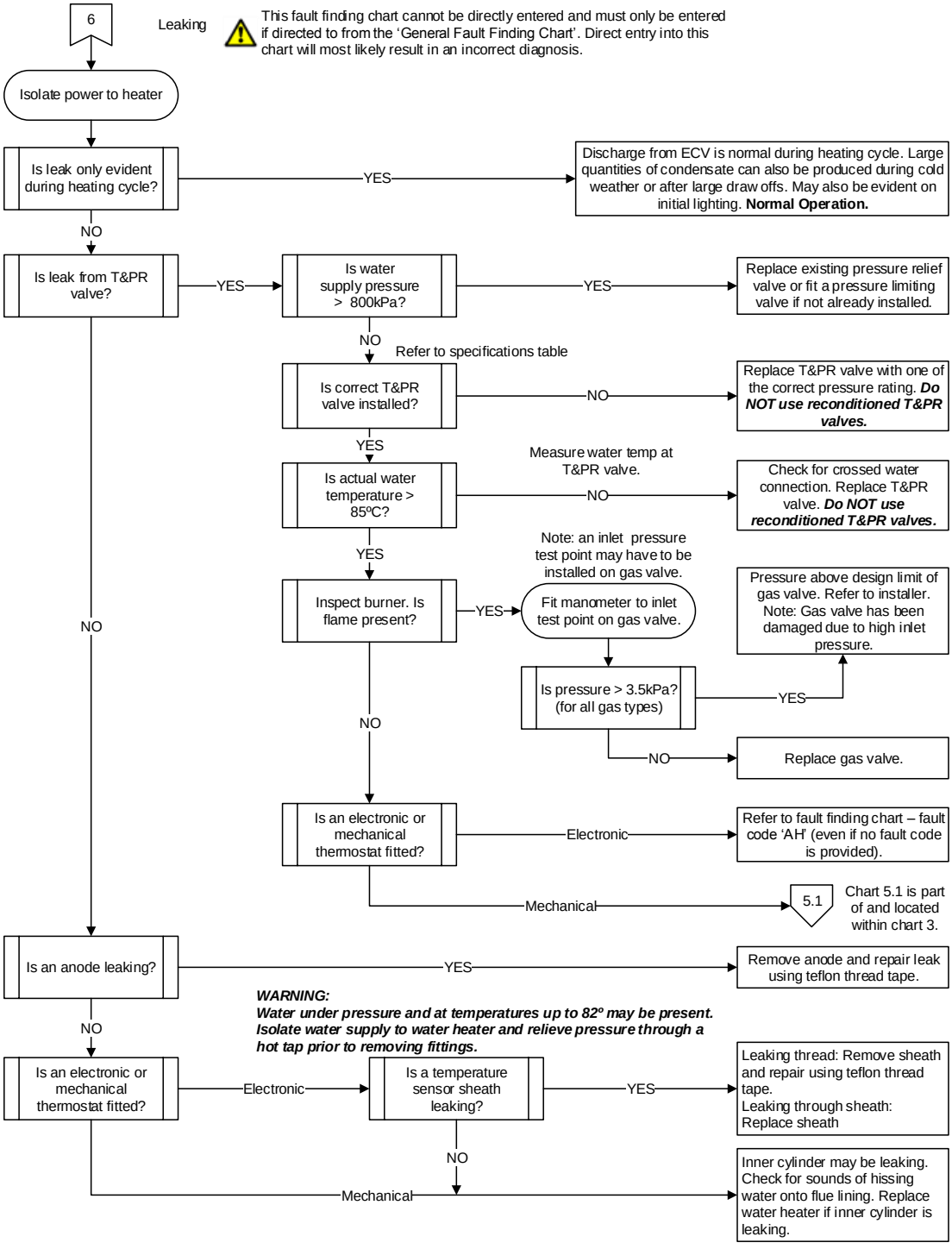
Fault Finding Chart 4



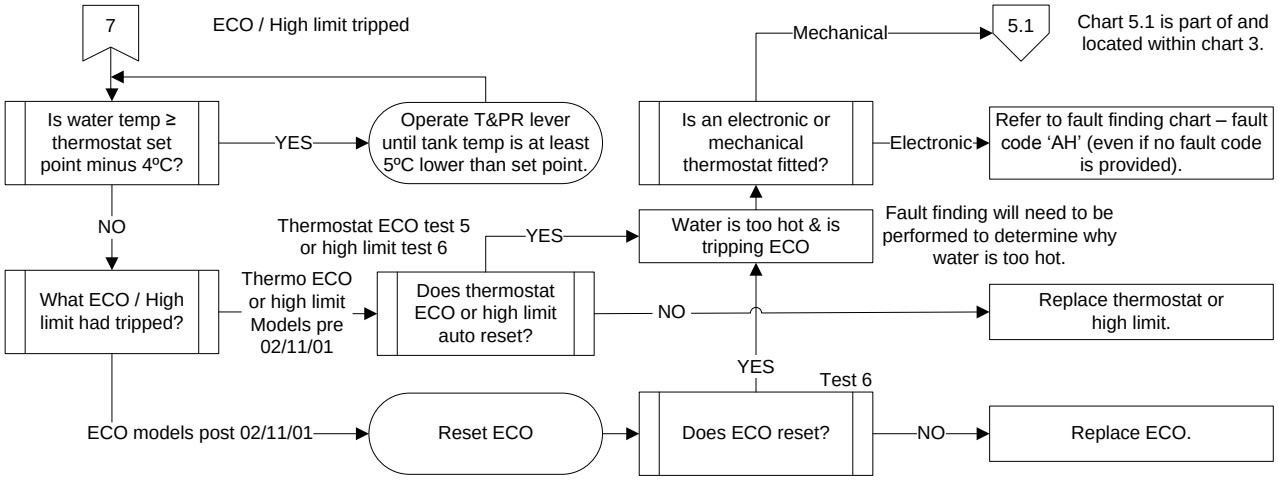
Fault Finding Chart 5



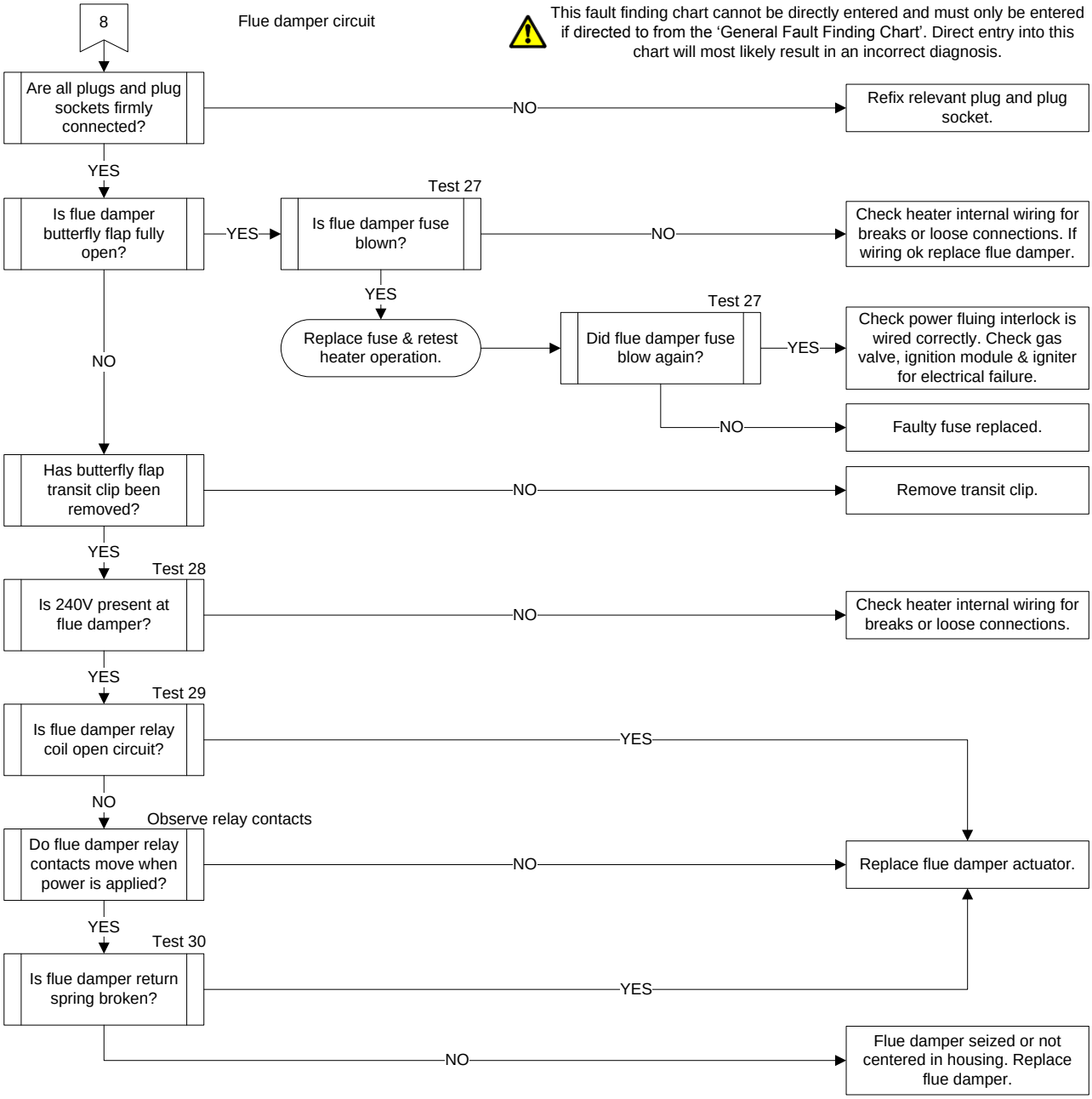
Fault Finding Chart 6



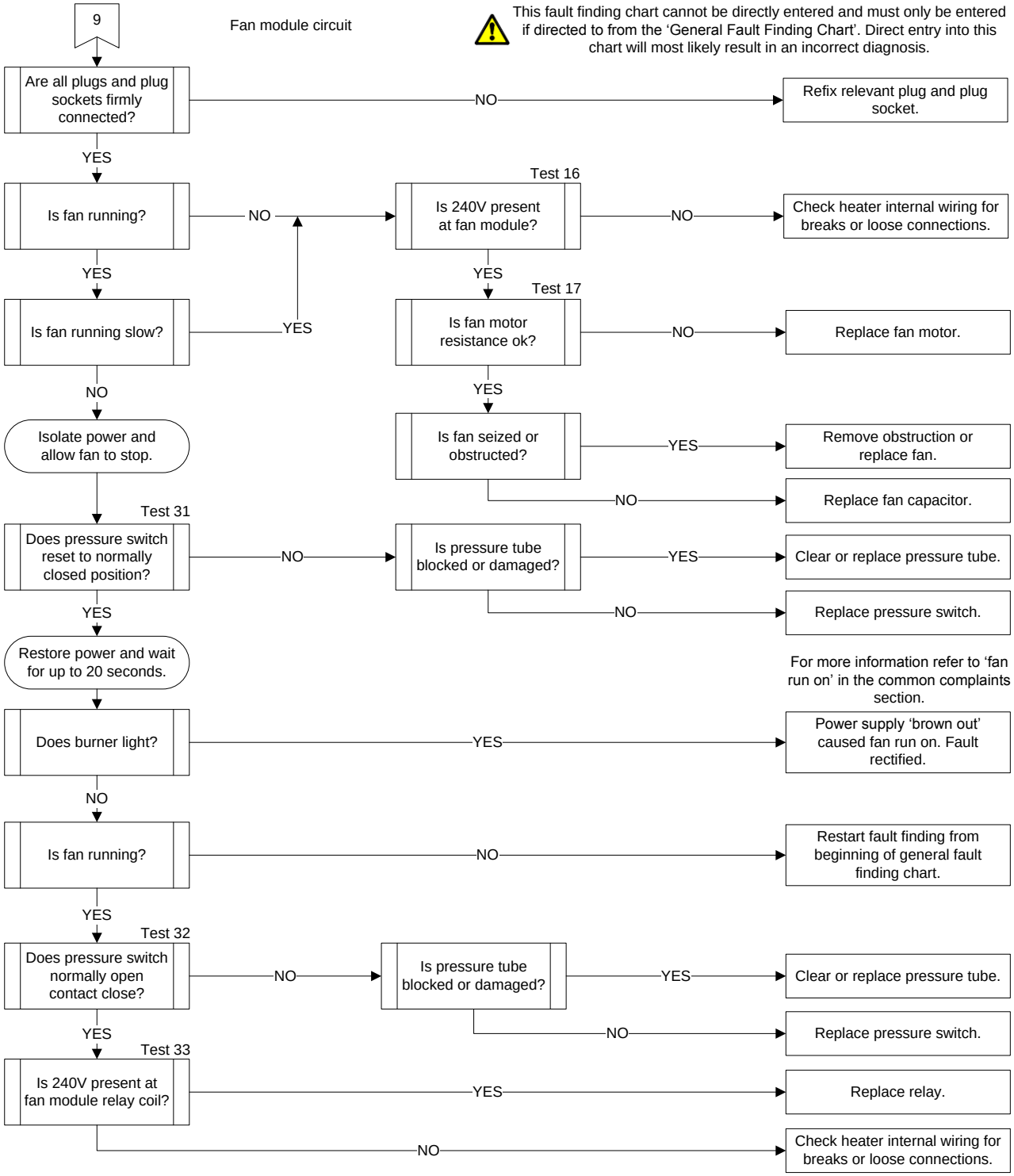
Fault Finding Chart 7



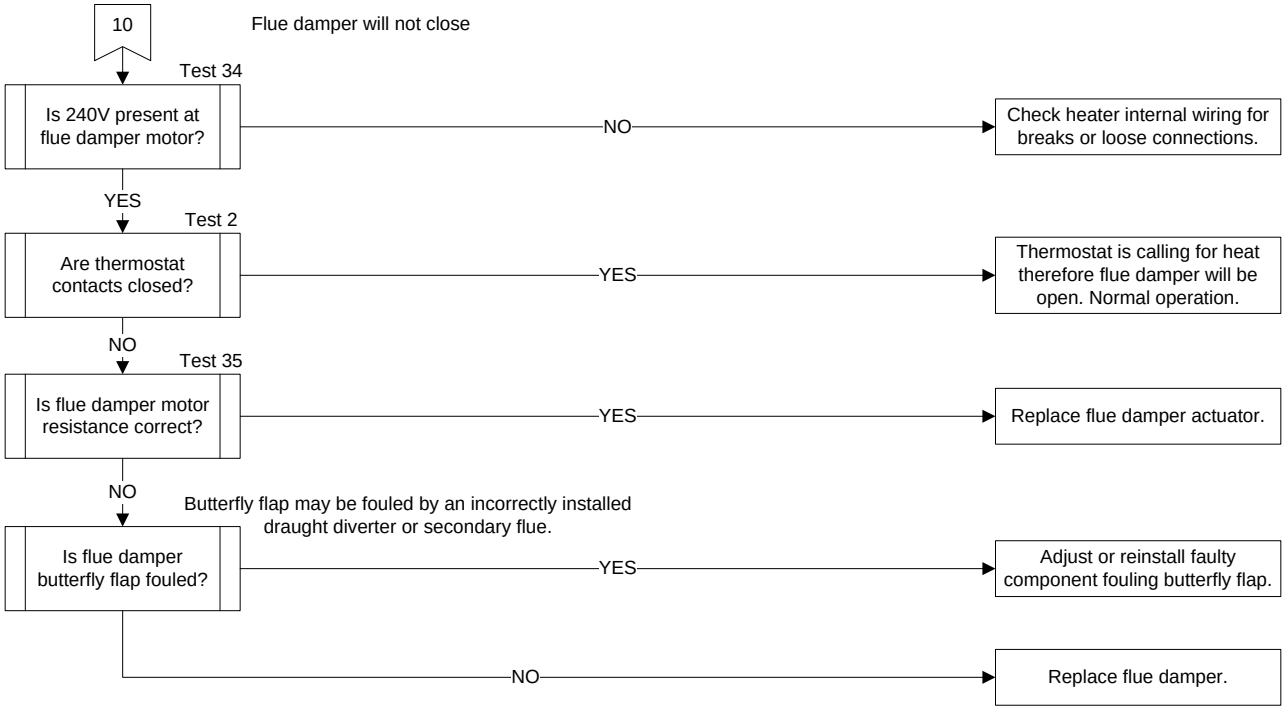
Fault Finding Chart 8



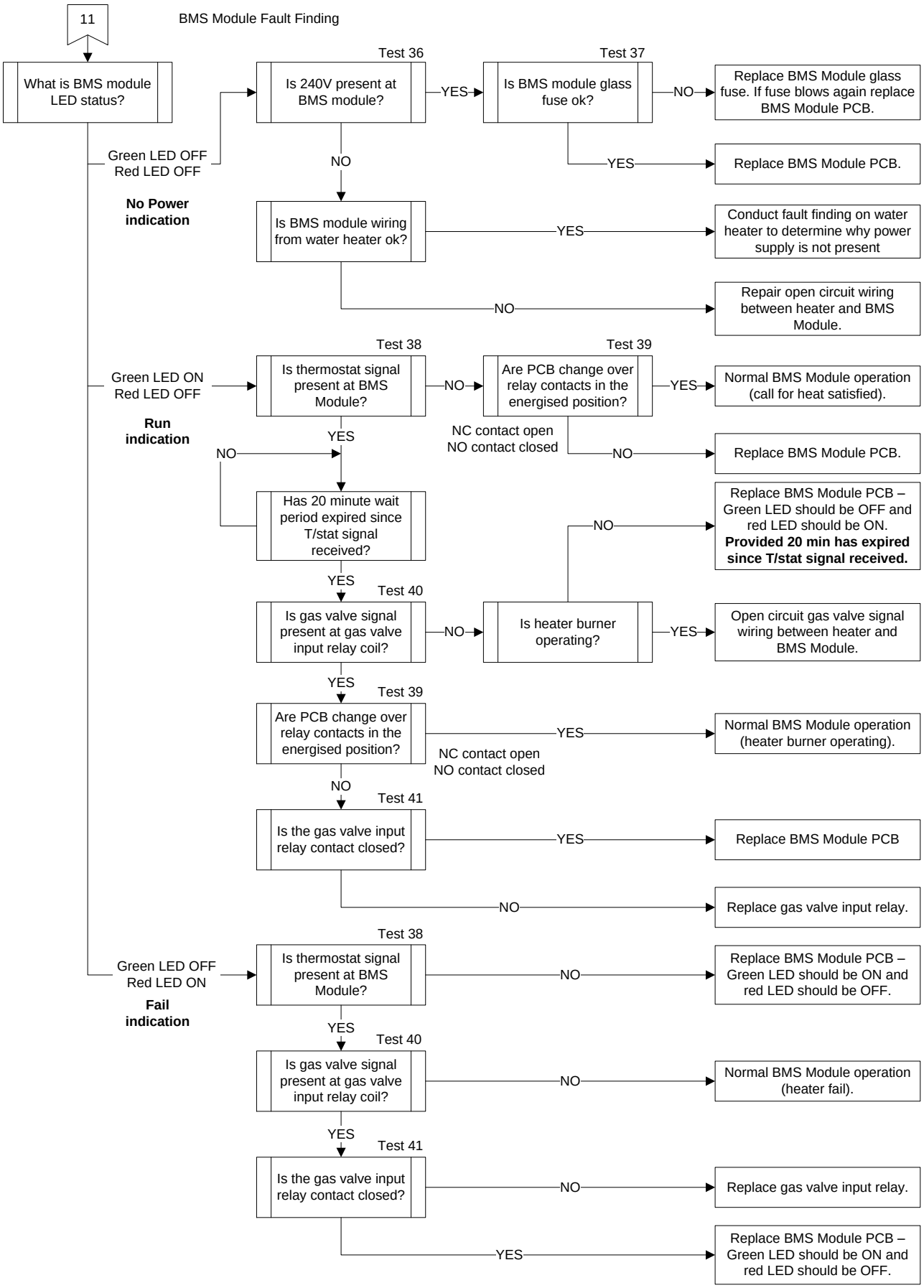
Fault Finding Chart 9 (applicable to pre-01/04/05 produced 631275 models only)



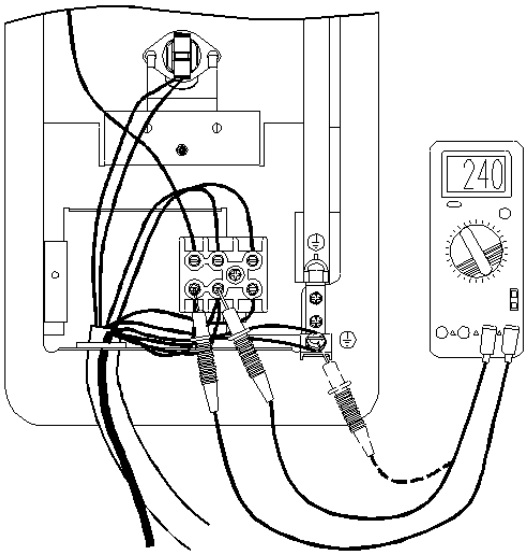
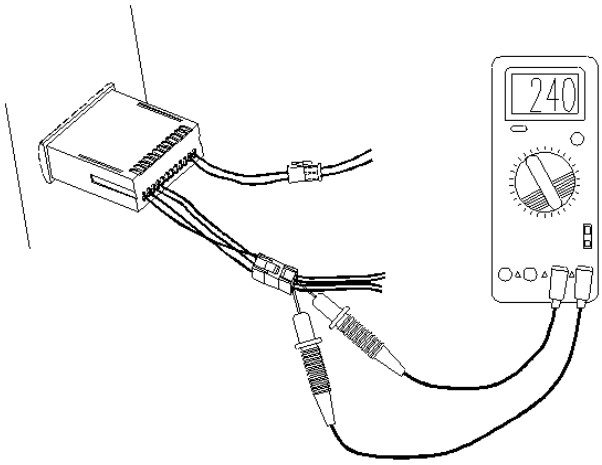
Fault Finding Chart 10

