Rheem Australia Pty Ltd

ABN 21 098 823 511

SERVICE INSTRUCTIONS

PowerStore Variable Power Electric Water Heater

TM096

Solahart

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315PVV36

CONTENTS

INTRODUCTION

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

Should you require further technical advice on a Solahart PowerStore Variable Power Electric Water Heater contact Rheem Technical Support on 1300 712 863.

SAFETY WARNINGS

The purpose of this Service Manual is to provide sufficient information to allow a person with the skills as required by the controlling Regulatory Authorities to carry out effective repairs to a Solahart PowerStore Variable Power Electric Water Heater (VPEWH) 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.

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 the instructions accompanying the symbol.

Live Testing

A number of test procedures detailed within this document require 'live' testing to be conducted.

All State and Territory Authorities stipulate requirements that must be met before working live i.e. conducting a risk assessment and/or preparing a safe work method statement and wearing appropriate PPE.

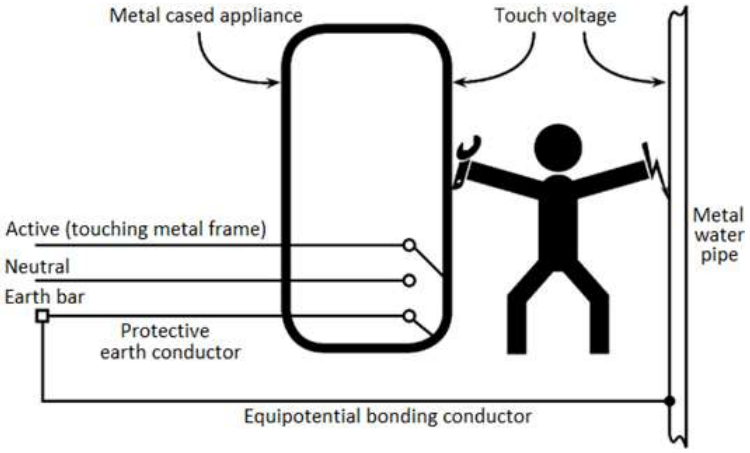
It is the responsibility of the service person to be aware of and comply with the requirements of the State or Territory where the water heater is installed before working 'live'.

Under certain fault conditions it is possible for the metal jacket of a water heater to become live. To check for a shock hazard in a suspect installation, a Touch Voltage Test must be performed (refer page 4).

Touch Voltage Testing

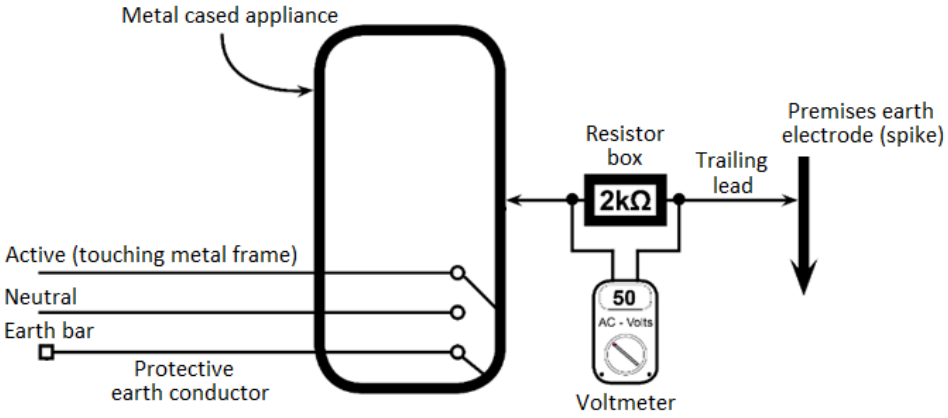
Under certain fault conditions it is possible for the metal jacket of a water heater to become live. The electrical fault may be an internal appliance issue or an issue with the premises wiring.

In the example opposite, the appliance metal jacket has become live due to the appliance active wire touching the metal frame.



To check for a shock hazard in a suspect installation, a **Touch Voltage Test** must be performed using the following equipment:

1. A high impedance multimeter with an input impedance greater than 5 Megaohm.
2. A 2 kΩ resistor box fitted with contact terminals (the 2 kΩ resistor is used to simulate the body resistance of a typical person).
3. A long trailing lead for connection to the premises earth electrode.



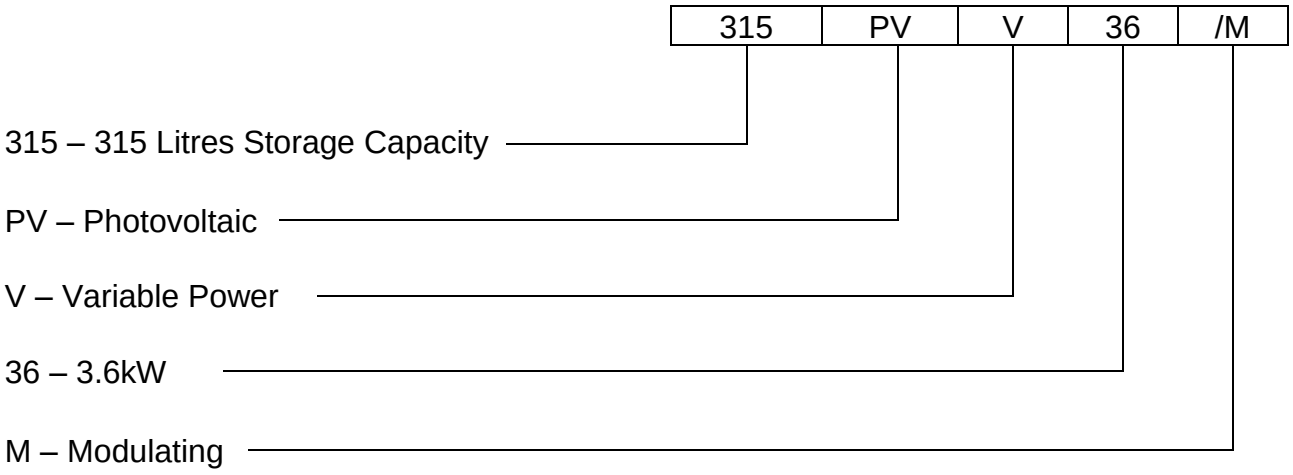
Procedure

Personal Protective Equipment (electrical insulating gloves) should be worn when conducting this procedure to reduce the risk of electric shock.

1. Connect resistance box between metal casing of appliance and premises main earth electrode (spike) using the long trailing lead (as depicted above).
2. Connect multimeter (set on AC voltage scale) to resistor box terminals and record reading.
3. If reading is higher than 50 VAC (dry) or 25 VAC (wet), then there is a fault either with the premises wiring or with the appliance.
4. To confirm earthing of the appliance:
   - Electrically isolate appliance from electrical circuit.
   - Conduct an earth continuity test to AS/NZS 3760 (pay particular attention to the cordset earth on plug-in water heaters).
   - If the earth continuity test is ok (≤ 0.5 ohms), the problem is with the premises wiring.

MODEL IDENTIFICATION

All identification numbers are designed to convey detailed information about the water heater to which it is attached. Model number, serial number and date of manufacture should be quoted in all correspondence.



SPECIFICATIONS

General

Model		315PVV36
Rated Capacity		315 L
Maximum Water Supply Pressure (1)	With ECV	680 kPa
	Without ECV	800 kPa
Water Connections	Cold Inlet	RP¾/20
	Hot Outlet	RP¾/20
	T&PR	RP½/15
Electrical	Power Supply	240 VAC 50 Hz Hard Wired
	Nominal Power Max	3.6 kW
	Nominal Current Max	15 A
Water Temperature Setting (2)		75°C ~ 85°C
Communication Protocols (using PLT or RS485 connection)		TCP/IP (PLT) or Modbus (RS485)

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

(2) 75°C during normal operation via master controller. 80°C (± 5°C) via mechanical thermostat(s) when operating in a fault mode or independent Legionella sterilisation mode.

Water Heater Components

Model		315PVV36
T&PR Valve		1000 kPa
Anode Length		1395 mm
Master Controller		Solahart
Master Controller CT Resistance		56.6 ohms
Top Heating Unit (3)	Fixed Power Element 1 Rating	850 W
	Fixed Power Element 2 Rating	1700 W
	Variable Power Element Max	1050 W
Bottom Heating Unit (3)	Fixed Power Element 1 Rating	850 W
	Fixed Power Element 2 Rating	1700 W
	Variable Power Element Max	1050 W
Temperature Sensors	Top Temp Sensor	All temperature sensors have identical temperature/resistance characteristics. Refer to temperature/resistance table on page 65
	Mid Temp Sensor	
	Bottom Temp Sensor (4)	
	Legionella Temp Sensor (4)	
Top PCB	Fitted with R1, R2 & R3 Relays	Solahart
Bottom PCB	Fitted with R4 & R5 Relays	Solahart
Top Mechanical Thermostat	Make	Robertshaw ST1205134P (select)
	Nominal Setting	Opens 80°C ± 5°C. Closes @ 74 ~ 70°C
	ECO	Trips @ 87 ~ 93°C. Manual reset @ 82°C
Bottom Mechanical Thermostat	Make	Robertshaw ST1205134P (051009)
	Nominal Setting	Opens 80°C ± 5°C. Closes @ 74 ~ 70°C
	ECO	Trips @ 87 ~ 93°C. Manual reset @ 82°C

(3) Only one heating unit can operate at a time.

(4) Single unit dual sensor comprised of bottom temperature sensor and Legionella temperature sensor.

INSTALLATION

Solahart PowerStore Variable Power Electric Water Heaters are suitable for indoor or outdoor installation and must be installed in accordance with AS/NZS 3000, AS/NZS 3500.4, all local codes and regulatory authority requirements and the Installation Instructions supplied with the water heater and any ancillary components.

Note: If the water heater is installed without either an external control device or connection to a home energy management system (HEMS), then it will operate as a conventional twin element electric water heater only.

PREVENTATIVE MAINTENANCE

Servicing must be performed by a suitably qualified person.

Annual Service

It is suggested for peak performance that the water heater be serviced annually.

1. Check for discharge from the T&PR valve. When the element 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.
2. Check for discharge from the ECV if fitted. When the element 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.
3. Check for leaks at all tank fittings.
4. Check for signs of excessive corrosion on the water heater jacket.
5. Visually check the unit for any potential problems.
6. If a safe tray is installed, check to ensure the drain pipe is not blocked.
7. Ensure master controller fins and sunshield have adequate airflow and are free of insects/debris.
8. ***Isolate power*** to the water heater and check all electrical connections for signs of overheating due to poor connection.
9. Confirm correct system operation.

Major Five Year Service

It is recommended that a major five year service be conducted on the water heater.

Note: The five year service and routine replacement of any components, such as the anode and relief valve(s), are not included in the Solahart warranty. A charge is to be made for this work. Only genuine replacement parts should be used on the water heater.

1. Replace the T&PR valve.
2. Inspect and flush the expansion control valve (if fitted). If required, replace the valve.
3. Inspect and if required, replace the anode.
4. For water supplies which are either softened or desalinated, or where the water supply may alternate between a water tank and a reticulated public supply or another supply, or where there is a variable supply (e.g. from a bore or public reticulated supply from various water sources), the anode must be inspected (and replaced if there is any sign of depletion) within five years of installation, and within every five years thereafter.

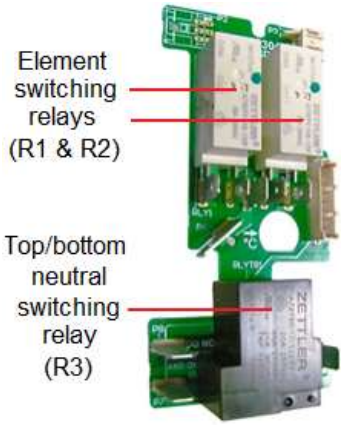
   For all water supplies, if the anode is not replaced during a major service then in any event, the anode must be replaced at ten years. Refer to the 'Anode Inspection and Replacement' section in the Owner's Guide and Installation Instructions for full details.
5. Check electric heating units for excessive calcium build up or corrosion and replace if necessary.
6. Perform steps 3 ~ 9 of 'Annual Service' on page 7.

Master Controller: An electronic device utilised to control water heater operation during normal operation. Refer to 'Master Controller' on page 32 for more information.

Sunshield: A plastic cover that fits over the master controller to provides sun/heat protection.

Current Transformer (CT): An electrical device that is connected to the master controller and utilised for water heater power consumption measurements.

Top PCB: A PCB located behind the top heating unit access cover comprised of three relays that is connected to and controlled by the master controller.



The two element switching relays (R1 & R2) are utilised to switch the supply of electrical energy to the fixed power 850 W and 1700 W top heating unit elements, whilst the neutral switching relay (R3) switches the neutral supply between the top and bottom heating units to ensure only one heating unit is operational at any time.

The top temperature sensor, top heating unit and top mechanical thermostat are connected to the top PCB.

Bottom PCB: A PCB located behind the bottom heating unit access cover comprised of two element switching relays (R4 & R5) that is connected to and controlled by the master controller, and utilised to switch the supply of electrical energy to the fixed power 850 W and 1700 W bottom heating unit elements. The bottom PCB is similar to the top PCB but does not have the additional neutral switching relay.

The dual bottom temperature/Legionella temperature sensor, mid temperature sensor, bottom heating unit and bottom mechanical thermostat are connected to the bottom PCB.

Heating Units: A tubular device containing three electric resistance elements that convert electrical energy to heat. A VPEWH has two heating units; one heating unit is located in the top section of the tank and the other near the bottom of the tank. Only one heating unit can be energised at a time.

Each heating unit has three elements; two fixed power elements (850 W and 1700 W) and a single variable power element (1050 W).

Temperature Sensors: Thermistor type sensors are utilised to sense the water temperature at various locations against the storage tank face and are monitored by the master controller. The resistance value of each sensor will change according to the detected temperature, and the master controller uses the resistance value, which has a corresponding temperature value, to determine mode of operation. There are three temperature sensors which have identical temperature/resistance characteristics and are located at the following positions on the storage tank:

- Bottom temperature sensor and Legionella temperature sensor. This is a single unit dual sensor comprised of the bottom temperature sensor and Legionella temperature sensor. The bottom temperature sensor is used for bottom heating unit monitoring/control and Legionella sterilisation monitoring/control. The Legionella temperature sensor is used for independent (backup) Legionella sterilisation monitoring/control.

- Mid temperature sensor. Used for tank heat monitoring and heating calculations.
- Top temperature sensor. Used for top heating unit monitoring/control.

Mechanical Thermostats: During normal operation, the water temperature is maintained by the master controller which utilises temperature sensors to determine the water temperature at various locations in the storage tank.

Top and bottom mechanical thermostats are also fitted to the water heater and are utilised to control water temperature in case the master controller fails, or enters critical fault mode or disable mode. Each thermostat's controlling contacts are set at 80°C and ***MUST NOT*** be altered.

Each mechanical thermostat has an integral double pole manual reset over temperature cut-out (ECO) to provide additional over temperature protection in case the mechanical thermostat controlling contacts fail.

The ECO contacts open at 87 ~ 93ºC. The ECO will not reset automatically and must be manually reset by pressing and releasing the ECO reset button after temperatures have fallen to a safe level (≤ 82°C). ***DETERMINE CAUSE OF OPERATION*.**

Temperature and Pressure Relief (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.

Expansion Control Valve (ECV): A valve designed to provide automatic relief by discharging water in case of excessive pressure. Commonly utilised in areas with poor water quality in which case the pressure relief valve provides a safety back up.

The expansion control valve pressure rating must not exceed 80% of the T&PR valve rating

Pressure Limiting Valve (PLV): A valve that controls its outlet pressure to a predetermined limit.

Outlet Delivery Tube (Dip Tube): A plastic tube installed in the hot water outlet of the water heater cylinder to conduct water from the highest point to the outlet connection. It also acts as a fitting liner.

Inlet Delivery Tube (Dip Tube): A plastic tube installed in the cold water inlet of the water heater cylinder to assist with stratification. It also acts as a fitting liner.

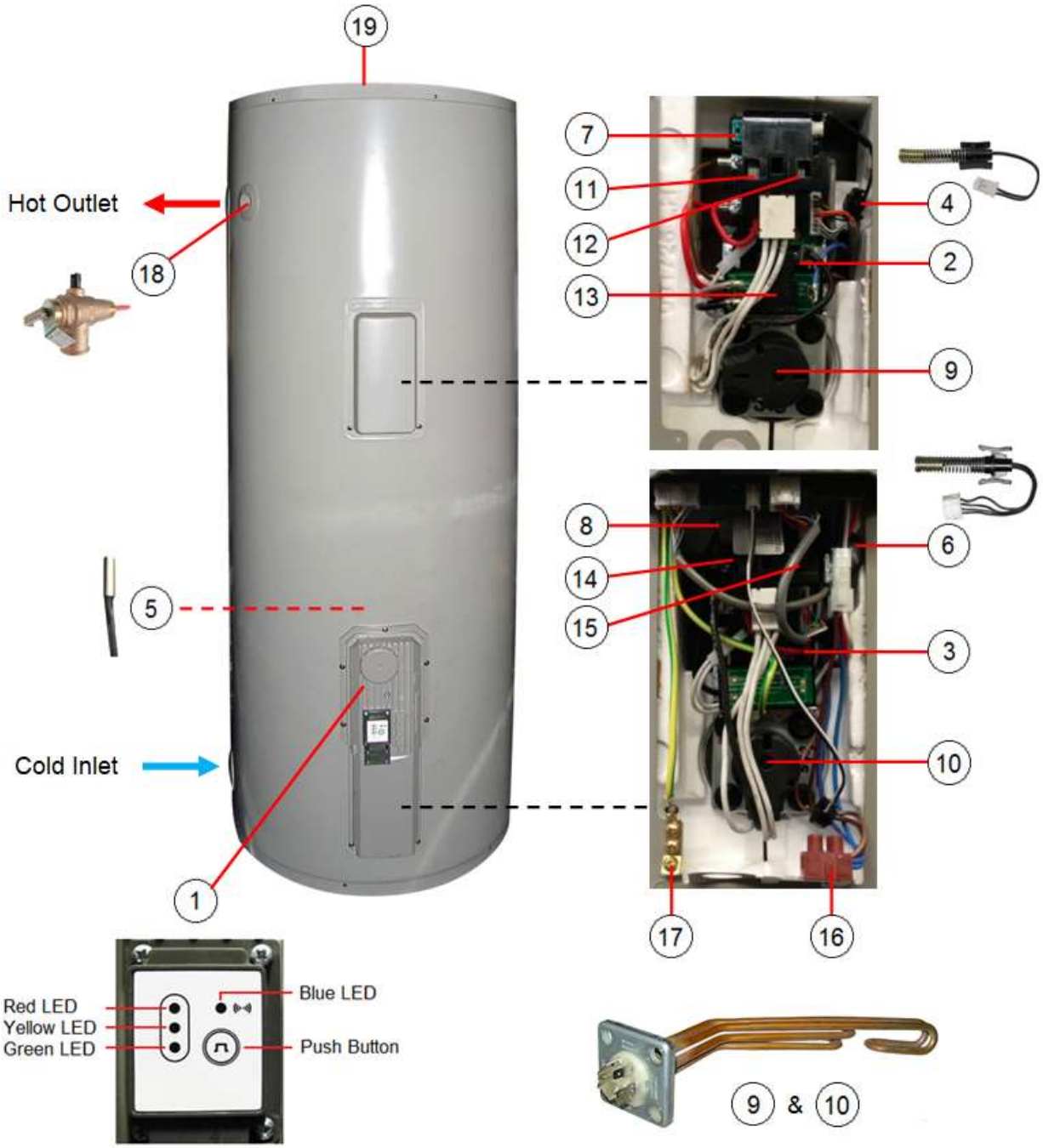
Diffuser: A plastic device installed in the cold water inlet of the water heater cylinder to assist with stratification. It also acts as a fitting liner.