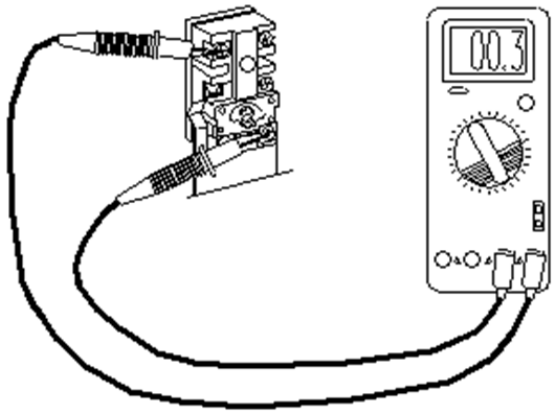


Fault Finding Chart 11



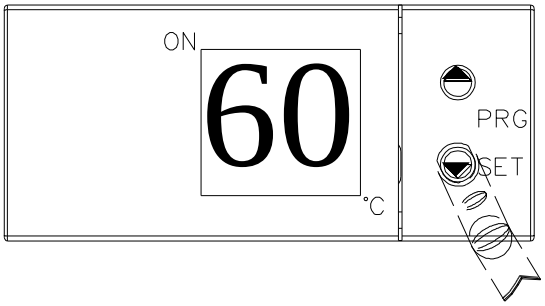
Tests 1 ~ 2A

Test 1	Test 2A – Electronic Thermostat
	
Using a multimeter set on the AC voltage scale, measure between active and neutral and active and earth on the terminal block. Normal voltage is 240 volts AC. If either test fails a polarity or wiring problem exists.	Using a multimeter set on the AC voltage scale, measure between terminal 1 (orange wire) and terminal 4 (blue wire) at the thermostat connecting plug. Normal voltage when thermostat contacts are closed is 240 volts AC.