Fitting Liner: A plastic tube installed in the cold-water inlet of the water heater to provide protection against corrosion throughout the life of the water heater.

Anode (Sacrificial): A metal alloy electrode installed in the water heater cylinder that by galvanic action protects the cylinder from corrosion.

Rating Label: The rating label details the model number, serial number and other specifications and is located on the left hand side of the water heater above the hot water outlet.

Component Overview Diagram



1	Master Controller (sunshield not shown)	11	R1 Relay (on top PCB - Switches 850W element)
2	Top PCB	12	R2 Relay (on top PCB - Switches 1700W element)
3	Bottom PCB	13	R3 Relay (on top PCB - Switches element neutrals
4	Top Temperature Sensor	14	R4 Relay (on bottom PCB - Switches 850W element)
5	Mid Temperature Sensor	15	R5 Relay (on bottom PCB - Switches 1700W element)
6	Bottom/Legionella Temperature Sensor	16	Power Supply Terminal Block (A & N)
7	Top Mechanical Thermostat	17	Power Supply Earth Connection
8	Bottom Mechanical Thermostat	18	T&PR Valve
9	Top Heating Unit *	19	Anode
10	Bottom Heating Unit *		

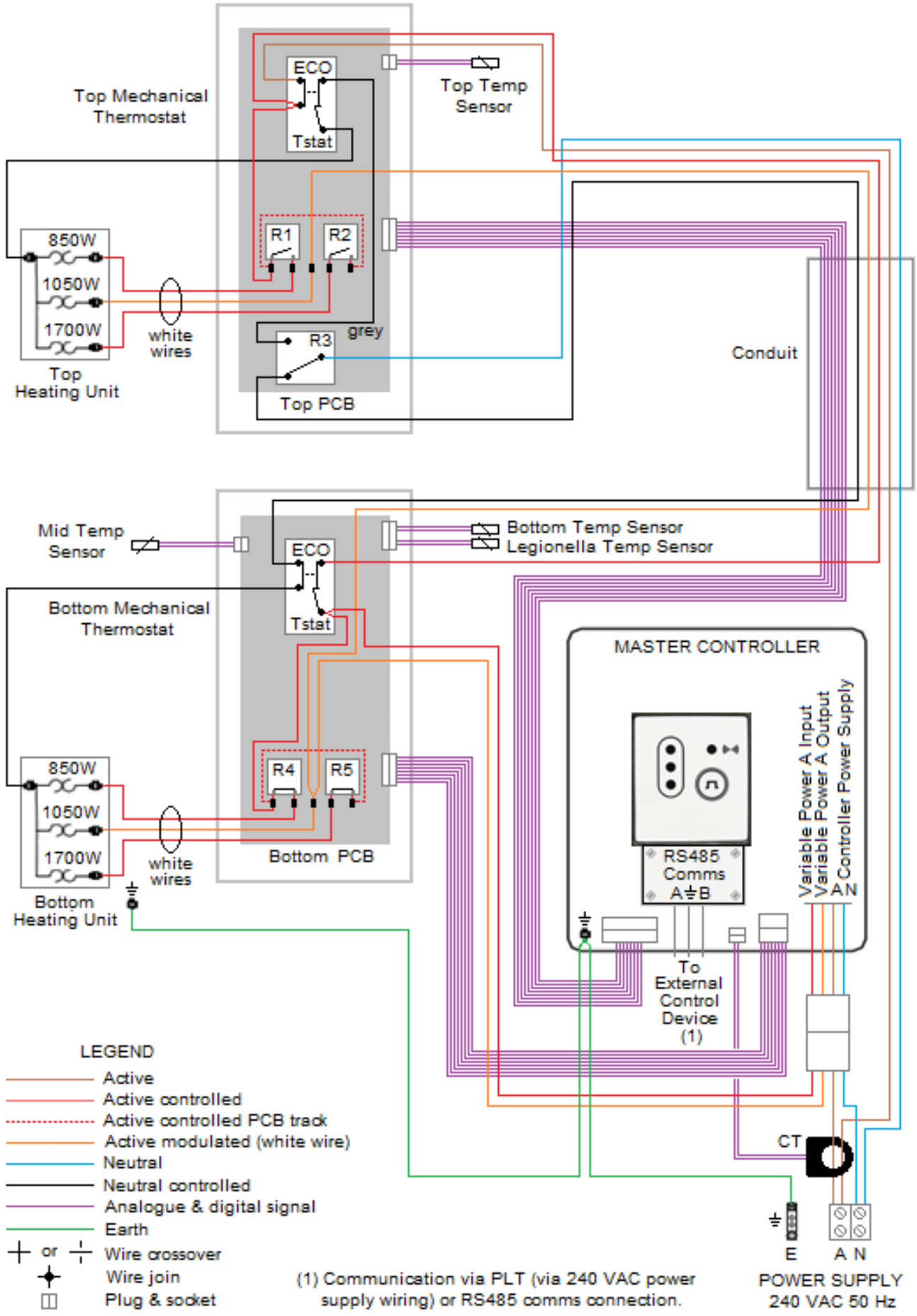
* Each heating unit has three elements (850 W & 1700 W fixed power & 1050 W variable power)

PRODUCT CHANGES

There are no product changes at time of writing other than various software updates.

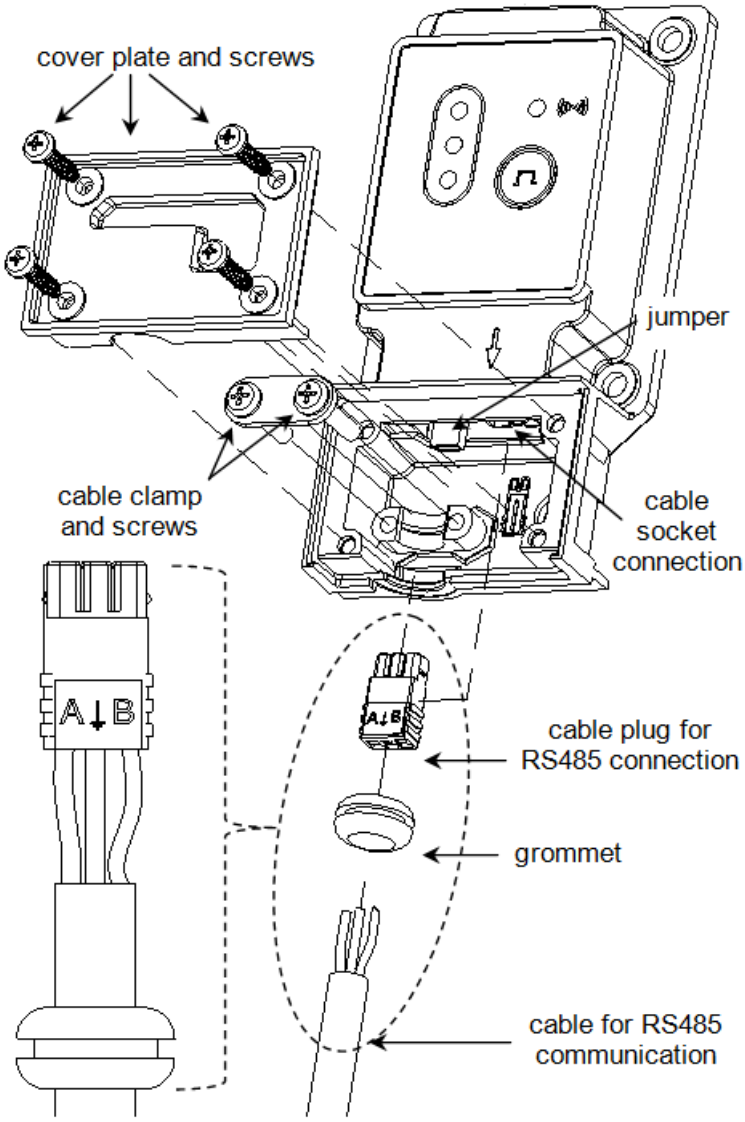
Note: Solahart may, in its discretion, provide remote patches or upgrades to the firmware or software incorporated in the water heater, either directly or through a third-party service provider. Remote upgrades are only possible if the water heater is connected to the internet through an external control device.

Water Heater Wiring Diagram



RS485 Communication Cable Wiring

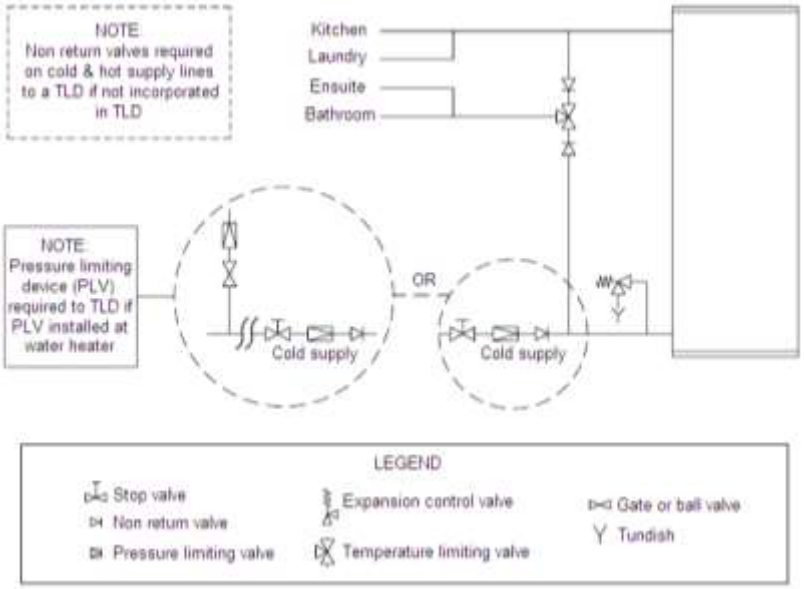
RS485 connection is optional and may or may not be present. Most systems utilise the PLT communication option which is communication via the water heater 240 VAC power supply wiring, in which case an RS485 connection is not required.



Note: The master controller has a termination resistor fitted for RS485 multi-drop applications. The terminator resistor can be removed from the circuit by the removal of the jumper, which is located adjacent to the cable socket connection. The jumper should only be removed in cases where the water heater is part of a multi-drop RS485 installation and the water heater ***is not*** the final node on the RS485 daisy chain.

Typical Installation with Two Temperature Zones Using a TLD

Two Temperature Zones Using A TLD



Notes:

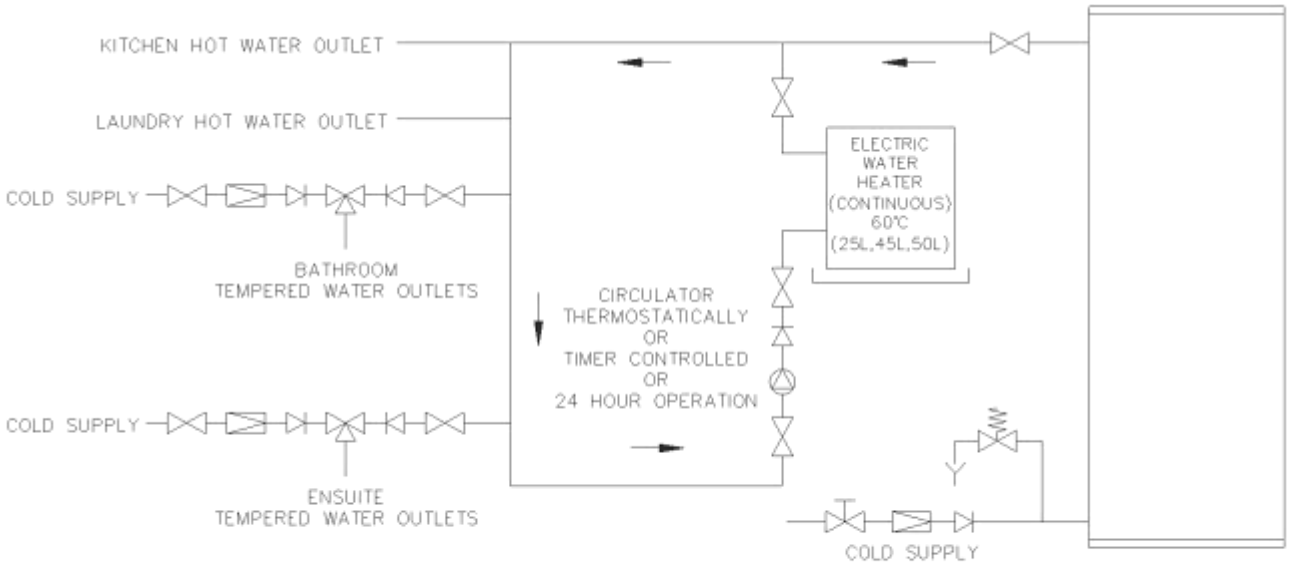
A TLD (temperature limiting device) cannot be installed in circulated hot water flow and return pipe work unless the device is designed for such an application, such as the Rheem Guardian Warm Water System.

The tempered water from a TLD cannot be circulated. Where a circulated hot water flow and return system is required in a building, a TLD can only be installed on a dead leg branching off the circulated hot water flow and return pipe.

Circulated Hot Water Flow & Return System

A VPEWH should not be installed as part of a circulated hot water flow and return system in a building as the benefits of solar gain will be significantly reduced.

If a circulated flow and return system is required, it is necessary to install a secondary water heater supplied from the VPEWH. The flow and return lines connect to the secondary water heater (not the VPEWH). The secondary water heater makes up for pipe heat loss in the flow and return system and must be able to provide a hot water outlet temperature of at least 60°C.



NOTE: A PLV IS REQUIRED TO BE INSTALLED ON THE COLD SUPPLY LINE TO THE TEMPERING VALVE IF A PLV IS INSTALLED ON THE COLD SUPPLY LINE TO THE WATER HEATER.

OPERATION

Operating Instructions

The start up and shut down procedures assume that the water heater is full of water and has been commissioned, and that all valves are positioned to allow water flow through the heater.

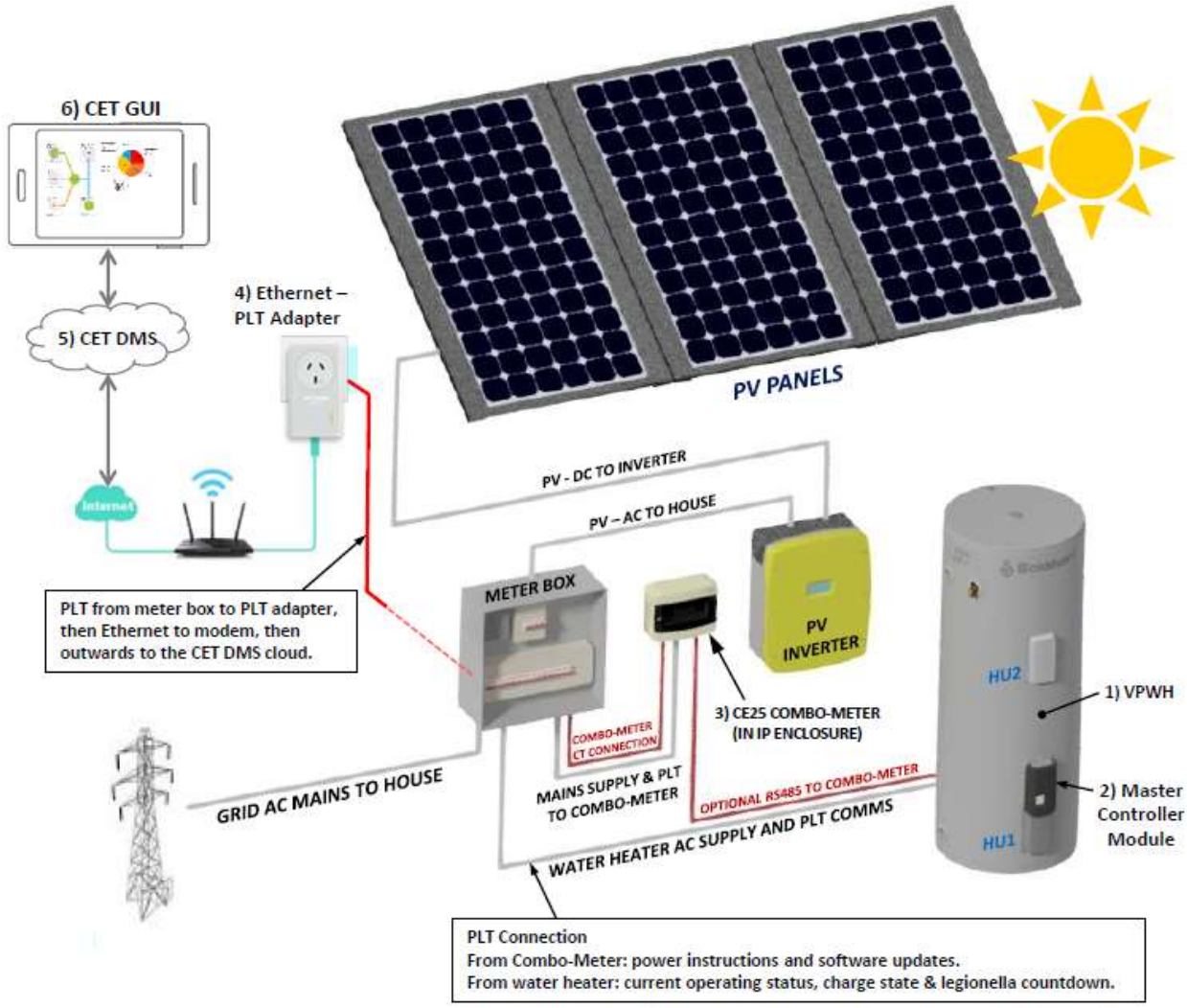
To Turn the Water Heater ON

1. Turn ON circuit breaker/electrical isolator in switchboard marked 'Water Heater'.
2. Turn ON water heater electrical isolator located adjacent to the heater (if installed).