Test 2B – Mechanical Thermostat	
	Note: Diagram wiring removed for clarity. Using a multimeter set on the resistance scale, measure between terminals 1L and 2T on the thermostat. Normal resistance should be less than 1 ohm when the thermostat contacts are closed.

Tests 3 ~ 5

Test 3

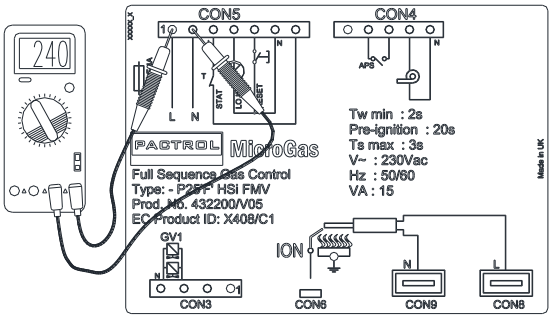


Eliwell: Press the ‘set’ button twice and the current set point temperature will be displayed.

AKO: Press and hold the ‘down’ button on the thermostat for 5 seconds. The current set point temperature will be displayed at which time the button can be released. Using a thermometer measure the water temperature at the T&PR valve drain.

If the measured temperature is equal to or greater than the set point there will not be a call for heat.

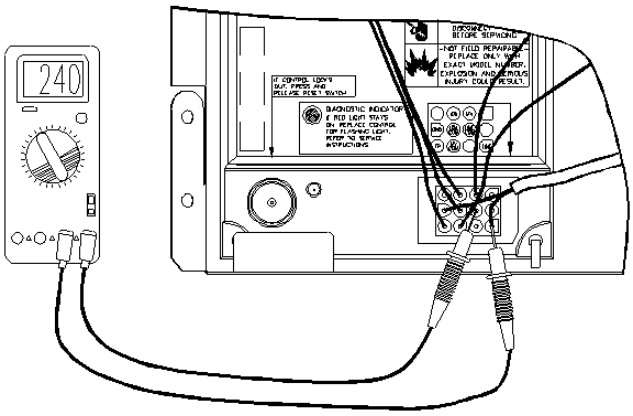
Test 4A – Pactrol Module



Using a multimeter set on the AC voltage scale, measure between the orange and blue wires at CON5 on Pactrol ignition control module.

Normal voltage is 240 volts AC when the thermostat is calling for heat (thermostat contacts closed).

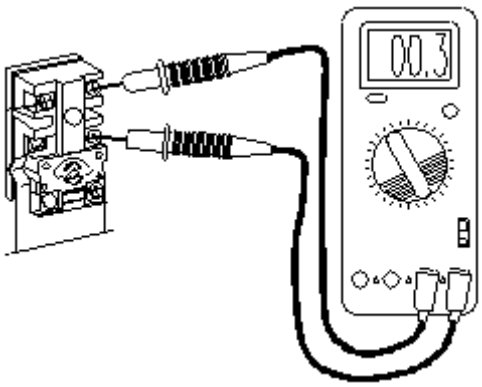
Test 4B – White Rodgers Module



Using a multimeter set on the AC voltage scale, measure between the ‘LINE’ and ‘LINE COM’ terminals on White Rodgers ignition control module.

Normal voltage is 240 volts AC when the thermostat is calling for heat (thermostat contacts closed).

Test 5



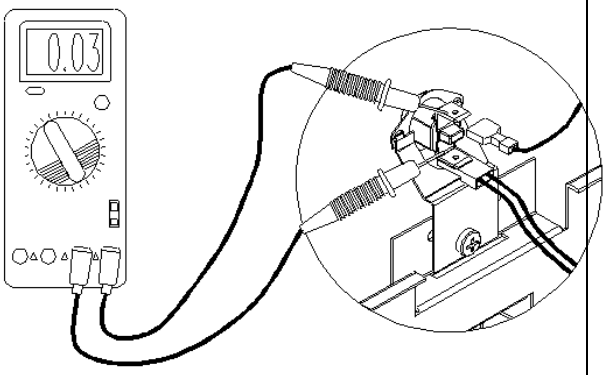
Note: Diagram wiring shown removed for clarity.

Using a multimeter set on the resistance scale, measure between terminals 3L and 4L on the thermostat.

Normal resistance should be less than 1 ohm when the thermostat ECO contacts are closed.

Tests 6 ~ 8

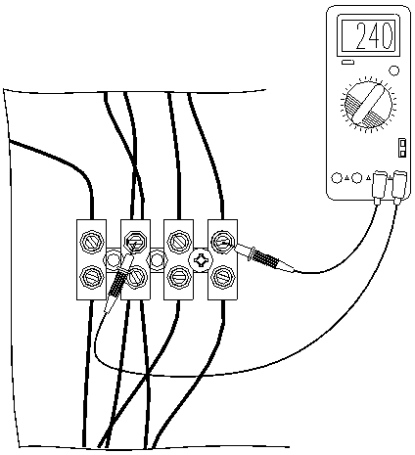
Test 6



Using a multimeter set on the resistance scale, measure across the terminals of the over temperature cut out.

Normal resistance should be less than 1 ohm when the ECO / High limit contacts are closed.

Test 7

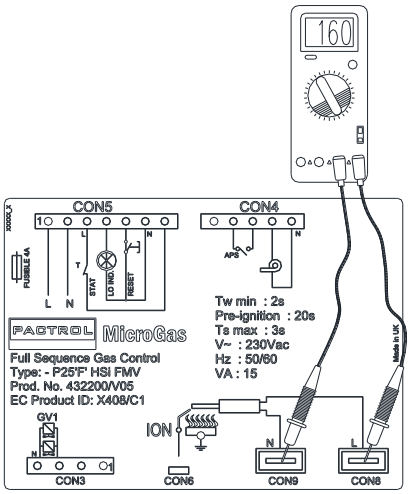


Note: The thermostat must be calling for heat (thermostat contacts closed) and the flue or mechanical ventilation fan operating to conduct this test.

Using a multimeter set on the AC voltage scale, measure between the switch wire from the pressure or sail switch and neutral on the heater terminal block.

Normal voltage is 240 volts AC when the sail or pressure switch contacts are closed.

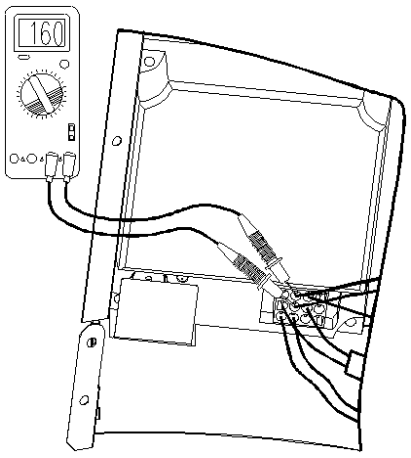
Test 8A – Pactrol Module



During the ignition trial period and using a multimeter set on the AC voltage scale, measure between the red wire at CON8 and orange wire at CON9 on the ignition module.

Normal voltage should be between 160 and 190 volts AC.

Test 8B - White Rodgers Module

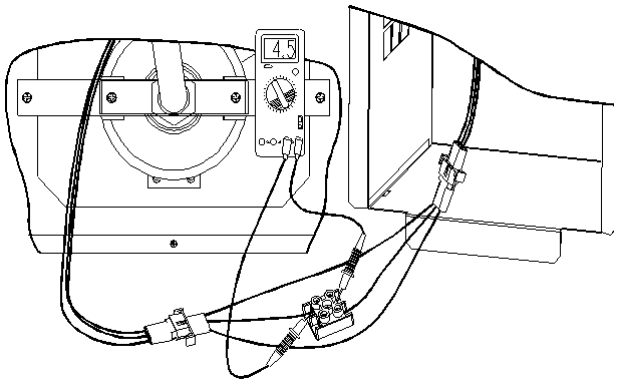


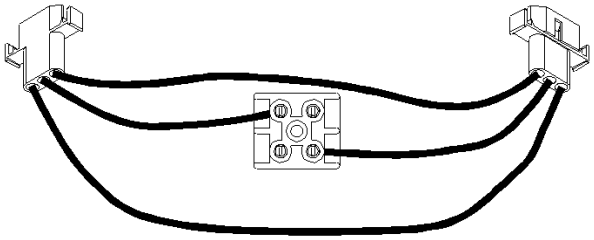
During the ignition trial period and using a multimeter set on the AC voltage scale, measure between the 'IGN' and 'IGN COM' terminals on the ignition module.

Normal voltage should be between 140 and 200 volts AC.

Tests 9 ~ 10

Test 9



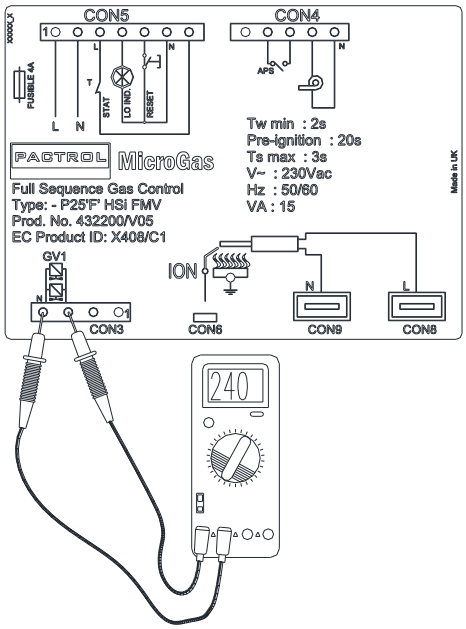


Flame current test loom 890284

Isolate power, disconnect the igniter flame rod plug and socket, install a ‘flame current test loom’ (part number 890284) in series with the disconnected plug and socket then connect the two multimeter probes into the spare terminals of the ‘flame current test loom’ terminal block as depicted above.

1. Set multimeter set on the AC micro-amps scale, restore power and allow the burner to light. A current up to but not exceeding AC10 micro-amps may be detected while flame is established.
2. Isolate power, set multimeter to the DC micro-amps scale, restore power and allow the burner to light. A current of approximately DC4.5 micro-amps should be detected while flame is established.

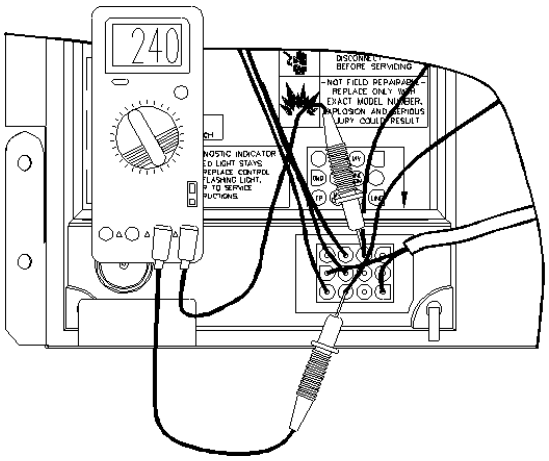
Test 10A – Pactrol Module



Using a multimeter set on the AC voltage scale, measure between the brown and blue wires at CON3 on the Pactrol ignition module while the heater is attempting to light.

Normal voltage is 240 volts AC.

Test 10B – White Rodgers Module

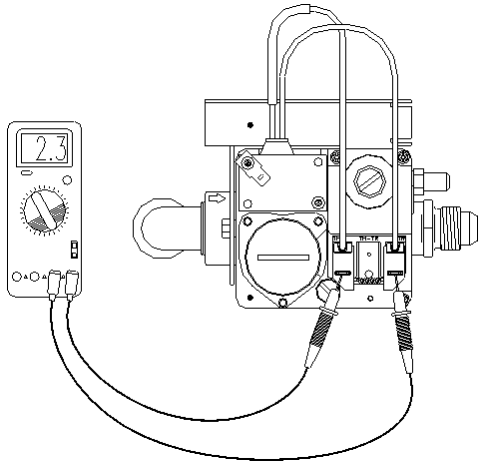


Using a multimeter set on the AC voltage scale, measure between the ‘MV’ and ‘MV COM’ terminals on the White Rodgers ignition module while the heater is attempting to light.

Normal voltage is 240 volts AC.