When power is provided to the water heater, it will automatically operate in initialisation mode for 60 seconds after which time it will operate according to the master controller determined mode of operation.

To Turn the Water Heater OFF

1. Turn OFF water heater electrical isolator located adjacent to the heater (if installed).
2. Turn OFF circuit breaker/electrical isolator in switchboard marked 'Water Heater'.



The PowerStore Variable Power Electric Water Heater (VPEWH) utilises excess power generated by a solar PV system, which would otherwise be exported to grid, for water heating.

An external control device (such as the Solahart CET combo-meter) monitors the flow of power to and from the premises and communicates the amount of excess PV power available to the VPEWH master controller via Powerline Telecommunications (via heater 240 VAC power supply wiring) or an RS485 communications line. The VPEWH master controller then adjusts the heating rate to match the available excess power.

150 litres of hot water is maintained regardless of excess PV power availability.

Legionella protection is also ensured regardless of excess PV power availability. A separate electronic circuit, including an independent Legionella temperature sensor, ensures the entire tank is heated to 60°C once every 7 days if such heating has not occurred during normal day to day operation.

In the event of a VPEWH master controller failure, or a component failure that causes the master controller to enter critical fault mode or disabled mode, the water heater defaults to operating as a 2.55kW bottom element water heater controlled by a mechanical thermostat.

For optional monitoring purposes, the system can interface with a third party web monitoring portal (such as the Solahart CET Gateway) via the internet to provide feedback on the PowerStore's performance.

The VPEWH master controller has 11 modes of operation and starts from initialisation mode when power is supplied/restored to the water heater or if the master controller is reset.

1. Initialisation Mode.
2. Standalone Control Mode.
3. External Control Mode – Amenity Maintenance (ECM-AM).
4. External Control Mode – Variable Heating (ECM-VH).
5. Controller Legionella Sterilisation Mode.
6. Independent Legionella Sterilisation Mode
7. Critical Fault Mode.
8. Variable Element Driver Circuit Failure Mode.
9. Disabled Mode.
10. Element Calibration Mode.
11. Factory Test Mode (currently only used during manufacturing end of line testing).

Whilst operating in any normal mode of operation (modes 1 ~ 6 and 10), the master controller continuously monitors the water heater and if a fault is detected the following occurs:

- If a warning fault is detected, the master controller yellow LED illuminates ON solid and a fault code is logged to memory. The heater operates as normal in the current mode of operation, but possibly with impeded functionality depending on the type of fault.
- If a critical fault is detected, The master controller red and yellow LEDs illuminate and flash a fault code and critical fault mode is entered (refer to page 20 for operation when in critical fault mode).

1. Initialisation Mode (Red, yellow & green LEDs undefined flashing)

When 240 VAC power is supplied to the water heater or after a master controller push button fault/service reset, the following actions are performed in the order given:

1. Master controller red, yellow and green LEDs undefined flashing (no defined sequence).
2. Top and bottom PCB relays (R1, R2, R3, R4 and R5) are de-energised within 3 seconds (if reboot was from master controller push button fault/service reset).
3. Master controller performs a self check routine.

If no critical faults are detected at step 3, standalone control mode is entered prior to any other mode of operation.

2. Standalone Control Mode (Green LED 3 flash or ON solid when at temp)

Standalone control mode is entered directly from initialisation mode, or if an external control device has not been connected/detected, or if the last communication with an external control device has been > 30 minutes.

In standalone control mode the VPEWH functions similar to a standard twin heating unit water heater but heating is controlled by the master controller (not the mechanical

thermostats), i.e. the top heating unit is energised (all three elements on full power) until the top temperature sensor detects 75°C. Heating then switches to the bottom heating unit (all three elements on full power) and continues until the bottom temperature sensor detects 75°C at which time all heating ceases.

Bottom heating is maintained between 72°C and 75°C as detected by the bottom temperature sensor, and if top temperature sensor detects ≤ 72°C (i.e. hot water usage), power is redirected to the top heating unit until the top temperature sensor detects 75°C.

Standalone control mode is also the transition mode between changeover from any of the operational modes detailed below (duration of transition is negligibly short).

- After completion of initialisation mode.
- After completion of a Legionella sterilisation mode.
- After exit from critical mode.

Note: Only one heating unit can be energised at any one time i.e. top heating unit or bottom heating unit. Also refer to 'Heating Unit Element Switching & Control' on page 21 for element switching/control methodology.

3. External Control Mode – Amenity Maintenance (ECM-AM) (Green LED 2 flash)

ECM-AM mode is entered if an external control device has been detected by the master controller, and if the top temperature sensor detects ≤ 60°C.

The master controller energises the top heating unit and heats the top 150 litres of water until the top temperature sensor detects 63°C, regardless of excess PV power availability. This ensures a usable amount of hot water is available during periods when little or no excess PV power is available.

When heating in ECM-AM mode, the top heating unit's two fixed power elements (850 W and 1700 W) are energised, with the master controller modulating the rate of power from 0 ~ 1050 W to the top heating unit's third variable power element (1050 W max) according to the amount of excess PV power available (if any). This provides a total heating power input of 2550 W ~ 3600 W.

Also refer to 'Heating Unit Element Switching & Control' on page 21 for element switching/control methodology.

4. External Control Mode – Variable Heating (ECM-VH) (Green LED continuous normal flashing or ON solid when at temp)

ECM-VH mode is entered if an external control device has been detected by the master controller, and if excess PV power is available, and if ECM-AM mode has been satisfied i.e. if the top temperature sensor detects ≥ 63°C.

The master controller energises the top heating unit and heats the top 150 litres of water until the top temperature sensor detects 75°C, at which time the master controller then de-energises the top heating unit and energises the bottom heating unit until the bottom temperature sensor detects 75°C. This provides 315 litres of hot water.

Bottom heating is maintained between 72°C and 75°C as detected by the bottom temperature sensor, and if the temperature at the top temperature sensor falls to ≤ 72°C, power is redirected to the top heating unit until the top temperature sensor detects 75°C.

When heating in ECM-VH mode, a combination of a heating unit's fixed power element energisation (850 W and 1700 W) and variable power element modulation (0 ~ 1050 W) is used according to the amount of excess PV power available as follows:

- 1050 W variable: Provides 0 ~ 1050 W.
- 850 W fixed + 1050 W variable: Provides 850 W ~ 1900 W.
- 1700 W fixed + 1050 W variable: Provides 1700 ~ 2750 W.
- 850 W fixed + 1700 W fixed + 1050 W variable: Provides 2550 W ~ 3600 W.

Note: Only one heating unit can be energised at any one time i.e. top heating unit or bottom heating unit. Also refer to 'Heating Unit Element Switching & Control' on page 21 for element switching/control methodology.

5. Controller Legionella Sterilisation Mode (Green LED 4 flash)

Controller Legionella sterilisation mode is entered if the bottom temperature sensor does not detect ≥ 60°C for a minimum of 33 minutes within a 6 day 14 hour period.

If the top temperature sensor detects < 60°C, the master controller energises the top heating unit (all three elements on full power) until the top temperature sensor detects ≥ 63°C. Heating then switches to the bottom heating unit (all three elements on full power) and continues until the bottom temperature sensor detects ≥ 62.5°C at which time all heating ceases.

Bottom heating is maintained between 60°C and 62.5°C as detected by the bottom temperature sensor, and if top temperature sensor detects ≤ 60°C (i.e. hot water usage), power is redirected to the top heating unit until the top temperature sensor detects 63°C.

Heating continues in this manner until the bottom temperature sensor detects ≥ 60°C for 33 minutes in a single period, after which time standalone mode is entered.

Also refer to 'Heating Unit Element Switching & Control' on page 21 for element switching/control methodology.

6. Independent Legionella Sterilisation Mode (Green LED 4 flash)

The controller has an independent (backup) Legionella circuit and control system to ensure Legionella sterilisation is performed in case there is a failure that prevents the master controller from performing controller Legionella sterilisation mode.

Independent Legionella sterilisation mode is entered if the Legionella temperature sensor does not detect ≥ 60°C for a minimum of 32 minutes within a 6 day 19 hour period. Note that this is 5 hours after controller Legionella sterilisation mode should have occurred. The detection time is also 1 minute less (32 min instead of 33) to prevent unnecessary double sterilisations.

The top PCB and bottom PCB relays are de-energised (if energised), and two of the bottom heating unit's three elements (850W & 1700W fixed power elements) are energised directly by the water heater's 240 V power supply and controlled by the bottom mechanical thermostat i.e. both elements are energised (2550 W total) until the bottom mechanical thermostat contacts open at 80°C (± 5°C). Independent Legionella sterilisation mode heats the entire tank from the bottom up i.e. 315 litres.

Heating continues in this manner until the bottom temperature sensor detects ≥ 60°C for 32 minutes in a single period, after which time standalone mode is entered.

Also refer to 'Heating Unit Element Switching & Control' on page 21 for element switching/control methodology.

7. Critical Fault Mode (Red & yellow LED's provide fault code)

Critical fault mode is entered if the master controller detects a critical fault.

The top PCB and bottom PCB relays are de-energised (if energised), and two of the bottom heating unit's three elements (850W & 1700W fixed power elements) are energised directly by the water heater's 240 V power supply and controlled by the bottom mechanical thermostat i.e. both elements are energised (2550 W total) until the bottom mechanical thermostat contacts open at 80°C (± 5°C). Critical fault mode heats the entire tank from the bottom up i.e. 315 litres.

Also refer to 'Heating Unit Element Switching & Control' on page 21 for element switching/control methodology.

8. Variable Element Driver Circuit Failure Mode (Red & yellow LED's provide fault code 36)

Variable element driver circuit failure mode is entered if the master controller detects excessive temperature at its internal variable element driver heat sink or if the controller's internal variable element driver circuit has failed or short circuited.

The bottom PCB relays are de-energised (if energised), the top PCB relays are energised and two of the top heating unit's three elements (850W & 1700W fixed power elements) are energised by the master controller and controlled by the top mechanical thermostat i.e. both elements are energised (2550 W total) until the top mechanical thermostat contacts open at 80°C (± 5°C). Variable element driver circuit failure mode only heats the top portion of the tank i.e. 150 litres.

Note: The bottom heating unit is prevented from operating because the top relay board top/bottom neutral switching relay is energised providing a N/C neutral circuit for the top heating unit circuit only i.e. bottom heating unit neutral circuit is O/C. Also refer to 'Heating Unit Element Switching & Control' on page 21 for element switching/control methodology.

9. Disabled Mode (No or erratic LED indication)

Disabled mode is entered if a master controller failure occurs.

The top PCB and bottom PCB relays are de-energised (if energised), and two of the bottom heating unit's three elements (850W & 1700W fixed power elements) are energised directly by the water heater's 240 V power supply and controlled by the bottom mechanical thermostat i.e. both elements are energised (2550 W total) until the bottom mechanical thermostat contacts open at 80°C (± 5°C). Disabled fault mode heats the entire tank from the bottom up i.e. 315 litres.

Note: When in disabled mode, the controller may be unable to perform all other modes of operation and some erratic behaviour may result. Also refer to 'Heating Unit Element Switching & Control' on page 21 for element switching/control methodology.

10. Element Calibration Mode (Green LED 5 flash)

The master controller may occasionally perform an element calibration during normal operation or when requested to by the external control device via a third party web monitoring portal (such as the Solahart CET Gateway).

Element calibration normally takes 10 ~ 15 minutes during which time, current and resistance measurements are taken and recorded so that expected power consumption can be estimated as accurately as possible.

11. Factory Test Mode

Currently only used during manufacturing end of line testing. This mode is currently not available when installed.

Heating Unit Element Switching & Control

a) Top heating units are energised when all relays are energised by master controller.

Top variable power element is energised when a) occurs and master controller provides a variable power output.

b) Bottom heating unit elements are energised when all relays are de-energised by master controller (this is also critical fault mode and disable fault mode relay status).

Bottom variable power element is energised when b) occurs and master controller provides a variable power output.

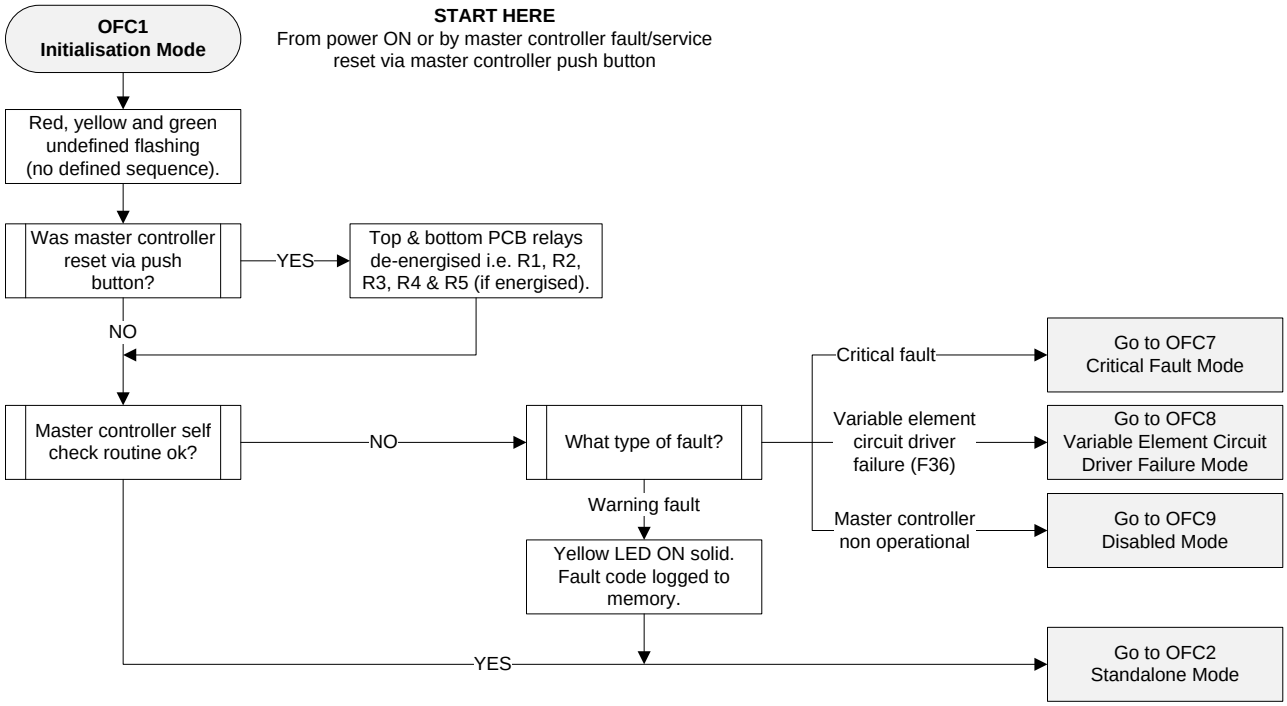
The following tables detail top and bottom PCB relay coil and contact status when the relevant heating unit is energised for all modes of operation.