Tests 11 ~ 14A

Test 11



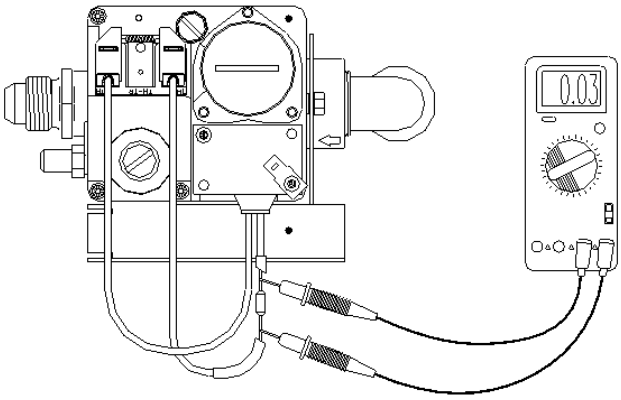
POWER

Disconnect wiring at gas valve and using a multimeter set on the resistance scale, measure across the gas valve terminals.

Normal resistance should be 2.3 kilo ohms ± 10%.

A reading of approx 3.1 kilo ohms indicates the internal solenoid has failed and a reading of approx 8.7 kilo ohms indicates the external solenoid has failed.

Test 12



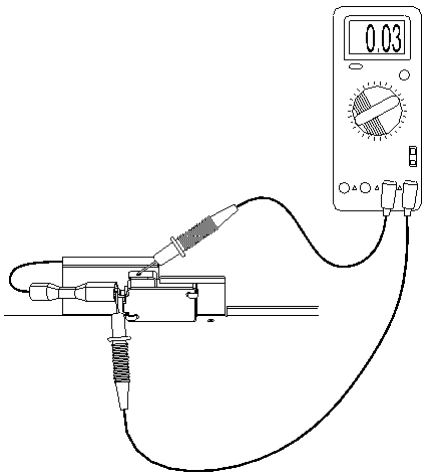
POWER

Note: It will be necessary to strip a small portion of the heat shrink off the gas valve wiring to access the temperature fuse.

Using a multimeter set on the resistance scale, measure across the temperature fuse fitted in the gas valve wiring.

Normal resistance should be less than 1 ohm (fuse has not blown).

Test 13

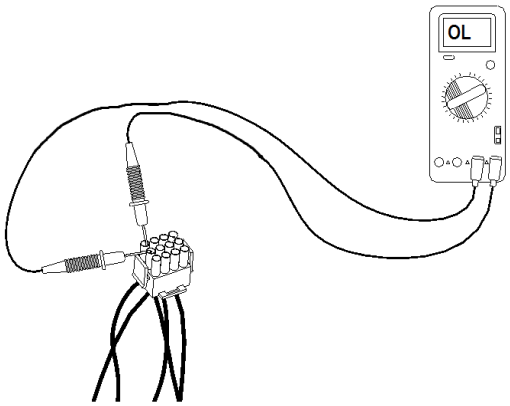


POWER

Using a multimeter set on the resistance scale, measure across the door switch terminals.

Normal resistance with the door switch striker button in the depressed position should be less than 1 ohm.

Test 14A – Pactrol Module



POWER

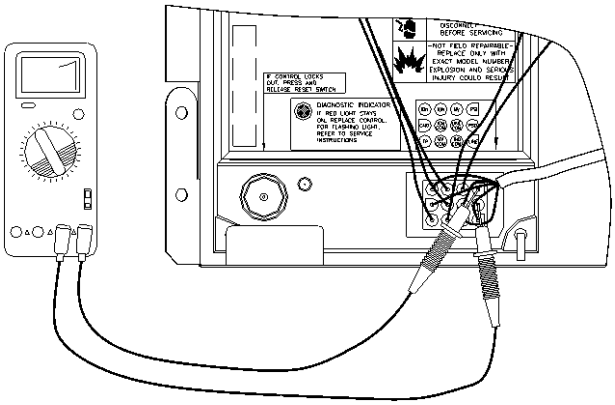
Note: Isolate power and wait for the fan to stop before conducting this test.

Disconnect wiring plug from underside of ignition module and using a multimeter set on the resistance scale measure between the white & red wires in male plug.

Normal resistance should be infinity ohms (pressure switch contacts open).

Tests 14B ~ 16

Test 14B – White Rodgers Module

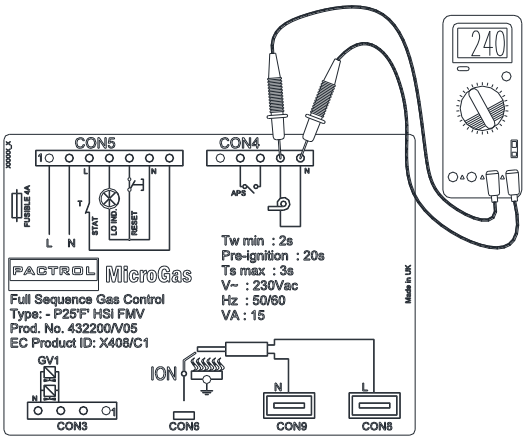


Note: Isolate power and wait for the fan to stop before conducting this test.

Using a multimeter set on the resistance scale, measure between the ‘PSO’ and ‘PSI’ terminals on the White Rodgers ignition module.

Normal resistance should be infinity ohms (pressure switch contacts open).

Test 15A – Pactrol Module

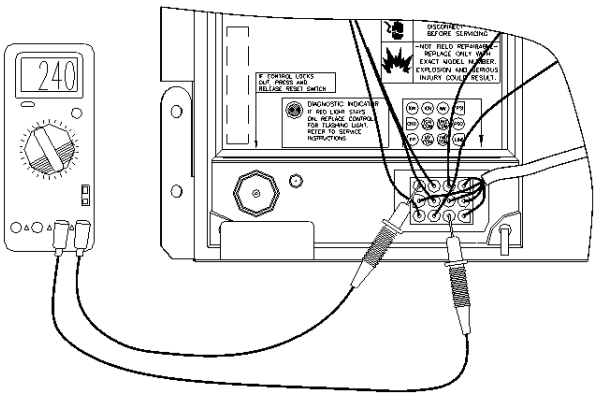


Note: The thermostat must be calling for heat to conduct this test.

Using a multimeter set on the AC voltage scale, measure between the brown and blue wires at CON4 on the Pactrol ignition control module.

Normal voltage is 240 volts AC.

Test 15B – White Rodgers Module

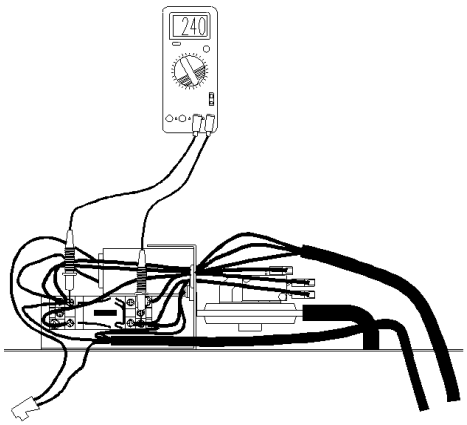


Note: The thermostat must be calling for heat to conduct this test.

Using a multimeter set on the AC voltage scale, measure between the ‘IND’ and ‘IND COM’ terminals on the ignition module.

Normal voltage is 240 volts AC.

Test 16



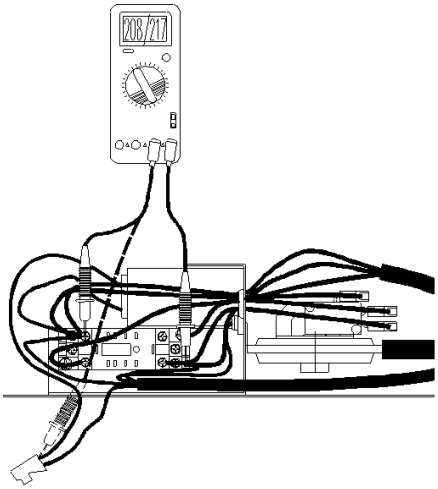
Note: The thermostat must be calling for heat to conduct this test. To prevent the burner commencing operation isolate the gas supply.

Using a multimeter set on the AC voltage scale, measure between the orange wire (pre 09/02/05) or brown wire (post 09/02/05) and the blue wire at the fan module unit.

Normal voltage is 240 volts AC.

Tests 17 ~ 19

Test 17

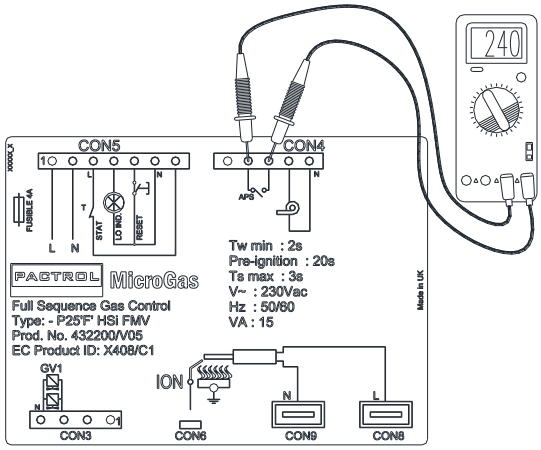


Note – Pre 9/2/05 Models: Remove the relay from the relay base before testing.

All models: Using a multimeter set on the resistance scale, measure between the blue wire and the brown wire and between the blue wire and the black wire to the fan motor.

Normal resistance is:
Blue ~ Brown wire: 222 ohms ± 10%.
Blue ~ Black wire: 218 ohms ± 10%.

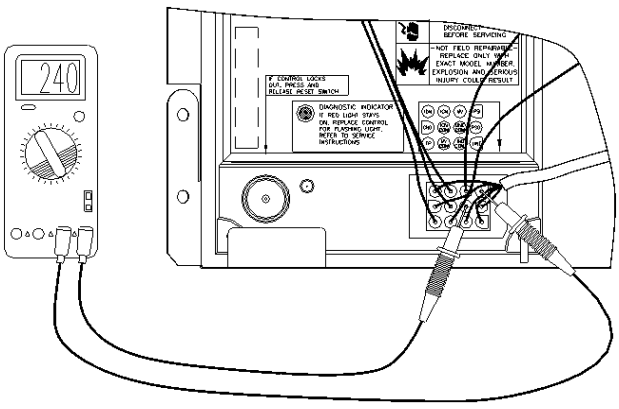
Test 18A – Pactrol Module



Note: The thermostat must be calling for heat and the fan running to conduct this test. Using a multimeter set on the AC voltage scale, measure between the red and white wires at CON4 terminal on the ignition module.

Normal voltage is 240 volts AC.

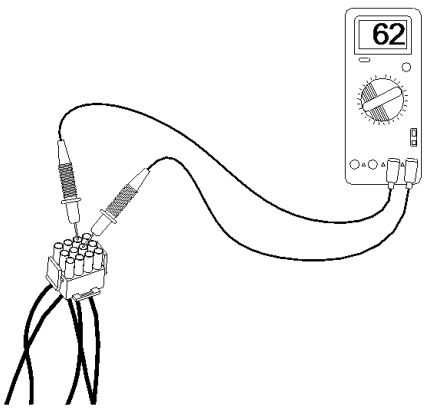
Test 18B – White Rodgers Module



Note: The thermostat must be calling for heat and the fan running to conduct this test. Using a multimeter set on the AC voltage scale, measure between the 'PSI' and 'LINE COM' terminals on the ignition module.

Normal voltage is 240 volts AC.

Test 19

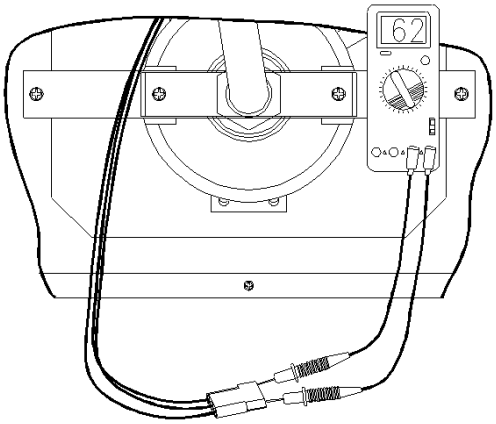


Disconnect the wiring plug from the ignition module and using a multimeter set on the resistance scale, measure between the orange wire (IGN) and the red wire (IGN COM) of the wiring loom.