Top Heating Unit Energised	Relay Coil & Relay Contact Status (1)	Element Powered From
850 W fixed power element	R1 energised (N/O closed) R3 energised (top neutral circuit closed)	Heater 240 VAC power supply via R1 & R3 contacts
700 W fixed power element	R2 energised (N/O closed) R3 energised (top neutral circuit closed)	Heater 240 VAC power supply via R2 & R3 contacts
1050 W variable power element	R3 energised (top neutral circuit closed)	Master controller variable power output

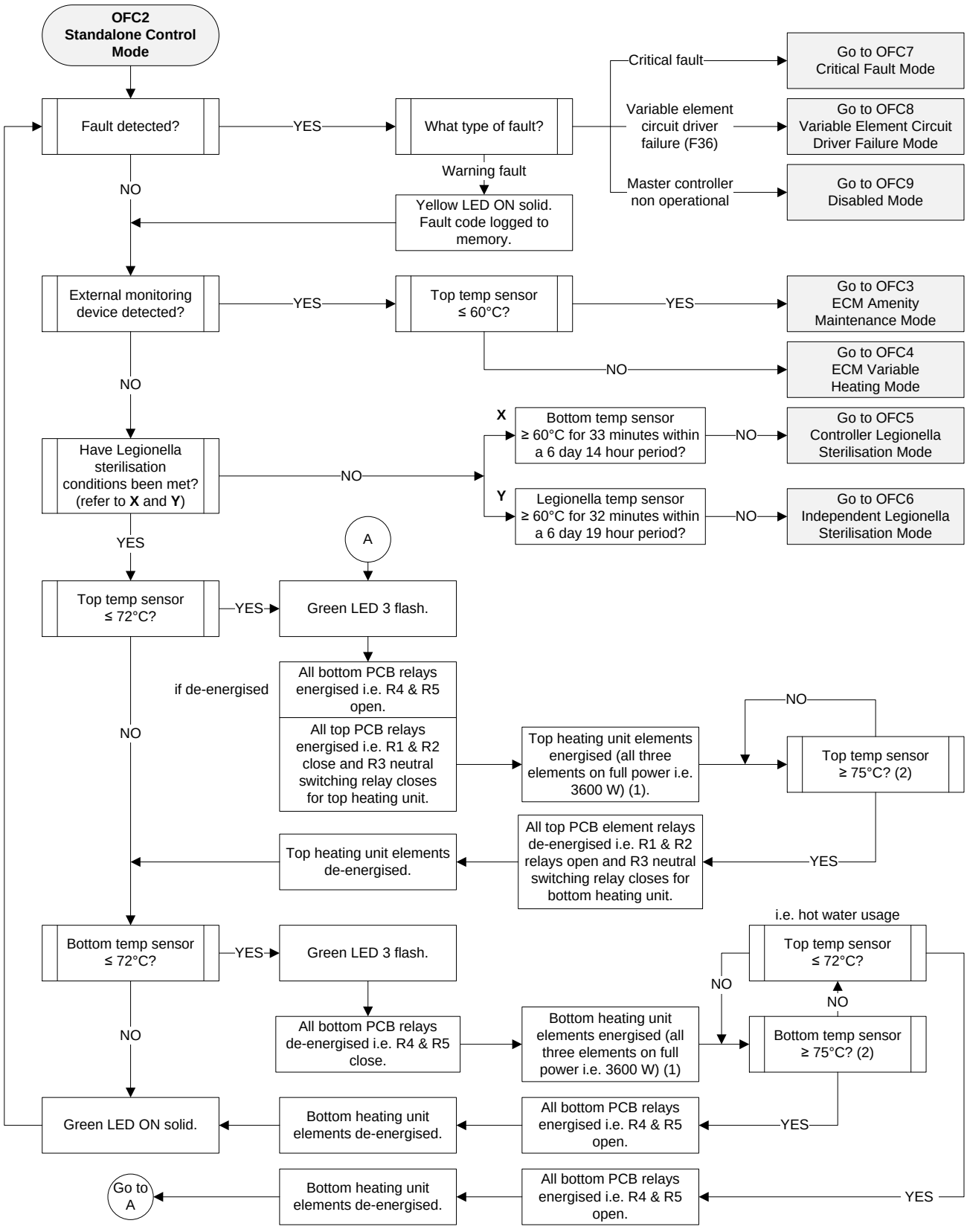
Bottom Heating Unit Energised	Relay Coil & Relay Contact Status (1)	Element Powered From
850 W fixed power element	R4 de-energised (N/C closed) R3 de-energised (bottom neutral circuit closed)	Heater 240 VAC power supply via R4 & R3 contacts
700 W fixed power element	R5 de-energised (N/C closed) R3 de-energised (bottom neutral circuit closed)	Heater 240 VAC power supply via R5 & R3 contacts
1050 W variable power element	R3 de-energised (bottom neutral circuit closed)	Master controller variable power output

(1) Relay coil energised/de-energised by master controller.

OFC1 – Initialisation Mode



OFC2 – Standalone Control Mode

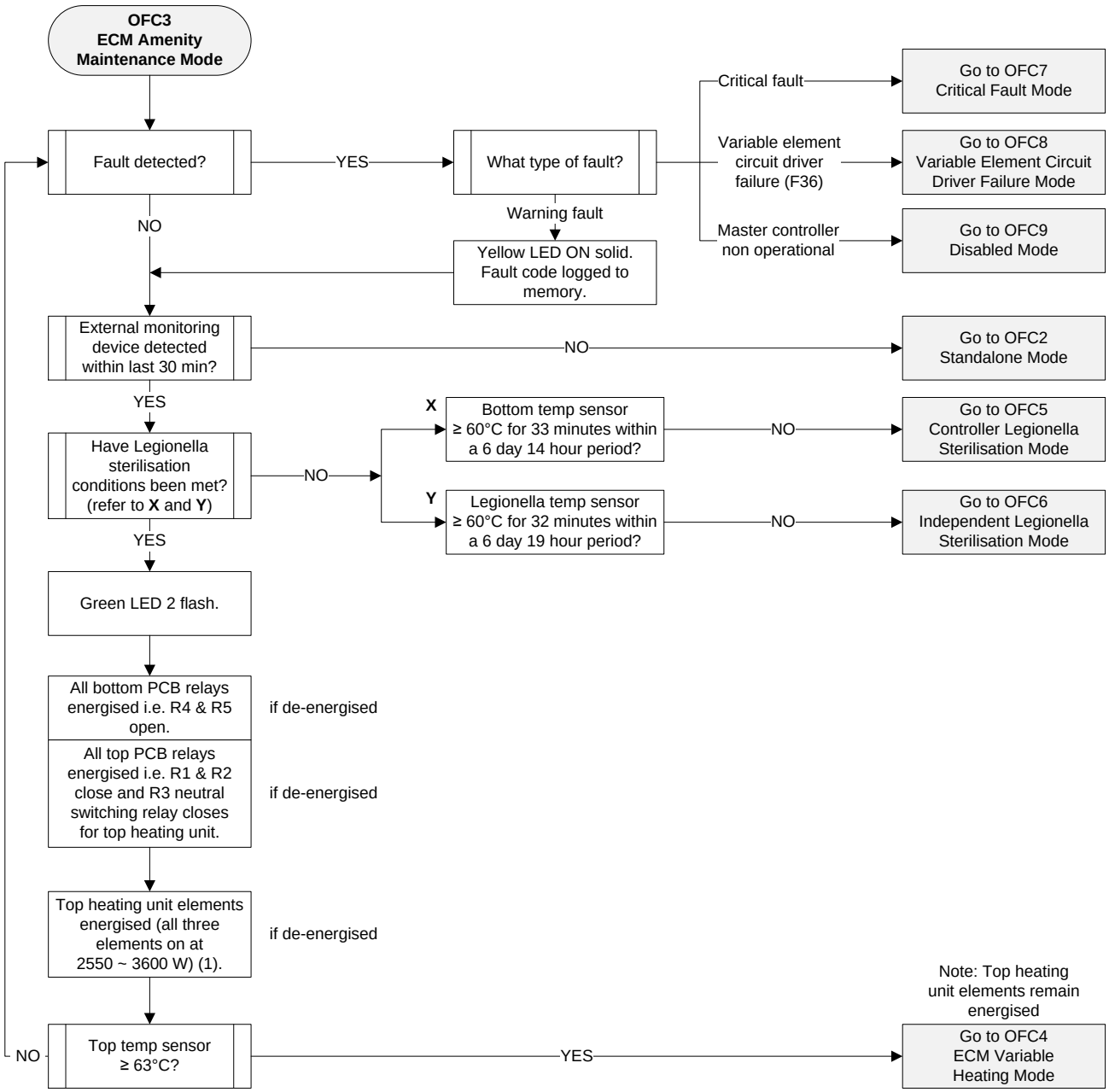


NOTES

(1) 850 W and 1700 W fixed power elements energised directly from heater 240 VAC power supply via mechanical thermostat/s & PCB relays. 1050 W variable power element energised via master controller variable power output.

(2) During heating, if the mechanical thermostat contacts open, the electronic setpoint is automatically reduced by 1°C i.e. 75°C becomes 74°C, 73°C becomes 72°C etc. This occurs to a minimum electronic setpoint of 70°C. Should the mechanical thermostat contacts open when the electronic setpoint is < 70°C the master controller will enter critical fault mode.

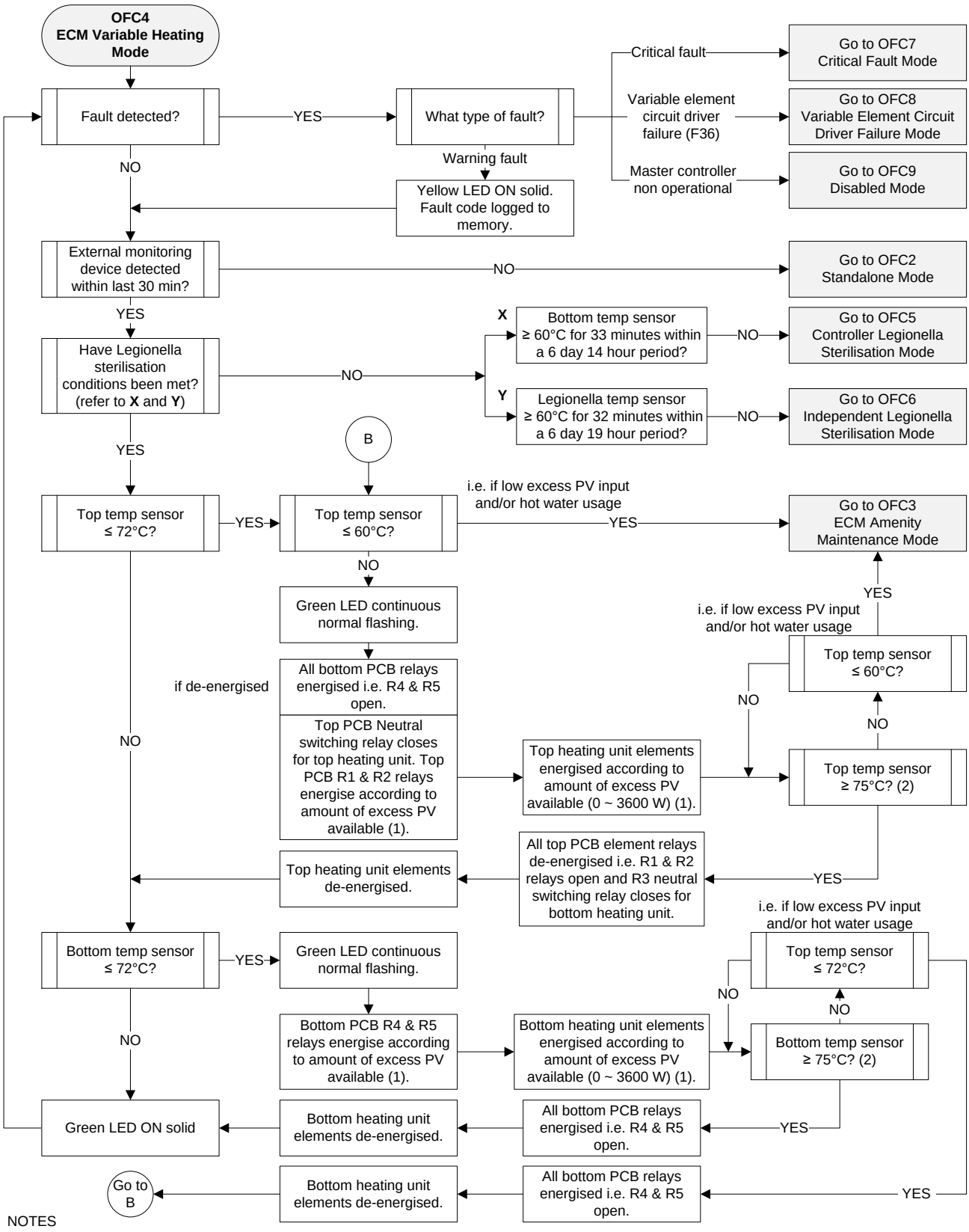
OFC3 – ECM Amenity Maintenance Mode



NOTES

(1) 850 W and 1700 W fixed power elements energised directly from heater 240 VAC power supply via mechanical thermostat & PCB relays. 1050 W variable power element energised via master controller variable power output according to the amount of excess PV power available (0 ~ 1050 W).

OFC4 – ECM Variable Power Mode



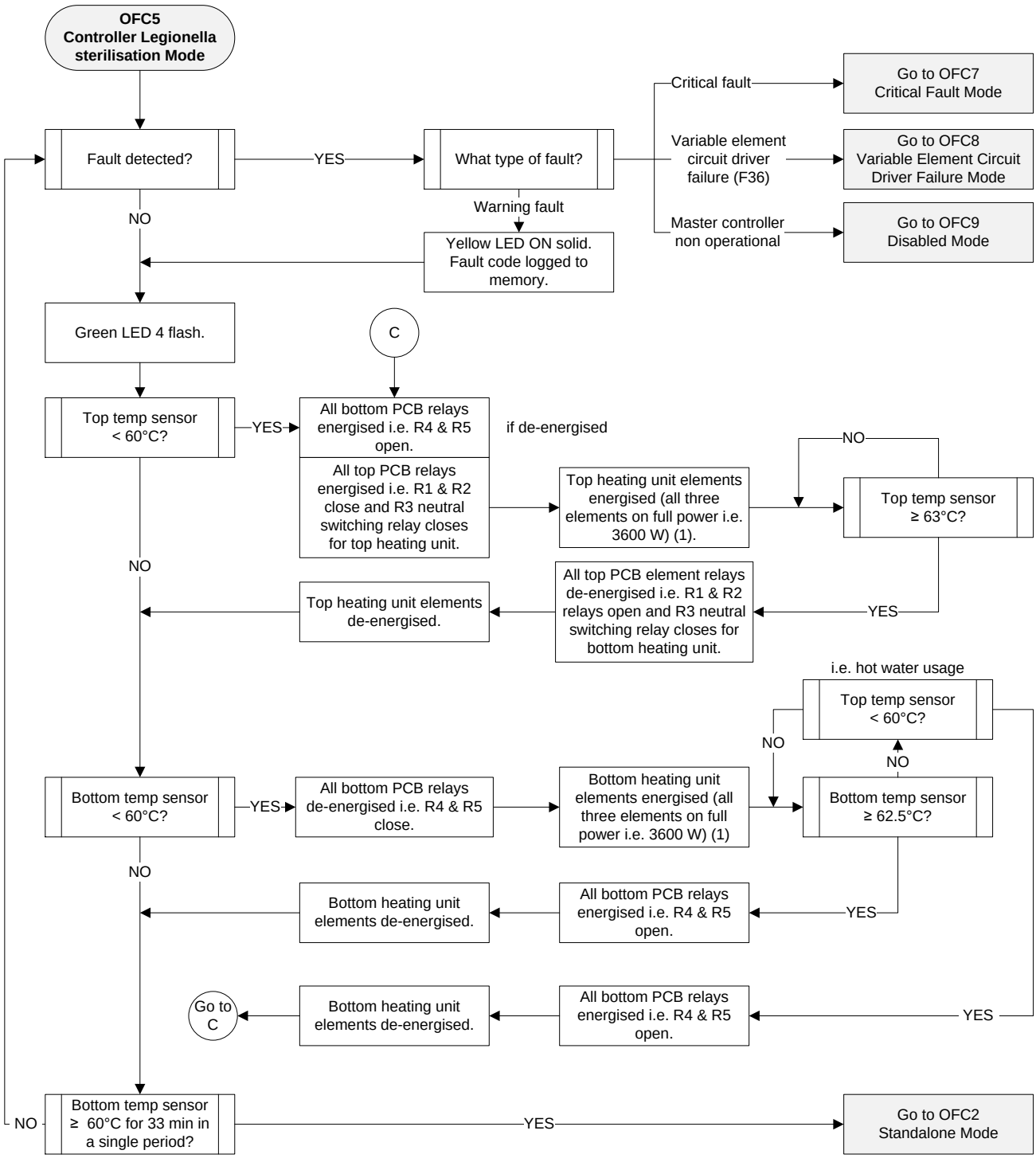
NOTES

(1) 850 W and 1700 W fixed power elements energised directly from heater 240 VAC power supply via mechanical thermostat & PCB relays. 1050 W variable power element energised via master controller variable power output according to the amount of excess PV power available (0 ~ 1050 W).

- 1050 W variable: Provides 0 ~ 1050 W.
- 850 W fixed + 1050 W variable: Provides 850 W ~ 1900 W (Top heating Unit = R1 energised or bottom heating unit = R4 de-energised).
- 1700 W fixed + 1050 W variable: Provides 1700 ~ 2750 W (Top heating Unit = R2 energised or bottom heating unit = R5 de-energised.
- 850 W fixed + 1700 W fixed + 1050 W variable: Provides 2550 W ~ 3600 W (Top heating Unit = R1+ R2 energised or bottom heating unit = R4 + R5 de-energised.