Normal resistance should be between 60 and 75 ohms when the igniter is cold.

Tests 20 ~ 23

Test 20

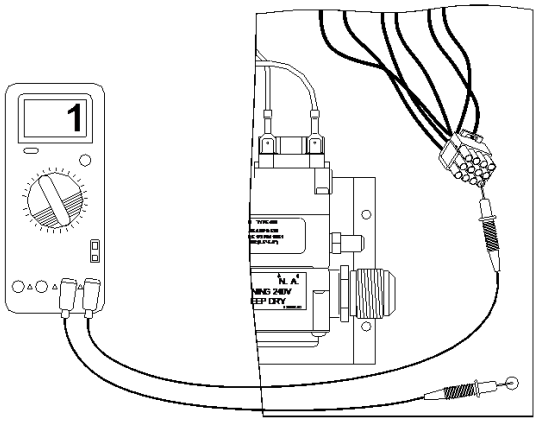


POWER

Using a multimeter set on the resistance scale, disconnect the 3 pin wiring plug to the igniter/flame rod assembly and measure between the outer pins of the 3 pin connector.

Normal resistance should be between 60 and 75 ohms when the igniter is cold.

Test 21



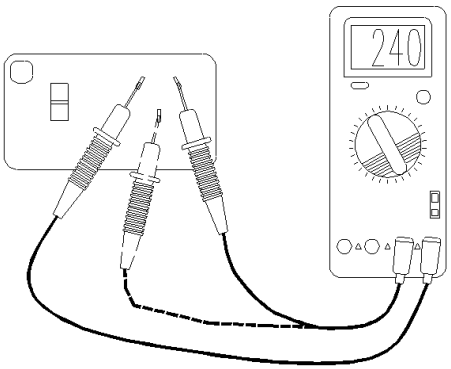
POWER

Using an insulation tester (Megger) set on the 500 volts scale, disconnect the wiring plug from the ignition module and conduct an insulation test between the light blue wire in male plug and earth.

Repeat the test from the 3 pin wiring plug to the igniter/flame rod assembly.

Normal resistance should be infinity for both tests.

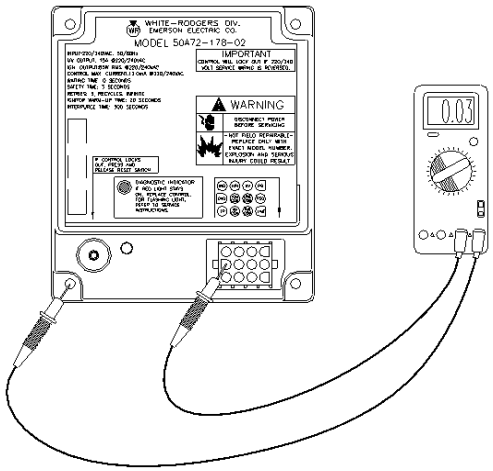
Test 22



Using a multimeter set on the AC voltage scale, unplug the 3 pin plug from the GPO and measure between the active and neutral pins and between the active and earth pins of the GPO.

Normal voltage for both tests is 240 volts AC. If either test fails a polarity or wiring problem exists.

Test 23



POWER

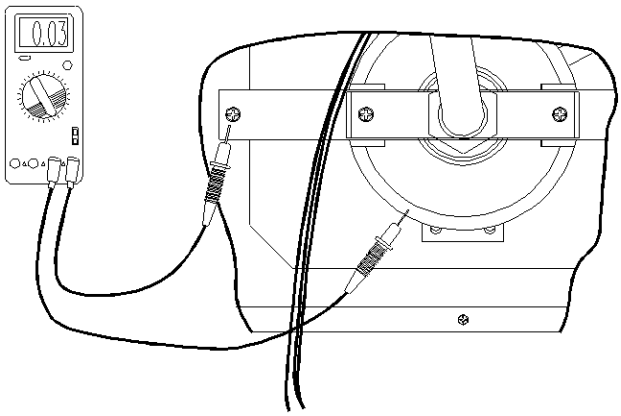
Note: Wiring and plug is not shown on diagram for clarity.

Using a multimeter set on the resistance scale, measure between the green/yellow wire (GND on White Rodgers module or earth nest on base of Pactrol module) and the base of the water heater / earthing point.

Normal resistance should be less than 1 ohm.

Tests 24 ~ 27

Test 24

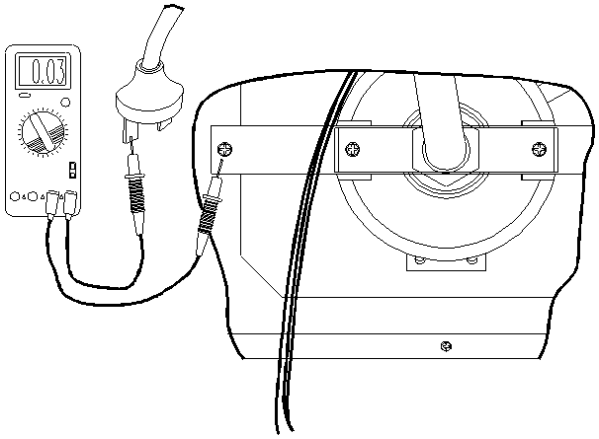


Using a multimeter set on the resistance scale, measure between the burner and the base of the water heater.

Note: It may be necessary to clean a section of the burner to ensure continuity of the multimeter test lead probe.

Normal resistance should be less than 1 ohm.

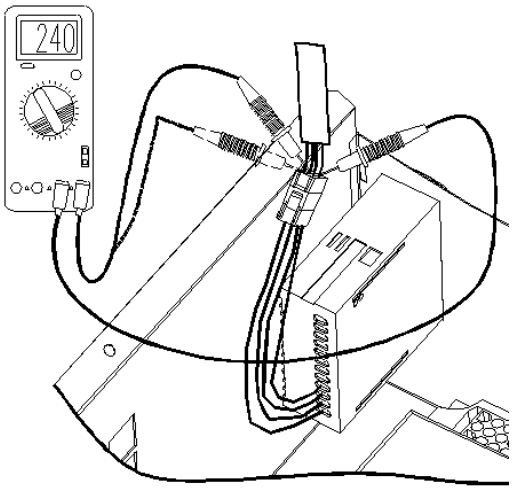
Test 25



Remove the 3 pin plug from the GPO and using a multimeter set on the resistance scale, measure between the earth pin of the cord set and the base of the water heater.

Normal resistance should be less than 0.5 ohms.

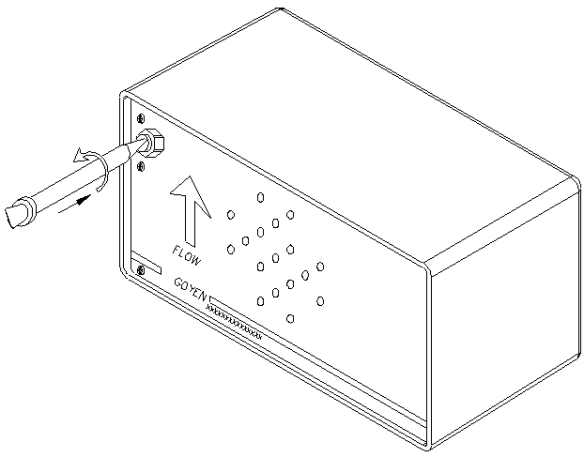
Test 26



Using a multimeter set on the AC voltage scale, measure between terminal 2 (red wire) and terminal 4 (blue wire) then terminal 3 (red wire) and terminal 4 (blue wire) of the thermostat.

Normal voltage for both tests is 240V AC.

Test 27



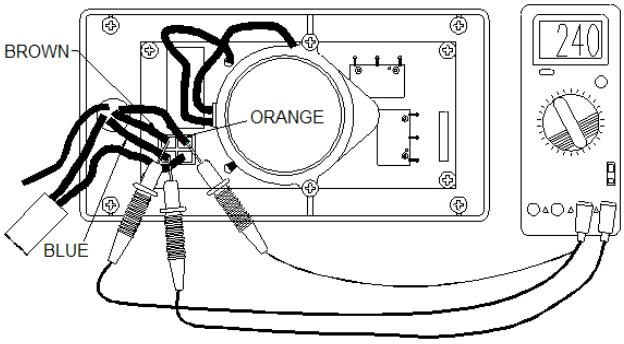
Using a flat blade screwdriver gently push and turn the fuse holder counter clockwise. Release pressure, the fuse holder will spring partially out.

Remove the fuse holder and using a multimeter set on the resistance scale, measure across the ends of the fuse.

Normal resistance is less than 1 ohm.

Tests 28 ~ 31

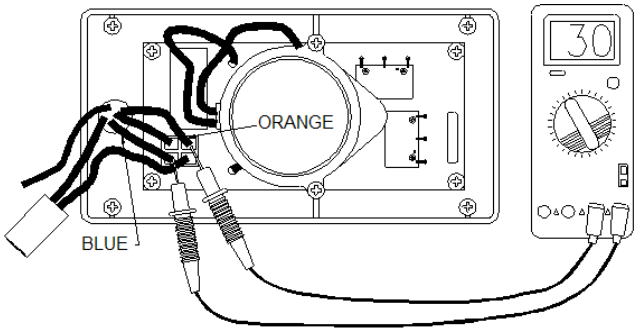
Test 28



Remove the green cover from the flue damper actuator and using a multimeter set on the AC voltage scale, measure between the brown and blue wires then between the orange wire (going directly to the PCB) and blue wire.

Normal voltage for both tests is 240 volts AC.

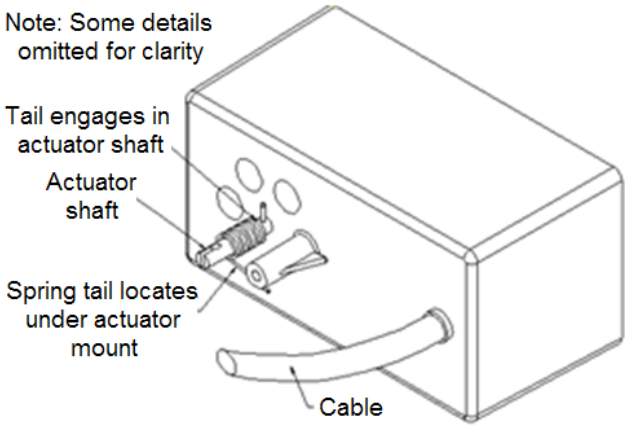
Test 29



Remove the green cover from the flue damper actuator and using a multimeter set on the resistance scale, measure between the orange wire (going directly to the PCB) and the blue wire.

Normal resistance is 30 kilo- ohms ± 10%.

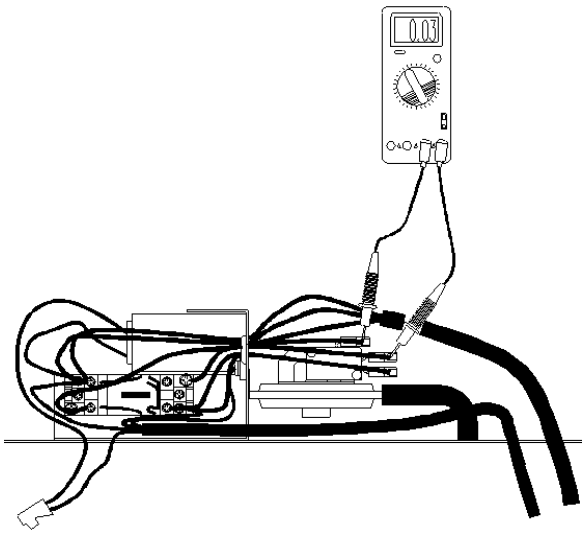
Test 30



Remove the flue damper actuator from the flue damper assembly.

Carefully inspect the spring on the actuator. One tail of the spring should be engaged in a hole through the actuator shaft. The other tail of the spring should be engaged against the mounting post of the actuator.

Test 31



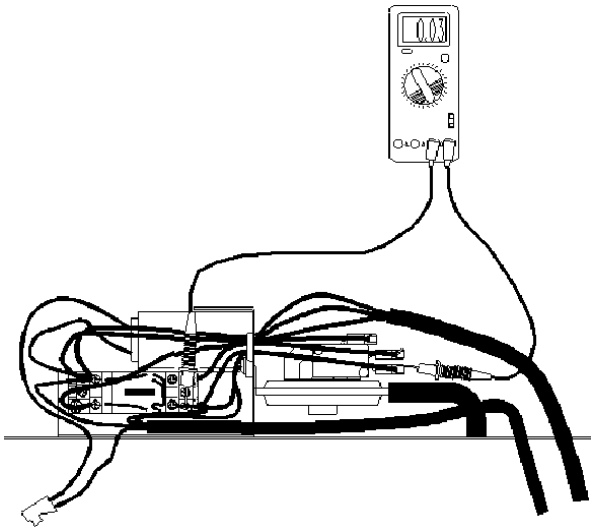
Note: Wait for the fan to stop before conducting this test.

Using a multimeter set on the resistance scale, measure between the red and brown wires on the micro-switch.

Normal resistance should be less than 1 ohm.

Tests 32 ~ 35

Test 32

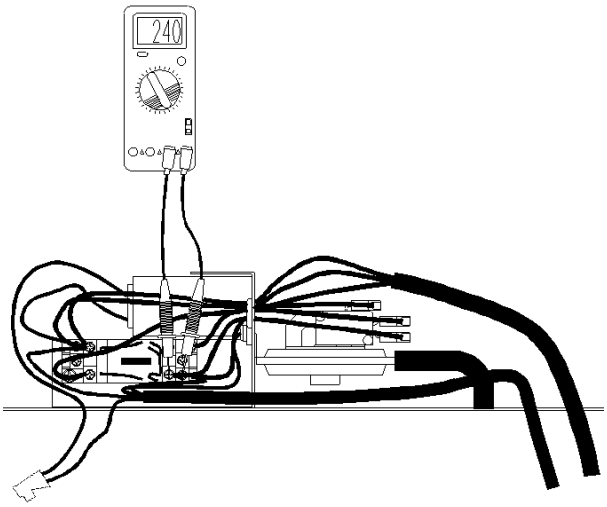


Note: The thermostat must be calling for heat and the fan must be running whilst conducting this test.

Using a multimeter set on the AC voltage scale, measure between the black wire on the micro-switch and the blue wire on the relay base.

Normal voltage is 240 volts AC.

Test 33



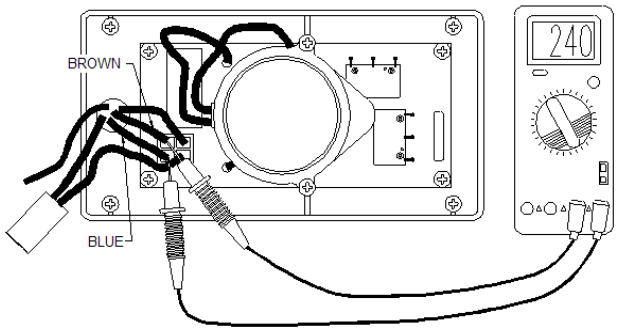
Note: The thermostat must be calling for heat and the fan must be running whilst conducting this test.

To prevent the burner commencing operation, isolate gas supply to the gas valve.

Using a multimeter set on the AC voltage scale, measure between the brown and blue wires on the relay base.

Normal voltage is 240 volts AC.

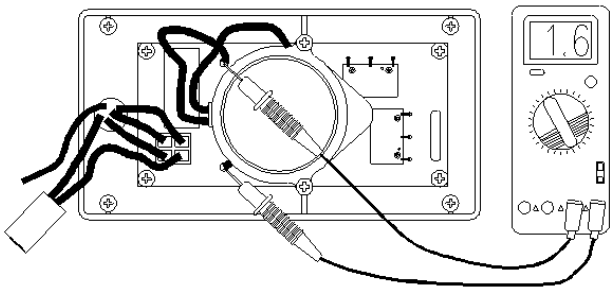
Test 34



Remove the green cover from the flue damper actuator and using a multimeter set on the AC voltage scale, measure between the brown and blue wires.

Normal voltage is 240 volts AC.

Test 35

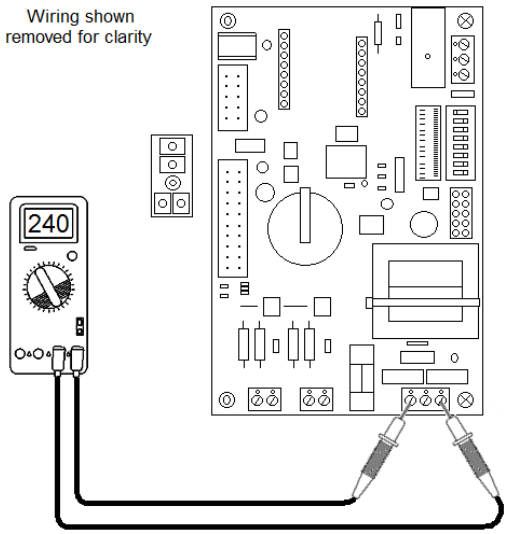


Remove the green cover from the flue damper actuator and using a multimeter set on the resistance scale, measure between the two blue wires to the actuator motor.

Normal resistance is 1.6 kilo- ohms ± 10%.

Tests 36 ~ 39

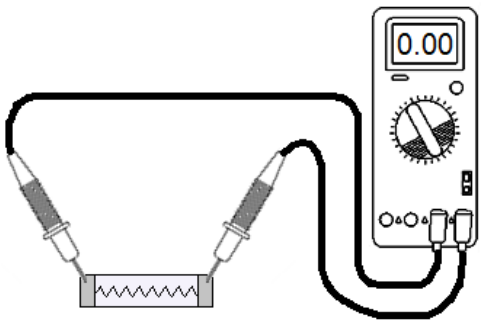
Test 36



Using a multimeter set on the AC voltage scale, measure between the red and blue wires on the BMS Module power supply terminal block.

Normal voltage is 240 volts AC.

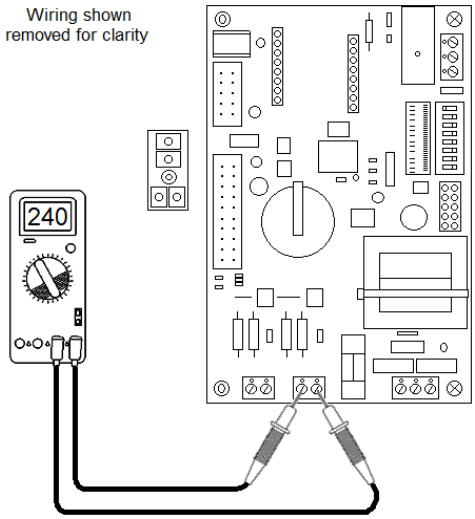
Test 37



Remove glass fuse from BMS module PCB and using a multimeter set on the AC voltage scale, measure between the two ends of the fuse.

Normal resistance should be less than 1 ohm (glass fuse is ok and has not blown).

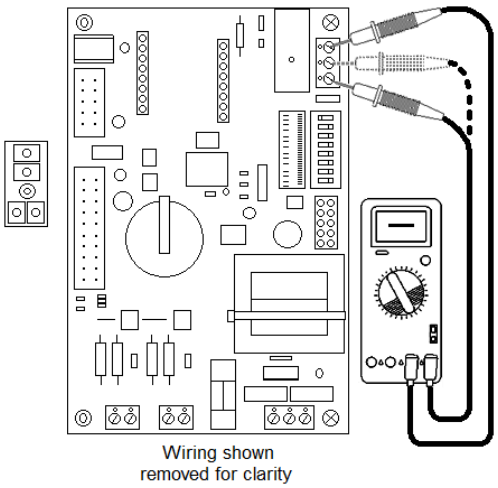
Test 38



Using a multimeter set on the AC voltage scale, measure between the red and blue wires on the BMS Module thermostat signal terminal block.

Normal voltage is 240 volts AC when the heater's thermostat signal is present.

Test 39



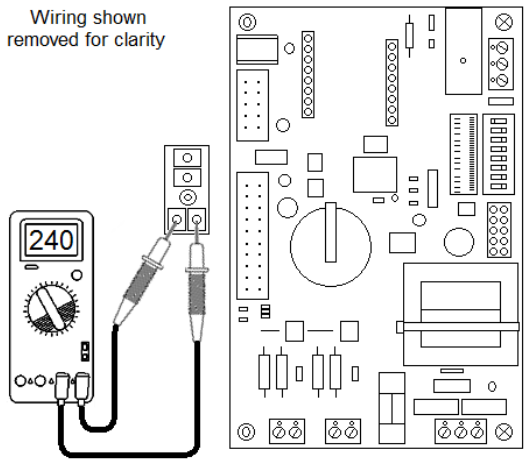
Using a multimeter set on the resistance scale, measure between the black and grey wires and then measure between the black and orange wires on the BMS Module volt free contact terminal block.

Normal resistance when the contacts are in the energised position is as follows:

Black wire to grey wire: Less than 1 ohm.
Black wire to orange wire: infinity ohms.

Tests 40 ~ 41

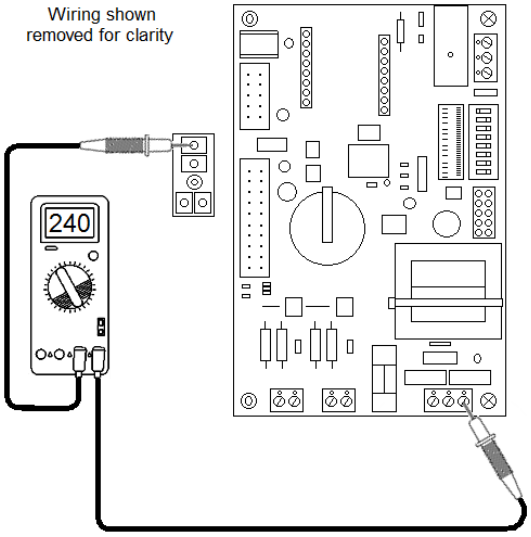
Test 40



Using a multimeter set on the AC voltage scale, measure between the brown and blue wires on the BMS Module gas valve input relay.

Normal voltage is 240 volts AC when the heater's gas valve signal is present.

Test 41



Using a multimeter set on the AC voltage scale, measure between the purple wire on the BMS Module gas valve input relay and the blue wire on the BMS Module power supply terminal block.

Normal voltage is 240 volts AC when the gas valve input relay contact is closed.

COMPONENT REPLACEMENT PROCEDURES

Warnings

HSI Heavy Duty Gas model water heaters are fitted with a 3 pin plug & lead. All procedures relating to replacement of electrical components assume removal of the plug from the GPO will safely isolate the appliance electrically. HOWEVER where ancillary equipment, such as a power flue, has been electrically interlocked with the water heater or the water heater has been hard wired, extreme caution must be exercised to ensure 'live' conductors are not present from the additional circuit(s). It is strongly recommended that the power supply to all ancillary equipment is also isolated when servicing any water heater electrically interlocked to it.

When performing any component replacement procedure water, components or pipe work of an elevated temperature may be present. Ensure PPE is worn to prevent the risk of scalding.

Draining the Water Heater (Procedure 1)

1. ***Remove 3 pin plug from GPO and isolate gas and water supplies to the water heater.***
2. ***Relieve pressure from the water heater through T&PR valve or a hot tap.***
3. Fit a drain hose to the drain cock outlet and run the other end to a drain or safe location.
4. Open drain cock.
5. Open temperature and pressure relief valve to allow air into system.

Gas Valve (Procedure 2)

1. ***Remove 3 pin plug from GPO & isolate gas supply to heater (note warning on page 86).***
2. *Outdoor Models* - Remove lower access door.