(2) During heating, if the mechanical thermostat contacts open, the electronic setpoint is automatically reduced by 1°C i.e. 75°C becomes 74°C, 73°C becomes 72°C etc. This occurs to a minimum electronic setpoint of 70°C. Should the mechanical thermostat contacts open when the electronic setpoint is < 70°C the master controller will enter critical fault mode

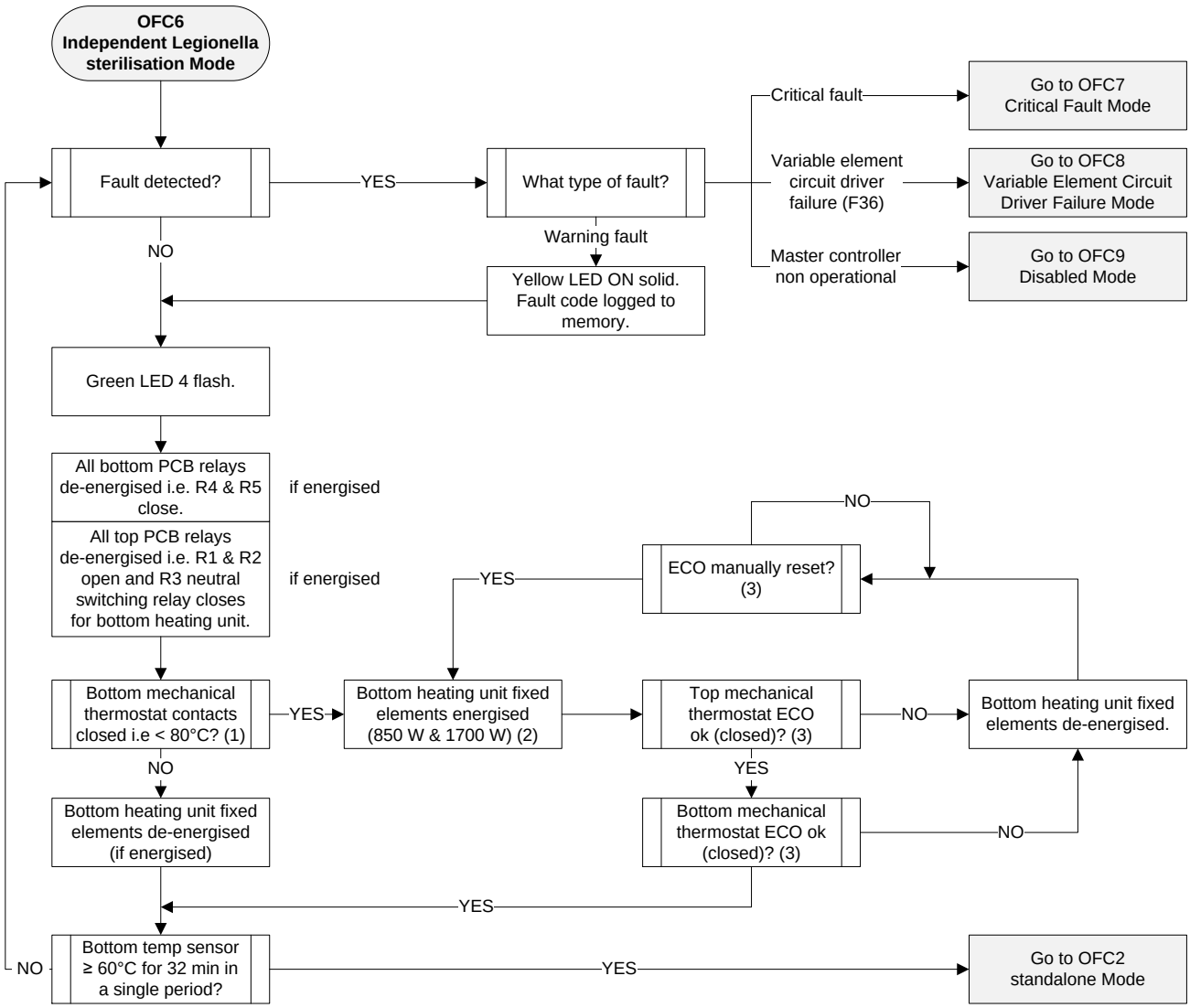
OFC5 – Controller Legionella Sterilisation Mode



NOTES

(1) 850 W and 1700 W fixed power elements energised directly from heater 240 VAC power supply via mechanical thermostat/s & PCB relays. 1050 W variable power element energised via master controller variable power output.

OFC6 – Independent Legionella Sterilisation Mode



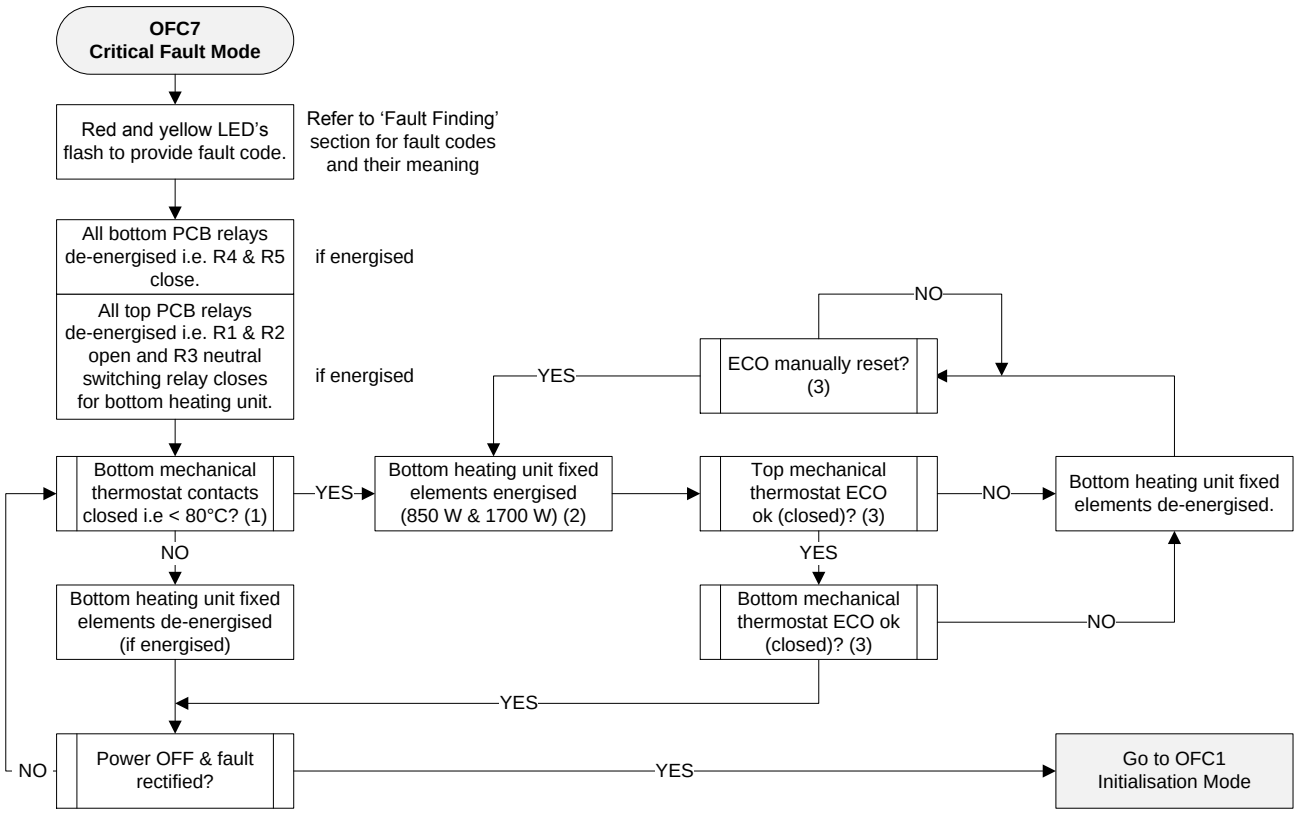
NOTES

(1) In independent Legionella sterilisation mode the bottom mechanical thermostat controls heating and has a setting of 80°C.

(2) 850 W and 1700 W fixed power elements energised directly from heater 240 VAC power supply via mechanical thermostat/s.

(3) Mechanical thermostat ECO trip (open) setting is 87 ~ 93°C and can be manually reset (closed) at 82°C.

OFC7 – Critical Fault Mode



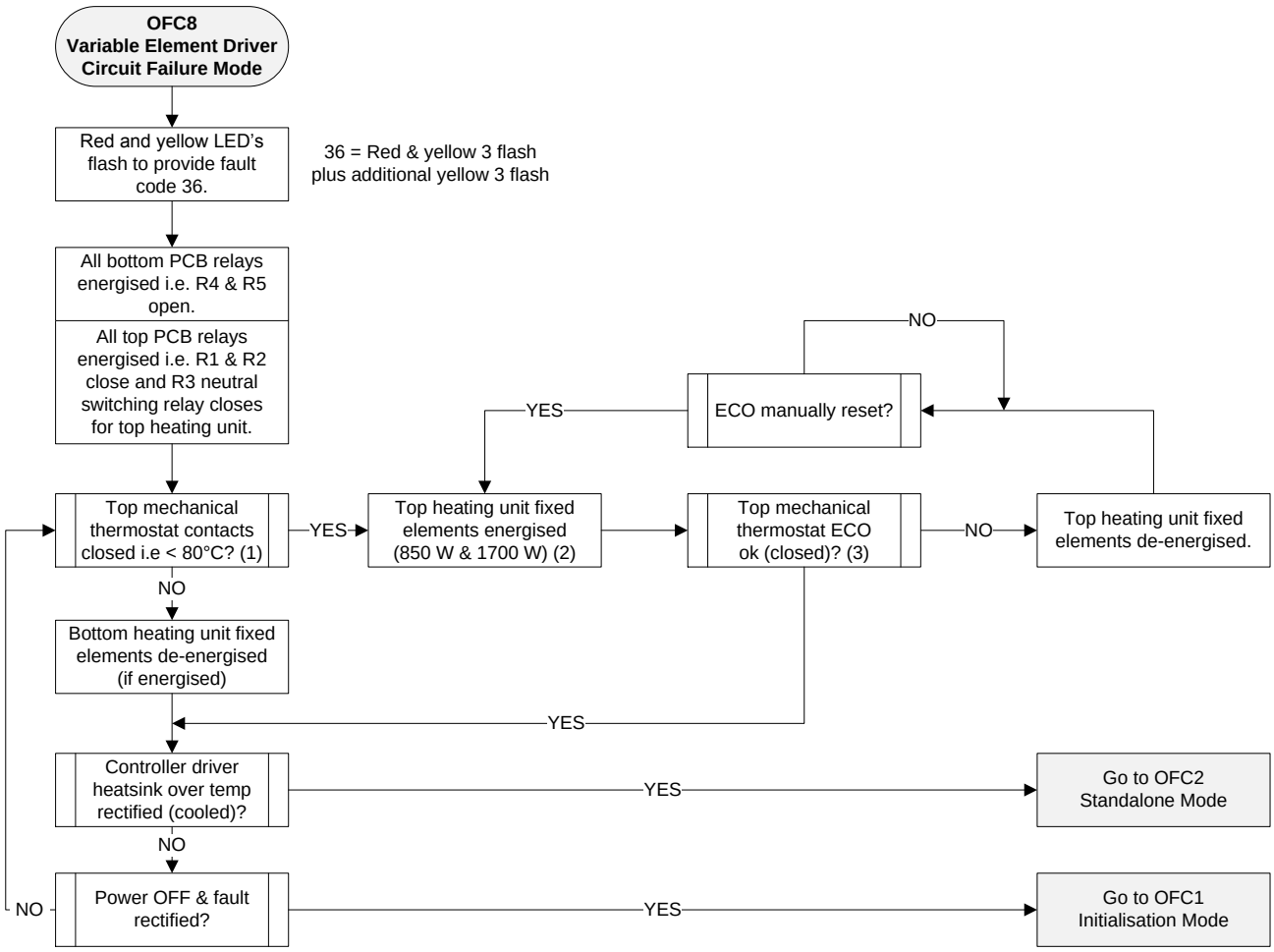
NOTES

(1) In critical fault mode the bottom mechanical thermostat controls heating and has a setting of 80°C.

(2) 850 W and 1700 W fixed power elements energised directly from heater 240 VAC power supply via mechanical thermostat/s.

(3) Mechanical thermostat ECO trip (open) setting is 87 ~ 93°C and can be manually reset (closed) at 82°C.

OFC8 – Variable Element Circuit Driver Failure Mode



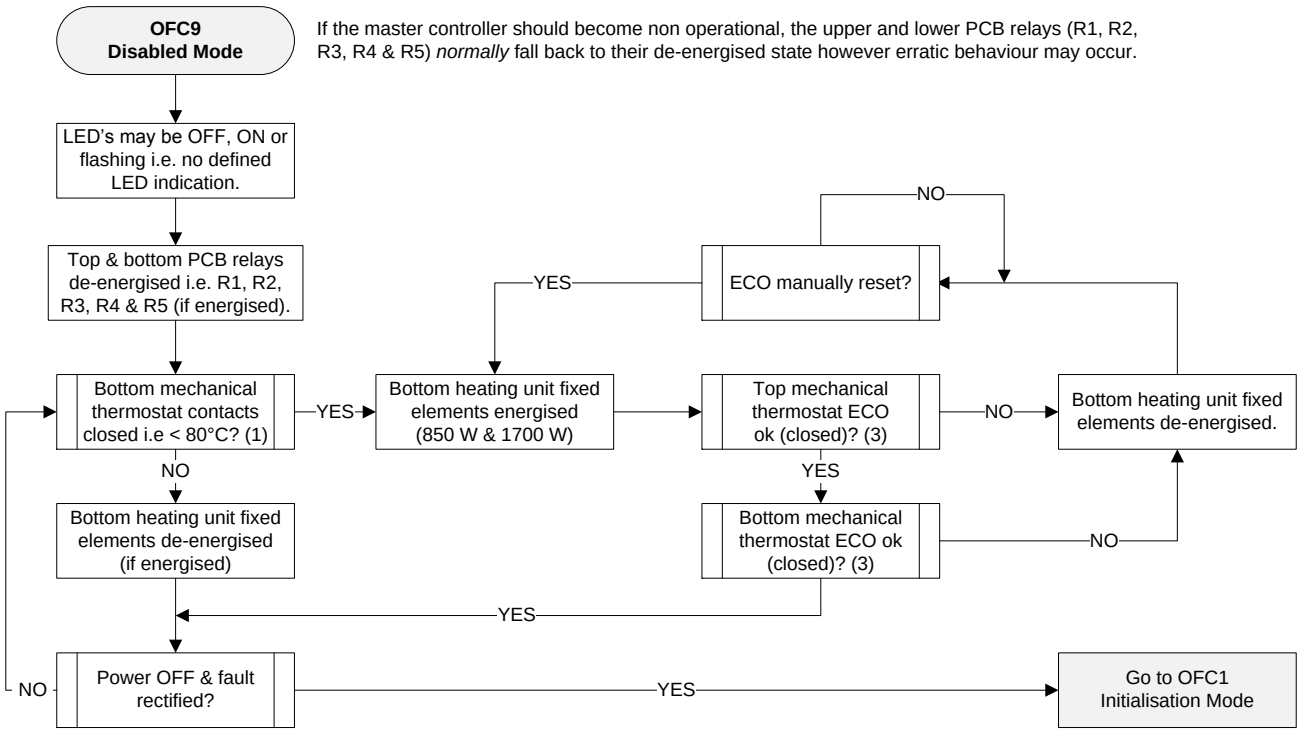
NOTES

(1) In variable element driver circuit failure mode the top mechanical thermostat controls heating and has a setting of 80°C.

(2) 850 W and 1700 W fixed power elements energised directly from heater 240 VAC power supply via mechanical thermostat.

(3) Mechanical thermostat ECO trip (open) setting is 87 ~ 93°C and can be manually reset (closed) at 82°C.

OFC9 – Disabled Mode



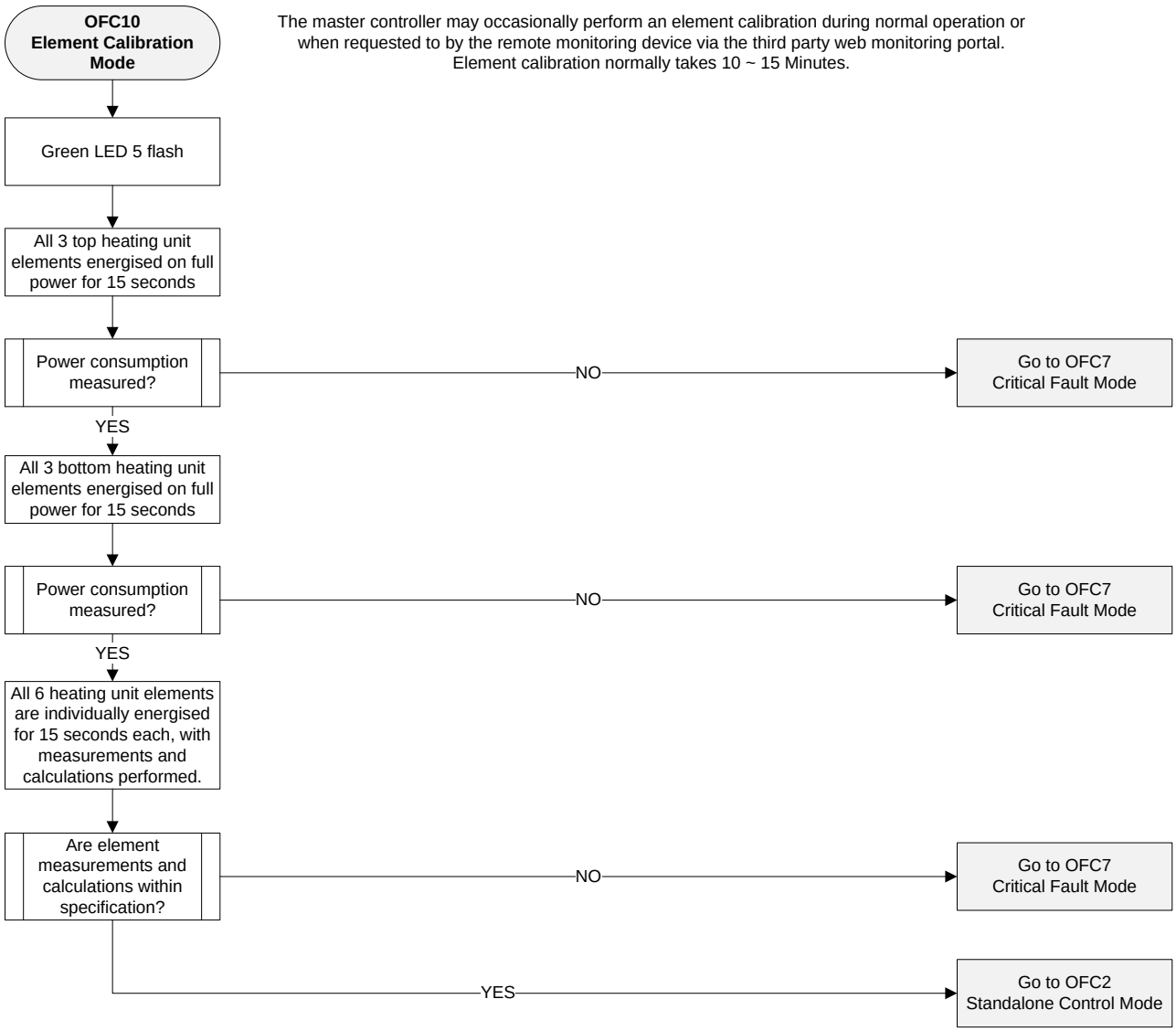
NOTES

(1) In disabled mode the bottom mechanical thermostat controls heating and has a setting of 80°C.