   Indoor Models - Remove gas valve cover **Note:** It will be necessary to disconnect the wiring to the thermostat, temperature sensor and ignition module to allow complete removal of the gas valve cover.
3. Disconnect wiring from ignition module to gas valve terminal block, noting the positions of each wire.
4. Disconnect inlet gas pipe work.
5. Disconnect burner feed pipe.
6. Remove screw retaining gas valve to support bracket.
7. Remove gas valve.
8. Reassemble in the reverse order of above. **Note:** On indoor models ensure lip on bottom of gas valve cover engages inside jacket opening.
9. Restore gas and test all inlet gas connections for leaks using a soapy water solution.
10. Restore power.
11. Allow heater to light and test all outlet gas connections for leaks using a soapy water solution. **NOTE:** On 631275 models it will be necessary to hold the door switch closed while conducting the leak test.

Burner (Procedure 3)

1. ***Remove 3 pin plug from GPO & isolate gas supply to heater (note warning on page 86).***
2. *Outdoor Models* - Remove lower access door.

   Indoor Models - Remove gas valve cover **Note:** It will be necessary to disconnect the wiring to the thermostat, temperature sensor and ignition module to allow complete removal of the gas valve cover.
3. *Outdoor models* - Remove burner access panel **Note:** On 631275 models it will be necessary to disconnect the wiring to the door switch to remove the cover.
4. Disconnect burner feed pipe at gas valve.
5. Disconnect wiring to igniter and flame sensor rod at the 3 pin connector plug.
6. *275 models* - Remove heat shield (3 screws) located at top of combustion chamber opening and the 2 screws retaining injector bracket to burner. The burner feed pipe assembly can now be removed.
7. Remove screws retaining burner to water heater jacket.
8. Carefully withdraw burner ensuring flame sensor rod and igniter is not damaged.
9. Remove igniter and heat shield assembly from the old burner.
10. Reassemble in reverse order of above. **Note:** Care must be taken to ensure that the igniter wiring heat shield is fitted correctly when fitting the igniter to the new burner. The flame rod and hot surface igniter must not be touched with bare hands.
11. Restore gas and test all inlet gas connections for leaks using a soapy water solution.
12. Restore power, allow heater to light and test all outlet gas connections for leaks using a soapy water solution. **NOTE:** On 631275 models it will be necessary to hold the door switch closed while conducting the leak test.

Main Burner Injector (Procedure 4)

1. Follow Procedure 3 (Burner Replacement) steps 1 ~ 7.

265 Models

2. Remove screws retaining burner to jacket and withdraw burner slightly.
3. Remove spring clip and remove burner feed pipe assembly from burner bracket .

275 Models

2. Remove 2 screws retaining injector bracket to burner.
3. Remove burner feed pipe assembly.

Both Models

4. Remove injector from the burner feed pipe.
5. Fit replacement injector using an approved gas sealant. **Note:** Sealant should be used sparingly to prevent blockage of injector.
6. Reassemble in reverse order of above. **Note:** On indoor models ensure lip on bottom of gas valve cover engages inside jacket opening.
7. Restore power and gas supplies, allow heater to light and test all outlet gas connections for leaks using a soapy water solution. **NOTE:** On 631275 models it will be necessary to hold the door switch closed while conducting the leak test.

Igniter/Flame Rod (Procedure 5)

Follow procedure 3. **Note:** For 631275 models there are two types of igniter/flame rod assemblies available. One type has a weatherproof plug and one type does not have a weatherproof plug. Weatherproof plugs are not compatible with non-weatherproof plug sockets and if replacing an igniter/flame rod assembly, it is imperative that the correct type of assembly is procured to match the heater's existing wiring loom plug socket (refer to 'Igniter/Flame Rod Assembly Change' on page 8).

Ignition Module (Procedure 6)

The Pactrol P25 module is a direct replacement for the White Rodgers module and no adjustments are required to be made in order to retro-fit, however when fitting a Pactrol module into a 621275 heater that was produced before 18/09/15 the viewing window in the heater front cover will be obstructed by the Pactrol module therefore it is advisable to replace the front cover (part number 108335) when fitting a new Pactrol module in these models.

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. *Outdoor Models* - Remove lower access door.

   Indoor Models - Remove gas valve cover **Note:** It will be necessary to disconnect the wiring to the thermostat, temperature sensor and ignition module to allow complete removal of the gas valve cover.
3. *Outdoor Models* - Disconnect multi-pin plug at ignition module.
4. Remove ignition module (2 screws on outdoor models, retaining tabs on indoor models).
5. Reassemble in reverse order of above.

Outdoor Models - Moisture shield must be refitted to ignition module.

Indoor Models - Ensure lip on bottom of gas valve cover engages inside jacket opening.

6. Restore power and test operation.

Thermostat – Mechanical Thermostat (Procedure 7A)

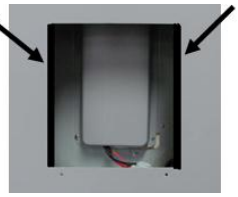
1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. Remove lower access cover and mark and disconnect wiring at thermostat.
3. Slide thermostat out from under retaining clamp. Note current temperature setting.
4. Remove any scale from cylinder surface.
5. Slide replacement thermostat under clamp, set temperature to that noted in step 3 and reconnect wiring.
6. Replace lower access cover.
7. Restore power and test operation.

Thermostat – Electronic Thermostat (Procedure 7B)

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. *Indoor Models* - Remove gas valve cover **Note:** It will be necessary to disconnect the wiring to the thermostat, temperature sensor and ignition module to allow complete removal of the gas valve cover.

   Outdoor Models - Remove upper access cover and disconnect power supply and sensor multi-pin connectors to thermostat.
3. Remove thermostat retainers from left and right sides of thermostat by pressing on centre lug and sliding retainer towards rear of thermostat Note: On outdoor models it may be necessary to remove the rain shield to provide easier access to retainers.

4. Remove thermostat.
5. Slide replacement thermostat into place ensuring sealing gasket has no twists.
6. Reassemble in the reverse order of above. **Note:** On indoor models ensure the lip on the bottom of the gas control cover engages inside the jacket opening. **Note:** For 631275 models, add a small amount of silicone along the two vertical edges of the cut-out in the air duct where the thermostat panel overlaps as depicted in the opposite illustration.



7. Restore power, adjust set point and check that thermostat parameters are set correctly (refer to 'Eliwell IC902 Controlling Thermostat' section on page 31 or 'AKO Controlling Thermostat' section on page 34).

Flue Terminal (Procedure 8)

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. Remove screws retaining flue terminal to air duct.
3. Remove flue terminal.
4. Reassemble in reverse order of above.
5. Refit access door.

Temperature Sensor Set (Procedure 9)

Note: Temperature sensors must be replaced as a set.

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. *Outdoor Models* - Remove upper access door and disconnect power supply and sensor multi-pin connectors to thermostat. Remove lower access door.

   Indoor Models - Remove gas valve cover **Note:** It will be necessary to disconnect the wiring to the thermostat, temperature sensor and ignition module to allow complete removal of the gas valve cover.
3. *Indoor and Outdoor models* - Remove upper and lower electrical covers.
4. Remove temperature sensors from each pocket.
5. *Outdoor models* - Withdraw cold sensor from conduit.

   Indoor models - Withdraw hot sensor from conduit.

   Note: Attaching a draw wire to the sensor will assist in drawing the replacement sensor through the conduit.
6. *Outdoor models* – Fit replacement cold sensor (blue band on insulation) through the conduit.

   Indoor models – Fit replacement hot sensor (red band on insulation) through the conduit.
7. Insert temperature sensors into relevant pockets. **Note:** Ensure temperature sensor is reinserted all the way to the end of the pocket; the opening should be sealed with silicone to prevent the sensor moving.
8. Complete reassembly in reverse order of above. **Note:** For 631275 models, add a small amount of silicone along the two vertical edges of the cut-out in the air duct where the thermostat panel overlaps as depicted in the illustration shown in step 6 of procedure 7
9. Restore power, test operation and ensure displayed water temperature and actual water temperature match.

Temperature Sensor Pocket (Procedure 10)

1. ***Remove 3 pin plug from GPO and isolate water supply to water heater (note warning on page 86).***
2. ***Relieve pressure from water heater through T&PR valve or a hot tap.***
3. Drain water heater (Refer to Procedure 1).
4. *Outdoor models* - Remove upper or lower access cover depending on which pocket is to be accessed. Note: If removing upper access cover, disconnect power supply and sensor multi-pin connectors to thermostat.
5. *Indoor and Outdoor models* – Remove upper or lower electrical cover depending on which pocket is to be accessed.
6. Remove relevant temperature sensor.
7. Using a 27mm socket, remove pocket.
8. ***Apply thread-sealing tape to pocket thread and tighten.***
9. Refill water heater. Ensure air is purged from cylinder and pipe work.
10. Check for leaks.
11. Reassemble in reverse order of above **Note:** Ensure temperature sensor is reinserted all the way to the end of the pocket; the opening should be sealed with silicone to prevent the sensor moving. **Note:** For 631275 models, add a small amount of silicone along the two vertical edges of the cut-out in the air duct where the thermostat panel overlaps as depicted in the illustration shown in step 6 of procedure 7B.

High Limit – Models with Mechanical Thermostat (Procedure 11A)

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
   Remove upper electrical cover.
2. Disconnect wiring to high limit.
3. Remove screw retaining high limit to bracket and remove high limit.
4. Reassemble in reverse order of above.
5. Restore power and test operation.

High Limit (ECO) – Models with Electronic Thermostat (Procedure 11B)

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. *Outdoor Models* - Remove lower access door.
   Indoor and Outdoor models - Remove lower electrical cover.
   Note: The ECO can be reset by pressing the small button in the centre of the terminals, replacement may not be necessary.
3. Disconnect wiring to ECO.
4. Remove screw retaining ECO to bracket and remove ECO.
5. Reassemble in reverse order of above.
6. Restore power and test operation.

Anode Inspection or Replacement (Procedure 12)

Note: HSI Heavy Duty Gas Water Heaters are fitted with 3 anodes.

1. ***Remove 3 pin plug from GPO & isolate water supply to heater (note warning on page 86).***
2. ***Relieve pressure through a hot tap or T&PR valve.***
3. *Outdoor models* - Remove screws from jacket top and from top of front air duct and remove jacket top, air duct and flue terminal assembly. **Note:** for 631275 models, the air duct may be sealed to the heater jacket using silicone; care should be taken not to damage the air duct when breaking the silicone seal.

   Indoor models - Disengage flue, remove screws from jacket top and remove jacket top, draught diverter and flue damper (if fitted) assembly.
4. Using a 27mm tube or socket spanner, unscrew and remove anode(s).
5. Apply thread sealing tape to anode(s) thread, refit and tighten.
6. Restore water supply and check for leaks.
7. Complete reassembly in reverse order of above. **Note:** for 631275 models installed in an external position, the air duct must have black sealing tape fitted or be sealed to the heater jacket using silicone. In either case an 'L' shaped silicone seal must be made between the rain guard and air duct as depicted in the '631275 Air Duct Silicone Seal Illustration' on page 91. A small amount of silicone must also be added along the two vertical edges of the cut-out in the air duct where the thermostat panel overlaps as depicted in the illustration shown in step 6 of procedure 7
8. Restore power supply.

631275 Air Duct Silicone Seal Illustration

When reinstalling the air duct on 631275 models located in an external position, an 'L' shaped silicone seal must be made between the rain guard and air duct as depicted opposite.

NOTE: Look through the cut-out for the thermostat display in the air duct to check that the silicone is completely sealing the gap between the air duct and bracket.

THE GAP BETWEEN THE RAINGUARD & THE AIR DUCT MUST BE FULLY SEALED.

When replacing the jacket top;

This gap SHOULD be sealed

Do NOT seal the gap between the terminal and the jacket top

Temperature & Pressure Relief Valve Replacement (Procedure 13)

Never fit a T&PR valve with a rating higher than that indicated on the water heater rating label. Do not use reconditioned T&PR valves

1. ***Remove 3 pin plug from GPO & isolate water supply to heater (note warning on page 86).***
2. ***Relieve pressure from water heater through T&PR valve or a hot tap.***
3. Remove drain line from T&PR valve.
4. Unscrew T&PR valve and remove. ***A quantity of hot water will discharge from the tank during this process. Personal Protective Equipment should be worn to prevent scalds or burns.***
5. Confirm replacement T&PR valve is the correct rating and refit using thread tape.
6. Refit drain line.
7. Close hot tap and restore water supply.
8. Check T&PR valve thread for leaks.
9. Operate T&PR valve lever to reset relief drain.
10. Purge air from system through hot taps.
11. Restore power and water supplies.

Dip Tube Replacement (Procedure 14)

1. ***Remove 3 pin plug from GPO & isolate water supply to heater (note warning on page 86).***
2. ***Relieve pressure from water heater through T&PR valve or a hot tap.***
3. Disconnect hot water line from the outlet of water heater. ***A quantity of hot water will discharge from the outlet during this process. Personal Protective Equipment should be worn to prevent scalds or burns.***
4. Using a flat blade screwdriver gently split outer rim at top and bottom of dip tube face and prise dip tube out from cylinder fitting.
5. Fit replacement dip tube into cylinder fitting ensuring the dip tube flat section lines up with fitting flat section (dip tube facing up) and gently drive dip tube into fitting a short distance.
6. Apply thread tape to plumbing fitting and refit; this step will push dip tube into correct location.
7. Reconnect hot water line and restore water supply.
8. Purge air from system through hot taps.
9. Restore power.

Components Specific to 621275

Flue Damper Assembly (Procedure 15)

NOTE: A blown fuse in the flue damper does NOT indicate a fault with the damper. The fault may be with the ignition module, gas valve, thermostat or damaged wiring.

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. Remove upper and lower electrical covers.
3. Disconnect wiring to flue damper (lower electrical opening) and attach a draw wire. Note wiring connections for reconnection of replacement flue damper wiring.
4. Withdraw wiring loom out from conduit at upper electrical opening.
5. Withdraw wiring loom up through jacket top. Note: It may be necessary to open up the insulation between upper electrical opening and jacket top to allow wiring to pass through.
6. Disengage flue and remove draught diverter.
7. Remove screws holding flue damper assembly to jacket top and remove damper assembly.
8. Reassemble in reverse order of above.
9. Restore power and test operation.

Flue Damper Actuator (Procedure 16)

1. Follow steps 3 – 5 of procedure 15.
2. Remove screws retaining actuator to flue damper assembly and remove actuator.
3. Reassemble in reverse order of above. **Note:** Ensure the butterfly shaft engages the actuator shaft correctly when refitting the actuator. The butterfly should be in the open position.
4. Restore power and test operation.

COMPONENTS SPECIFIC TO 631275

The fan motor, capacitor, relay, relay base, pressure switch and impulse tube all form part of the 'fan module' assembly which is mounted in the air duct assembly on the front of the water heater.

Pressure Switch (Procedure 17)

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. Remove upper access door and disconnect power supply and sensor multi-pin connectors to thermostat.
3. Remove fan module wiring cover (1 screw) **Note:** Access fan module wiring cover through upper opening in air duct.
4. Disconnect wiring from pressure switch. Note position of wiring connections for reconnection of replacement pressure switch.
5. Remove retaining screws (2), withdraw pressure impulse tube from fan chamber and remove pressure switch.
6. Remove pressure impulse tube and inspect for splits or damage. If undamaged fit to replacement pressure switch ensuring tube is on correct side.
7. Reassemble in reverse order of above. **Note:** Ensure pressure impulse tube is reinserted into fan chamber and that there are no kinks in tube.
8. Restore power and test operation.

Impulse Tube (Procedure 18)

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. Remove upper access door and disconnect power supply and sensor multi-pin connectors to thermostat.
3. Remove fan module wiring cover (1 screw) **Note:** Access fan module wiring cover through upper opening in air duct.
4. Disconnect tube from pressure switch and withdraw tube from fan chamber.
5. Reassemble in reverse order of above. **Note:** Ensure pressure impulse tube is reinserted into fan chamber and that there are no kinks in tube. **Note:** Add a small amount of silicone along the two vertical edges of the cut-out in the air duct where the thermostat panel overlaps as depicted in the illustration shown in step 6 of procedure 7B.
6. Restore power and test operation.

Relay Base (Procedure 19)

1. Follow steps 1 ~ 6 of procedure 21.
2. Remove fan module wiring cover (1 screw).
3. Disconnect wiring from relay base. Note position of wiring connections for reconnection of replacement base.
4. Remove retaining screws (2) and remove relay base.
5. Reassemble in reverse order of above. **Note:** When refitting the air duct a bead of silicone MUST be applied to both edges where air duct engages heater jacket to prevent water ingress. **Note:** Add a small amount of silicone along the two vertical edges of the cut-out in the air duct where the thermostat panel overlaps as depicted in the illustration shown in step 6 of procedure 7B.
6. Restore power and test operation.

Relay (Procedure 20)

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. Remove upper access door and disconnect power supply and sensor multi-pin connectors to thermostat.
3. Remove fan module wiring cover (1 screw) **Note:** Access fan module wiring cover through upper opening in air duct.
4. Unplug relay from relay base.
5. Reassemble in reverse order of above. **Note:** for models installed in an external position, the air duct must have black sealing tape fitted or be sealed to the heater jacket using silicone. In either case an 'L' shaped silicone seal must also be made between the rain guard and air duct as depicted in the '631275 Air Duct Silicone Seal Illustration' on page 91. A small amount of silicone must also be added along the two vertical edges of the cut-out in the air duct where the thermostat panel overlaps as depicted in the illustration shown in step 6 of procedure 7B.
6. Restore power and test operation.

Fan Motor Replacement (Procedure 21)

1. ***Remove 3 pin plug from GPO (note warning on page 86).***
2. Remove lower access door.
3. Disconnect wiring to ignition module and door switch.
4. Remove upper access door and disconnect power supply and sensor multi-pin connectors to thermostat.
5. Remove screws securing air duct. **Note:** It is not necessary to remove screws around base of air duct or the screw securing cord bracket to jacket.
6. Pull air duct out at bottom then slide down to disengage from top air duct. **Note:** The air duct may be sealed to the heater jacket using silicone; care should be taken not to damage the air duct when breaking the silicone seal.
7. Remove 4 screws (2 at front and 1 on each side of air duct) and remove fan module. **Note:** Support fan module when removing screws to prevent module from falling and being damaged.
8. Remove fan module wiring cover (1 screw) and disconnect fan motor wiring. Note position of wiring connections for reconnection of replacement motor.
9. Remove fan motor support bracket (4 screws).
10. Remove fan motor from bracket (4 screws).
11. Reassemble in reverse order of above. **Note:** for models installed in an external position, the air duct must have black sealing tape fitted or be sealed to the heater jacket using silicone. In either case an 'L' shaped silicone seal must also be made between the rain guard and air duct as depicted in the '631275 Air Duct Silicone Seal Illustration' on page 91. A small amount of silicone must also be added along the two vertical edges of the cut-out in the air duct where the thermostat panel overlaps as depicted in the illustration shown in step 6 of procedure 7B.
12. Restore power and test operation.

Capacitor Replacement (Procedure 22)

1. Follow steps 1 – 6 of procedure 21.
2. Remove fan module wiring cover (1 screw).
3. Disconnect capacitor wiring. Note position of wiring connections for reconnection of replacement capacitor.
4. Undo capacitor retaining nut and remove capacitor.
5. Reassemble in reverse order of above. **Note:** When refitting air duct a bead of silicone MUST be applied to both edges where air duct engages heater jacket to prevent water ingress.
6. Restore power and test operation.

OPTIONAL BMS MODULE COMPONENT REPLACEMENT PROCEDURES

The BMS module is optional and may not be fitted.

BMS Module Replacement Complete – (Procedure 23)

This procedure details complete removal and replacement of the BMS Module. To replace the BMS module PCB only refer to procedure 25.

1. ***Remove heater 3 pin plug from GPO and isolate BMS power supply to BMS module (note warning on page 86).***
2. *Outdoor Models* - Skip this step.

   Indoor Models - Remove the gas valve cover **Note:** It will be necessary to disconnect the wiring to the thermostat, temperature sensor and ignition module to allow complete removal of the gas valve cover.
3. Remove the lower electrical cover.
4. Disconnect BMS module earth wire from earth terminal located behind lower electrical cover.
5. Disconnect BMS module blue wire from 4 way terminal block located behind lower electrical cover.
6. Disconnect BMS module orange wire from 4 way terminal block located behind lower electrical cover.
7. Disconnect red wire spade connector from ECO.
8. Disconnect ECO red wires from the red wire removed in previous step (at male at female spade connector joiner).
9. Disconnect BMS module brown wire piggy back spade terminal from gas valve and separate brown wire from piggy back spade terminal.
10. Remove nut from conduit gland and withdraw conduit gland and BMS module wiring from conduit gland bracket and lower electrical cover.
11. Disconnect BMS wiring from BMS module (or disconnect BMS connecting plug).
12. Remove two screws retaining BMS module and remove BMS module complete with conduit and wiring harness.
13. Reassemble in reverse order of above.

BMS Module Glass Fuse Replacement – (Procedure 24)

1. ***Remove heater 3 pin plug from GPO and isolate BMS power supply to BMS module (note warning on page 86).***
2. Remove four Phillips head screws retaining BMS module cover and remove cover.
3. Remove glass fuse from PCB fuse holder.
4. Reassemble in reverse order of above.

BMS Module PCB Replacement – (Procedure 25)

1. ***Remove heater 3 pin plug from GPO and isolate BMS power supply to BMS module (note warning on page 86).***
2. Remove four Phillips head screws retaining BMS module cover and remove cover.
3. Mark and disconnect all wiring from PCB.
4. Remove two Phillips head screws retaining PCB to enclosure base.
5. Using a pair of long nose pliers, gently depress the locking barbs on PCB plastic stand-offs retaining PCB to enclosure base and pull PCB away from stand offs.
6. Reassemble in reverse order of above.

BMS Module Gas Valve Input Relay Replacement – (Procedure 26)

1. ***Remove heater 3 pin plug from GPO and isolate BMS power supply to BMS module (note warning on page 86).***
2. Remove four Phillips head screws retaining BMS module cover and remove cover.
3. Mark and disconnect wiring from gas valve input relay.
4. Pull relay away from BMS enclosure and remove double sided tape from relay.
5. Reassemble in reverse order of above.

BMS Module Battery Replacement – (Procedure 27)

The BMS module battery is a CR2302 3V lithium battery and is not required for operation with HSI Heavy Duty Gas Water Heaters.

1. ***Remove heater 3 pin plug from GPO and isolate BMS power supply to BMS module (note warning on page 86).***
2. Remove four Phillips head screws retaining BMS module cover and remove cover.
3. Gently slide battery out downwards from battery holder retaining arm.
4. Reassemble in reverse order of above.

DOCUMENT REVISION HISTORY

Title: - Service Instructions For Rheem Heavy Duty Gas	Document Number:	TM011

Revision	Details of change	D.O.I.
A	Service Instructions issued for HSI Heavy Duty Gas models	03/06
B	AKO Thermostat change.	08/09
C	Warranty Statement removed and Outdoor Installation drawing clarified.	07/13
D	Exploded views and replacement parts lists removed, now form part of SPM-COMM Commercial Spare Parts Manual. Eliwell IC902 thermostat information added.	09/13
AE	Flow charts in new format and total rewrite of Service Instructions. Addition of Mechanical Thermostat information (models manufactured before 02/11/2001). Addition of Product Safety Recall & Rework information for 621275 models. Weather Sealing update for 631275 models. HSI igniter change. Addition of BMS module information.	12/14
AF	White Rodgers HSI ignition module replaced with Pactrol P25	09/15
AG	Gas valve circuit check clarified in Product Changes' section	11/15

NOTE: Every care has been taken to ensure accuracy in preparation of this publication. No liability can be accepted for any consequences which may arise as a result of its application.