(2) 850 W and 1700 W fixed power elements energised directly from heater 240 VAC power supply via mechanical thermostat/s.

(3) Mechanical thermostat ECO trip (open) setting is 87 ~ 93°C and can be manually reset (closed) at 82°C.

OFC10 – Element Calibration Mode



OFC11 – Factory Test Mode

No operational flow chart – Currently only used during manufacturing end of line testing.

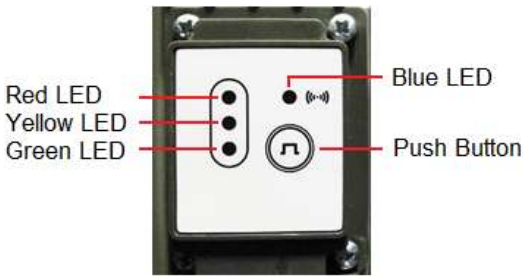
MASTER CONTROLLER

The master controller controls water heater operation and receives information from an external control device (such as the Solahart CET combo-meter) on the amount of excess PV power being exported to the grid. If water heating is required, and if excess PV power is available, the power consumption of the VPEWH is varied from 0 ~ 3600 W to utilise the excess PV power for water heating rather than exported it to the grid.

The master controller communicates with the external control device via Powerline Telecommunications (via heater 240 VAC power supply wiring) or RS485 comms and can also report tank charge status, current operation status, Legionella countdown and any detected faults or warnings.

The master controller monitors the top, mid and bottom sensors and if a call for heat is required, the master controller uses a combination of element switching and power modulation to heat the water in the storage tank, i.e. the master controller switches between the top and bottom heating units fixed power elements by energising or de-energising the top and bottom PCB relays (R1, R2, R3, R4 and R54), and by modulating power to the relevant variable power element.

The master controller has four LEDs and a push button that can be accessed by the end user and service personnel. It also has an integral light sensor that adjusts the LED's brightness according to ambient light conditions i.e. at night LEDs are dimmed.



Component	Description
Red LED	Flashes during start up and if a critical fault is detected i.e. flashes in conjunction with yellow LED to display a fault code.
Yellow LED	Flashes during start up and ON solid if a warning fault is detected. Also flashes in conjunction with red LED when displaying a fault code.
Green LED	Displays operational mode status.
Blue LED	Displays communication status.
Push Button	Used for reviewing stored fault codes, LED testing, network reset/repair and performing a fault/service reset.

The following table provides page numbers/links to all master controller information and procedures:

LED Operation Indication

LED ON solid ON continuously
LED Normal flash 1.0 sec ON → 1.0 sec OFF
LED Fast flash 0.25 sec ON → 0.25 sec OFF

Mode of Operation		Red LED	Yellow LED	Green LED
Initialisation mode		Undefined flashing	Undefined flashing	Undefined flashing
Firmware update		Undefined flashing	Undefined flashing	Undefined flashing
At temperature	Without fault	OFF	OFF	ON solid
	With fault/s	OFF	ON Solid	ON solid
ECM-VH mode	Without fault	OFF	OFF	Continuous normal flashing
	With fault/s	OFF	ON Solid	Continuous normal flashing
ECM-AM mode	Without fault	OFF	OFF	2 normal flashes with 2 sec delay between each group
	With fault/s	OFF	ON Solid	2 normal flashes with 2 sec delay between each group
Standalone mode	Without fault	OFF	OFF	3 normal flashes with 2 sec delay between each group
	With fault/s	OFF	ON Solid	3 normal flashes with 2 sec delay between each group
Controller or independent Legionella Sterilisation mode	Without fault	OFF	OFF	4 normal flashes with 2 sec delay between each group
	With fault/s	OFF	ON Solid	4 normal flashes with 2 sec delay between each group
Element calibration mode	Without fault	OFF	OFF	5 normal flashes with 2 sec delay between each group
	With fault/s	OFF	ON Solid	5 normal flashes with 2 sec delay between each group
Variable Element Driver Circuit Failure Mode		Flashes fault code 36 with yellow LED	Flashes fault code 36 with red LED	OFF
Critical fault mode		Flashes fault code with yellow LED (refer to page 34)	Flashes fault code with red LED (refer to page 34)	OFF
Disabled mode		OFF or	OFF or	OFF or
		ON solid or fast flash (1)	ON solid	ON solid
Factory test mode (2)		As per COM port command	As per COM port command	As per COM port command

(1) Continuous red only LED fast flash indicates master controller failure.

(2) Currently only used during manufacturing end of line testing.

LED Communication Indication

The blue LED displays communication activities with the external control device as follows:

Communication Status	Blue LED
OK – Connected with no current communication activity	Slow fade
OK – Connected with current communication activity	Extra fast flash
Fault – Communication activity timeout or not paired	Blink flash
Non operational master controller – Heater is operating in disabled mode	OFF or ON solid

Blue LED slow fade 0.25 sec ON → 0.25 sec dim to OFF → 0.25 sec OFF → 0.25 sec dim to ON
Blue LED extra fast flash 0.05 sec ON → 0.05 sec OFF
Blue LED blink flash 0.25 sec ON → 1.75 sec OFF

LED Fault Indication

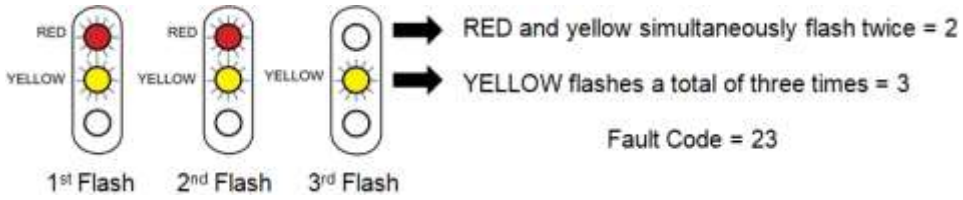
The master controller is capable of detecting warning faults and critical faults.

- **Warning fault:** The master controller yellow LED illuminates ON solid and a fault code is logged to memory. The heater operates as normal in the current mode of operation, but possibly with impeded functionality depending on the type of fault. Note: The fault log must be accessed to view the actual warning fault code (refer to 'Viewing Warning & Logged Fault Codes' on page 35).
- **Critical Fault:** The master controller red and yellow LEDs illuminate and flash a fault code and critical fault mode is entered (refer to page 20 for operation when in critical fault mode). The fault code is displayed and logged to memory.

Fault codes are indicated by the master controller red and yellow LEDs as shown in the following example for fault code F23:

Total normal red flashes = 1st digit.

Total normal yellow flashes = 2nd digit



The following table details available fault codes and links to relevant fault finding charts.

Greyed areas are critical faults i.e. master controller enters critical fault mode.

Non greyed areas are warning faults, i.e. heater operates as normal in current mode of operation, but possibly with impeded functionality depending on type of fault.

Fault Code	Fault Description	Fault Finding Chart
F11	A warning fault has occurred and has been logged to memory	Access fault log (1)
F12	Master controller internal fault	Page 40
F13	Independent Legionella circuit failure	Page 40
F21	Top temp sensor failure	Page 41
F22	Mid temp sensor failure	Page 42
F23	Bottom temp sensor failure	Page 42
F31	1 of more of the 6 element circuits is S/C	Page 43
F32	1 of the top 3 element circuits is O/C during heating	Page 44
F33	1 of the bottom 3 elements circuits is O/C during heating	Page 44
F34	2 or more of the 6 element circuits is O/C during heating	Page 45
F35	1 or more of the 6 elements has an incorrect resistance value	Page 46
F36	Master controller failure (internal element driver S/C)	Page 46
F41	Top mechanical thermostat out of range i.e. opens < 70°C	Page 47
F42	Bottom mechanical thermostat out of range i.e. opens < 70°C	Page 48
F51	High tank temperature (top, mid or bottom temp sensor ≥ 86°C)	Page 49
F52	Master controller non critical internal fault (controller PCB over temp)	Page 50
F53	Master controller non critical internal fault (element driver over temp)	Page 50
F54	Low tank temperature (Top temp sensor < 63°C with < 2000 W power draw for > 15 minutes)	Page 51
F61	Current transformer fault or no current draw detected	Page 52
F62	Over/under power fault (100 W or 5% difference to calculated value)	Page 53
F63	Voltage input fault	Page 54

(1) Generic warning fault i.e. yellow LED ON solid, red LED OFF. Access fault log to determine actual fault code (refer to 'Viewing Warning & Logged Fault Codes on page 35).

Viewing Warning & Logged Fault Codes

The master controller stores the last 5 occurring warning and/or critical faults in historical order. Note: The same fault will only be logged once if it has occurred repeatedly.

To view logged fault codes, press and release master controller push button three times in quick succession (within 3 seconds) to access the fault log i.e. press/release, press/release, press/release.

The fault log display routine will then commence after a 1 second delay in the following order, with a 3 second delay between each step:

1. Red, yellow and green LED's simultaneously fast flash once to indicate log 1.
2. Red and yellow LED's simultaneously normal flash to indicate fault code first digit, then yellow LED normal flashes to indicate second digit addition.
3. Red, yellow and green LED's simultaneously fast flash twice to indicate log 2.
4. Red and yellow LED's simultaneously normal flash to indicate fault code first digit, then yellow LED normal flashes to indicate second digit addition.
5. Red, yellow and green LED's simultaneously fast flash three times to indicate log 3.
6. Red and yellow LED's simultaneously normal flash to indicate fault code first digit, then yellow LED normal flashes to indicate second digit addition.
7. Red, yellow and green LED's simultaneously fast flash four times to indicate log 4.
8. Red and yellow LED's simultaneously normal flash to indicate fault code first digit, then yellow LED normal flashes to indicate second digit addition.
9. Red, yellow and green LED's simultaneously fast flash five times to indicate log 5.
10. Red and yellow LED's simultaneously normal flash to indicate fault code first digit, then yellow LED normal flashes to indicate second digit addition.

Note: Log history be repeated but cannot be paused/stopped.

Fault/Service Reset Procedure

Performing a fault/service reset will clear all fault codes from the fault log and restart the master controller in initialisation mode. Note: If the fault(s) is still present, the same fault indication will reoccur.

A fault/service reset will also reset thermostat and element calibration, and element calibration mode will be automatically entered after approximately one hour from reset.

1. Press and hold master controller push button in the depressed position for 3 ~ 6 seconds then release button (Green LED ON 3 seconds > *Release button immediately* when green LED extinguishes).

Network Reset/Repair Procedure

Performing a network reset/repair procedure will reset/repair communication between then water heater and the third part monitoring device. Note: The network may take several minutes to connect.

1. Press and hold master controller push button in the depressed position for 9 ~ 12 seconds then release button (Green LED ON 3 seconds > All LEDs OFF 3 seconds > Yellow LED ON 3 seconds > *Release button immediately* when yellow LED extinguishes).

LED Test Procedure

Whilst performing the LED test procedure, ensure the push button is released *immediately* when the red LED comes ON.

1. Press and hold master controller push button in the depressed position for 13 seconds then release button (Green LED ON 3 seconds > All LEDs OFF 3 seconds > yellow LED ON 3 seconds > All LEDs OFF 3 seconds > *Release button immediately* when red LED comes ON).

FAULT FINDING

Common Complaints

When a complaint is lodged about the performance of a water heater, 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 you in locating the most likely cause. All procedures assume there is water flowing through the water heater.

Insufficient Hot Water

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. 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. Areas to check for excessive usage are:

1. Automatic washing machines.
2. Showers exceeding 12 L/minute for mixed water and 5 minutes in duration.
3. Two or more showers operating at the same time.
4. Change of occupancy or an increase in the number of persons.
5. High water pressure area (look for excessive pressure relief valve discharge).
6. Plumbing leaks.
7. Crossed connection.

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 pressure relief valve may be attributed to a cross connection. The method of checking for a cross connection is:

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

Discoloured Water

This may be the result of discoloured water entering from the cold water mains. Check if the cold water is also discoloured.

Milky coloured water is generally air in suspension and will disperse of its own accord.

Water Hammer

A water heater will not cause water hammer, however valves associated with the water heater may be the source of the problem. For example, cold water stopcock, non-return valve or relief valve.

Most water hammer problems are associated with hot and cold water plumbing, or appliances. For example, solenoid valves, ballcocks, loose pipes, sharp angles in pipe work, faulty or worn valve parts, loose tap washers 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 premises cold water pressure will usually solve most problems.

High Power Bills

Complaints high power bills can on many occasions be attributed to one or more of the following conditions:

- 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 due to a leak if the pipe is warm. The method of checking for plumbing leaks is:

    1. Turn off stopcock on cold water supply to water heater.
    2. Open a hot tap to ensure the flow of water stops. This will confirm if the stopcock is operating correctly.
    3. Turn off hot tap.
    4. Turn on stopcock to make up water pressure in the cylinder, then turn 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 should be no leaks in the plumbing system.

- Insufficient excess PV power: Insufficient or no excess PV power can cause the water heater to mostly or always use power from the grid. Check the following:

    1. Water heater not communicating with external control device and therefore continuously operating in standalone mode.
    2. Undersized PV system i.e. not able to provide any excess PV power for water heating. Review the power usage of the household and compare this with the size of the PV system installed to establish if the PV system is large enough and can supply excess PV power for water heating.
    3. Underperforming PV system, due to orientation, inclination or excessive shading of PV array(s), particularly in winter.
    4. Failed or underperforming PV module(s), optimiser(s) or inverter.
    5. If connected to a third-party monitoring web portal (such as the Solahart CET Gateway), review site information on portal to determine if there are any possible issues.

Test Equipment

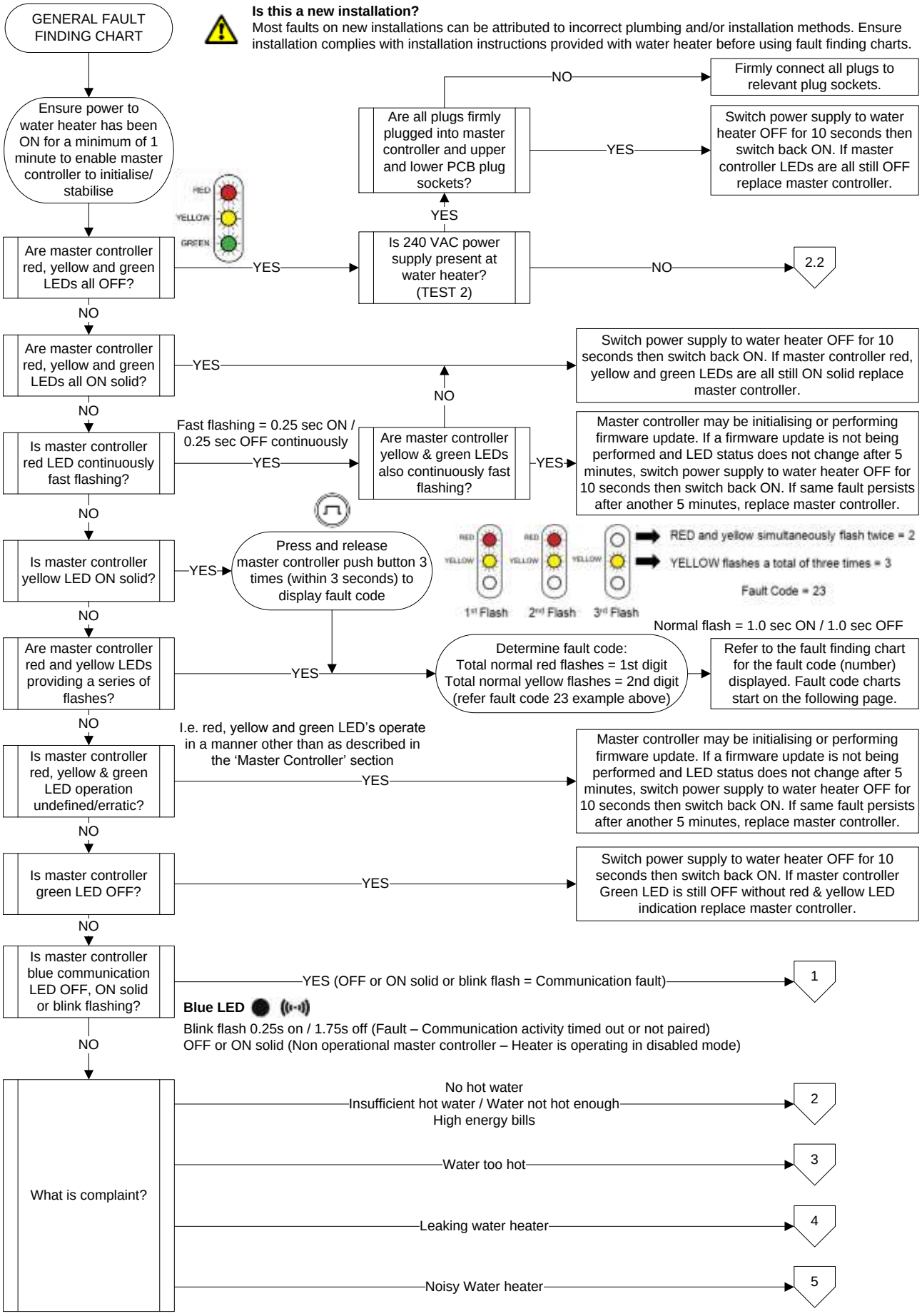
A list of test equipment which will assist in conducting diagnostic procedures is provided below. This equipment is available from Rheem Spare Parts.

Part	Part Number
Fine probe adapter kit	WH0020082

Fault Indication

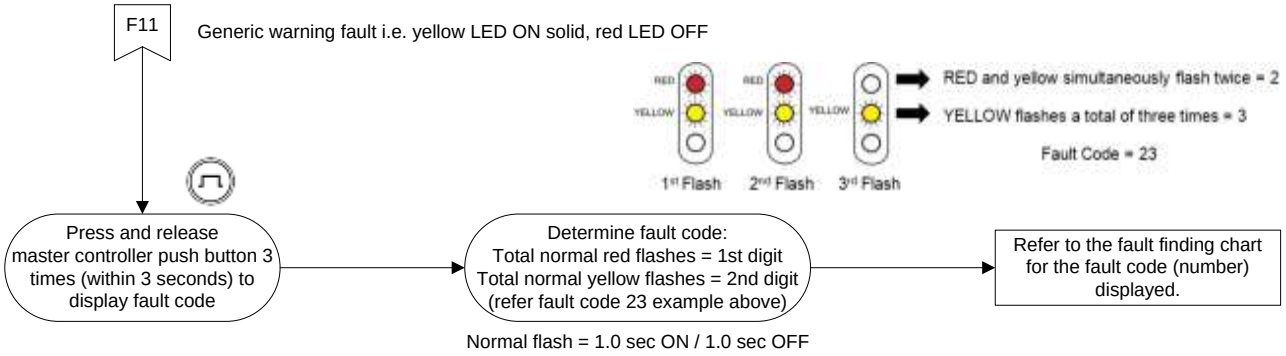
Refer to 'LED Fault Indication' on page 34.

General Fault Finding Chart (Start here for all fault finding)

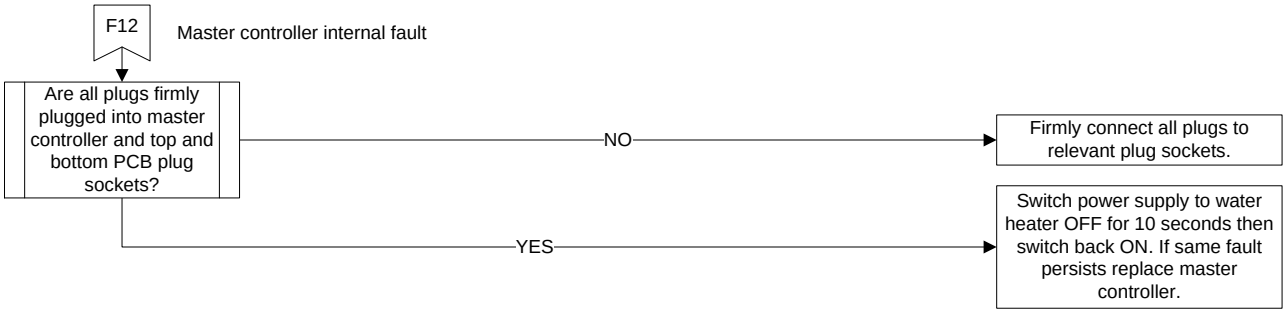


Fault Finding Chart – Fault Code F11

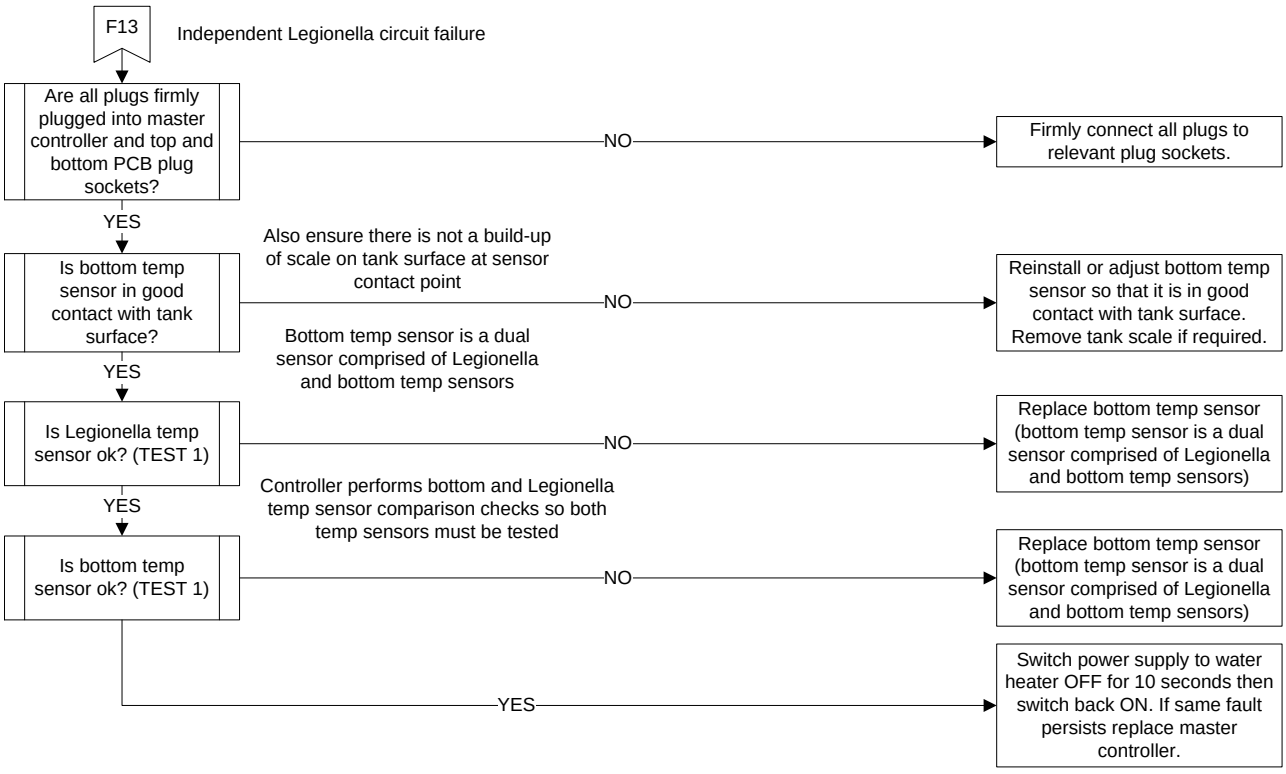
The master controller generic waring fault (Yellow red LED ON solid with Red LED OFF) is indicted as fault code F11 in web monitoring portal (such as the Solahart CET Gateway). Follow this fault finding chart to determine the actual fault code, then refer to the fault finding chart for that fault code.



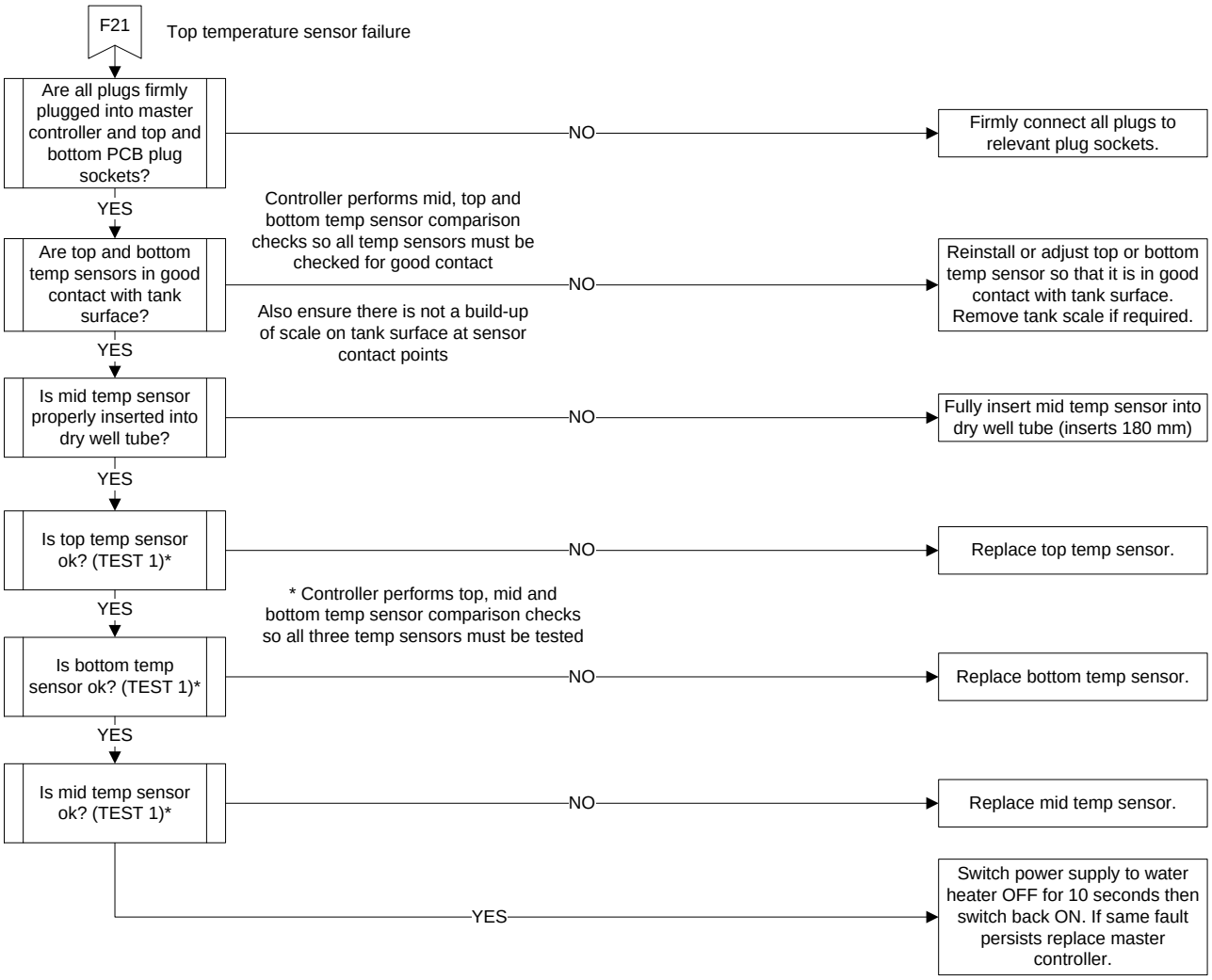
Fault Finding Chart – Fault Code F12



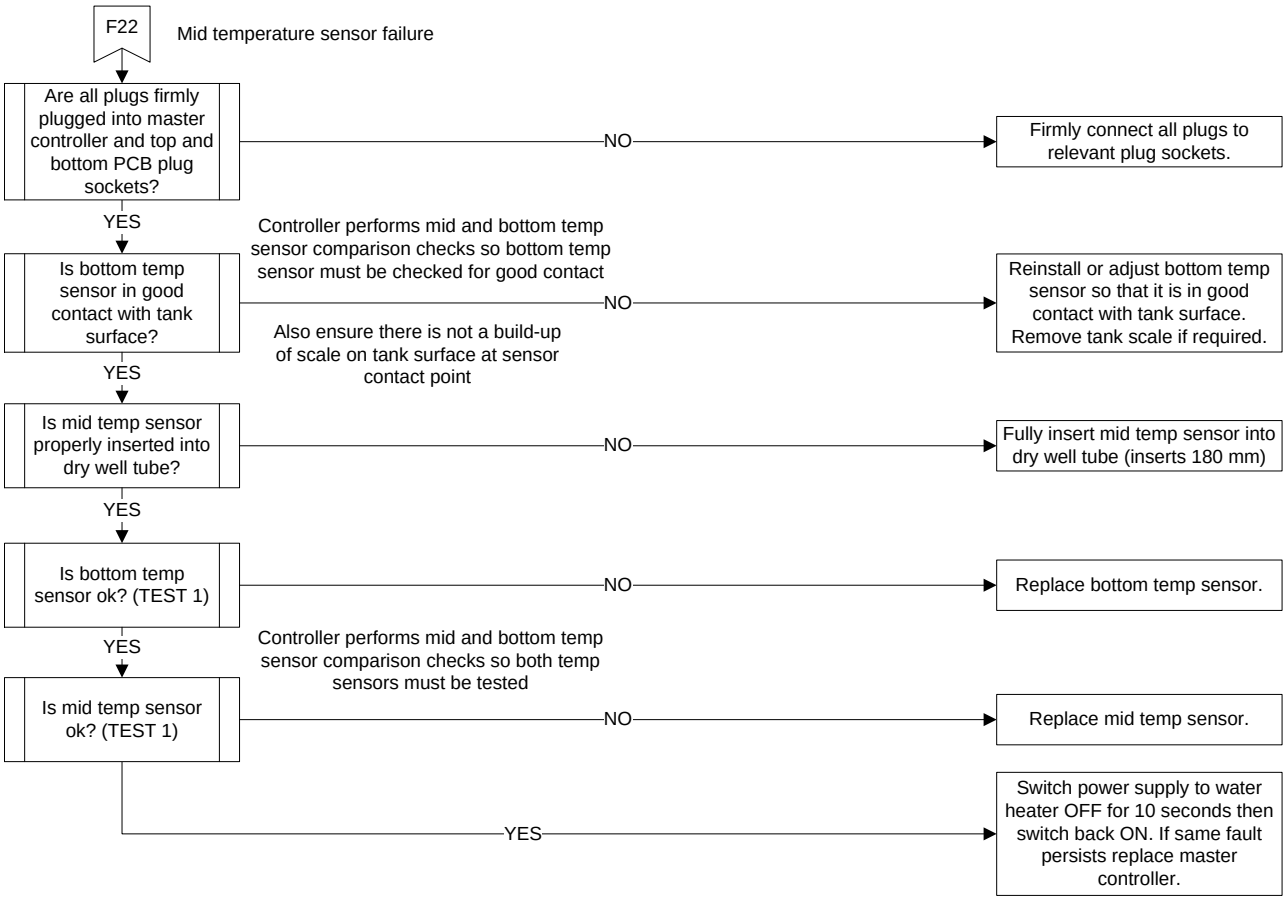
Fault Finding Chart – Fault Code F13



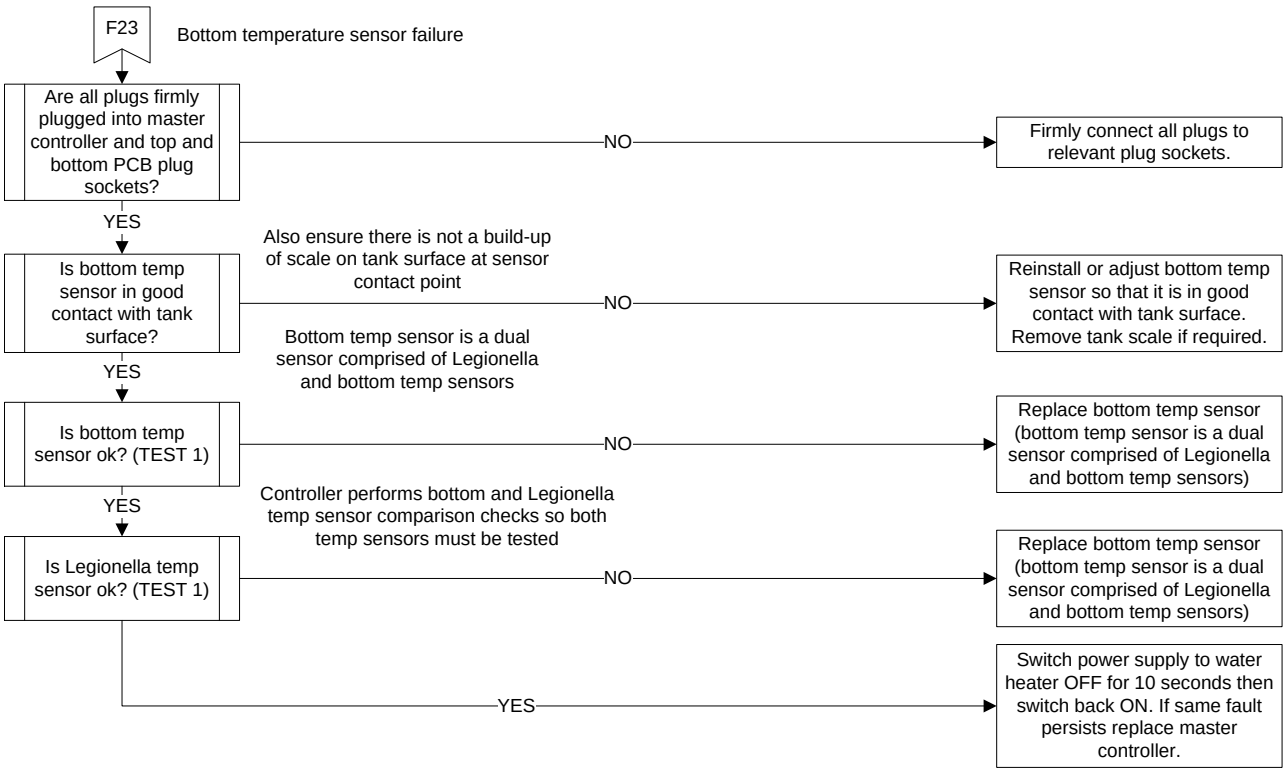
Fault Finding Chart – Fault Code F21



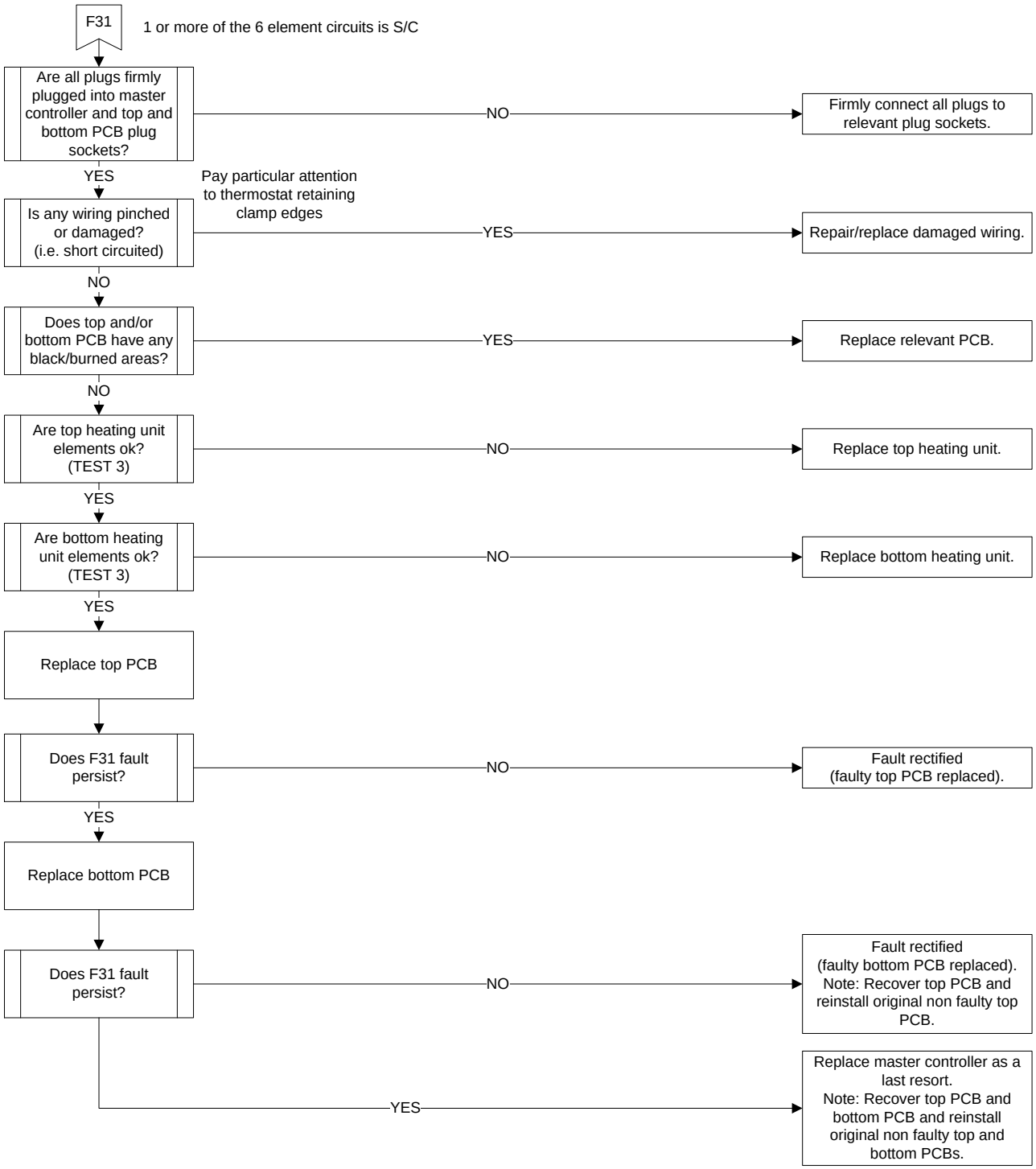
Fault Finding Chart – Fault Code F22



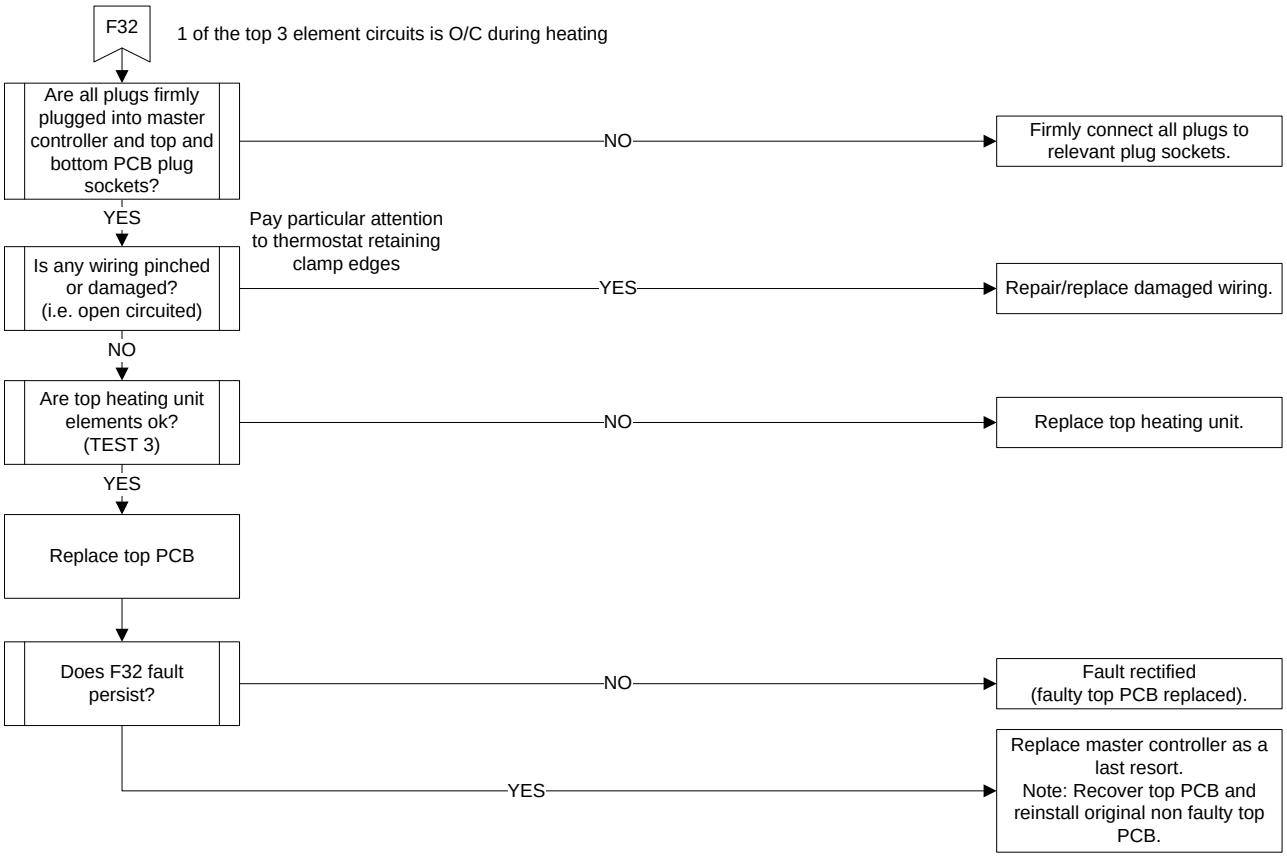
Fault Finding Chart – Fault Code F23



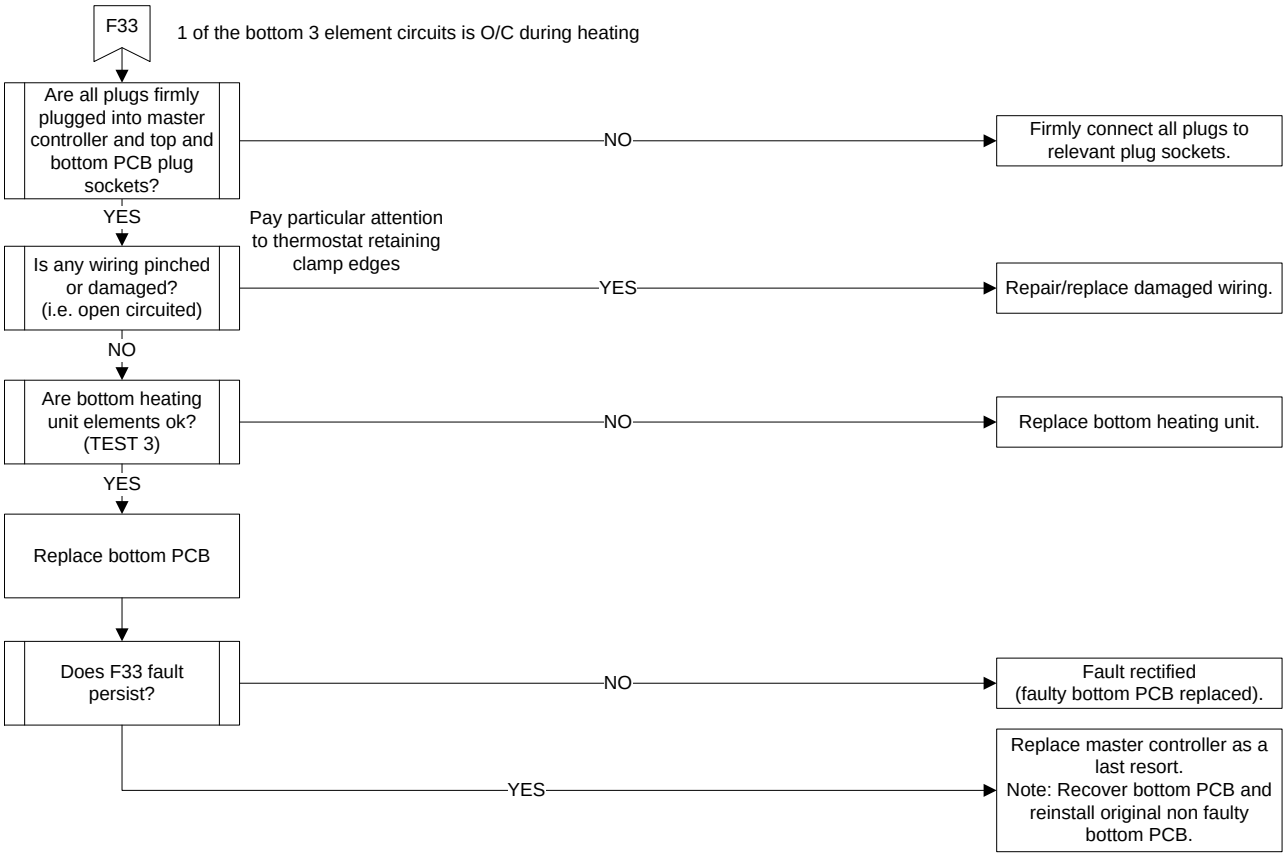
Fault Finding Chart – Fault Code F31



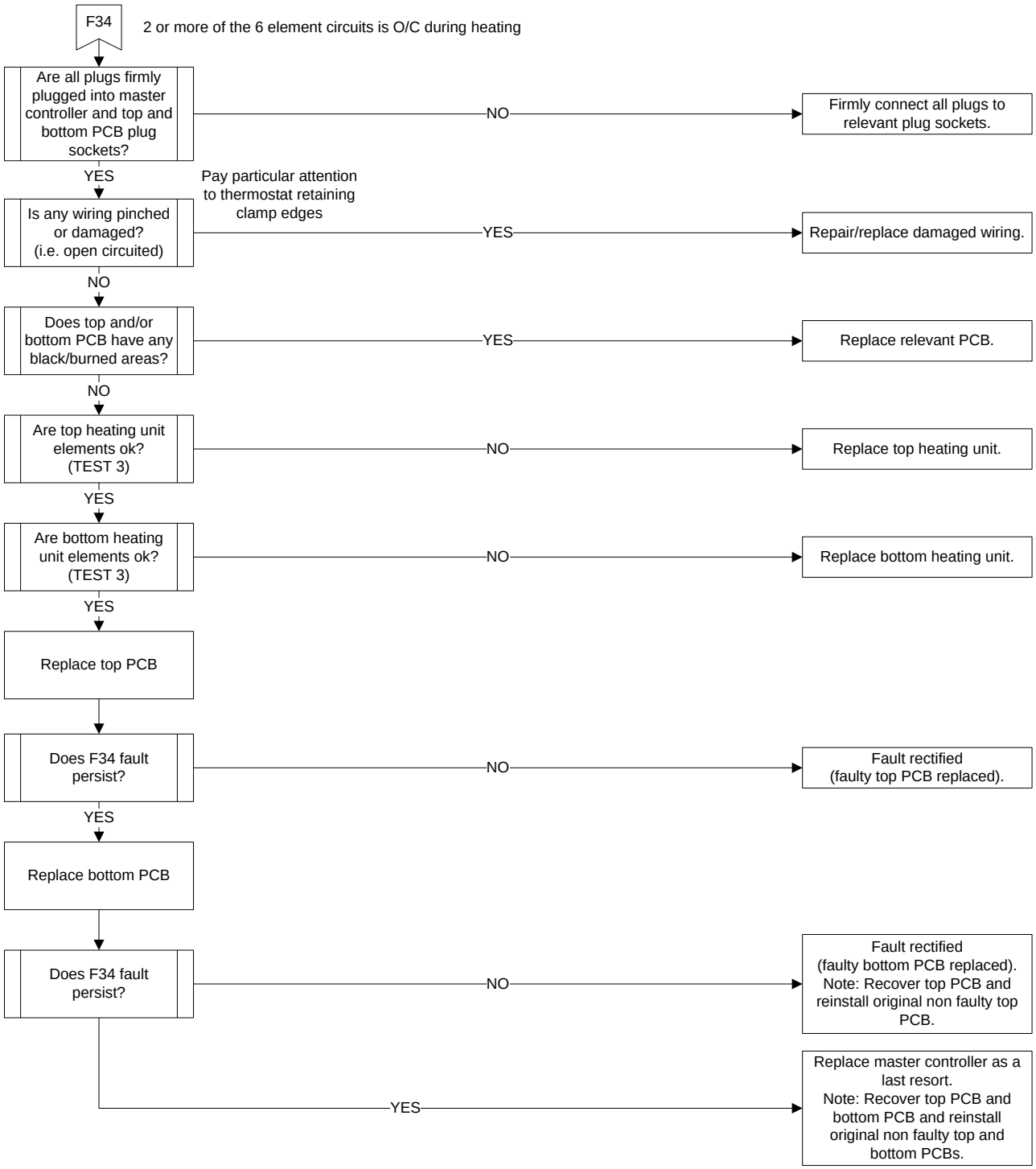
Fault Finding Chart – Fault Code F32



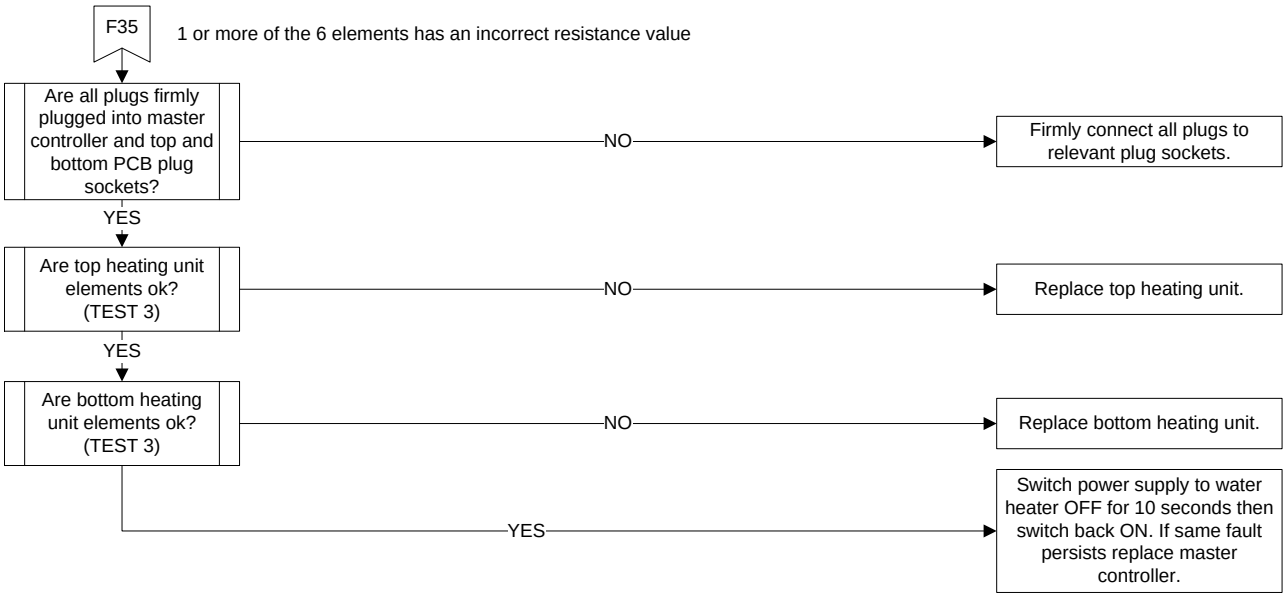
Fault Finding Chart – Fault Code F33



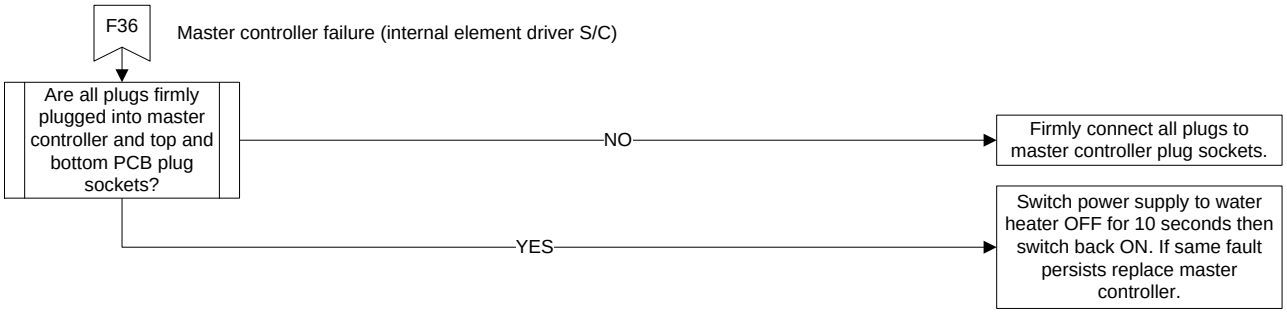
Fault Finding Chart – Fault Code F34



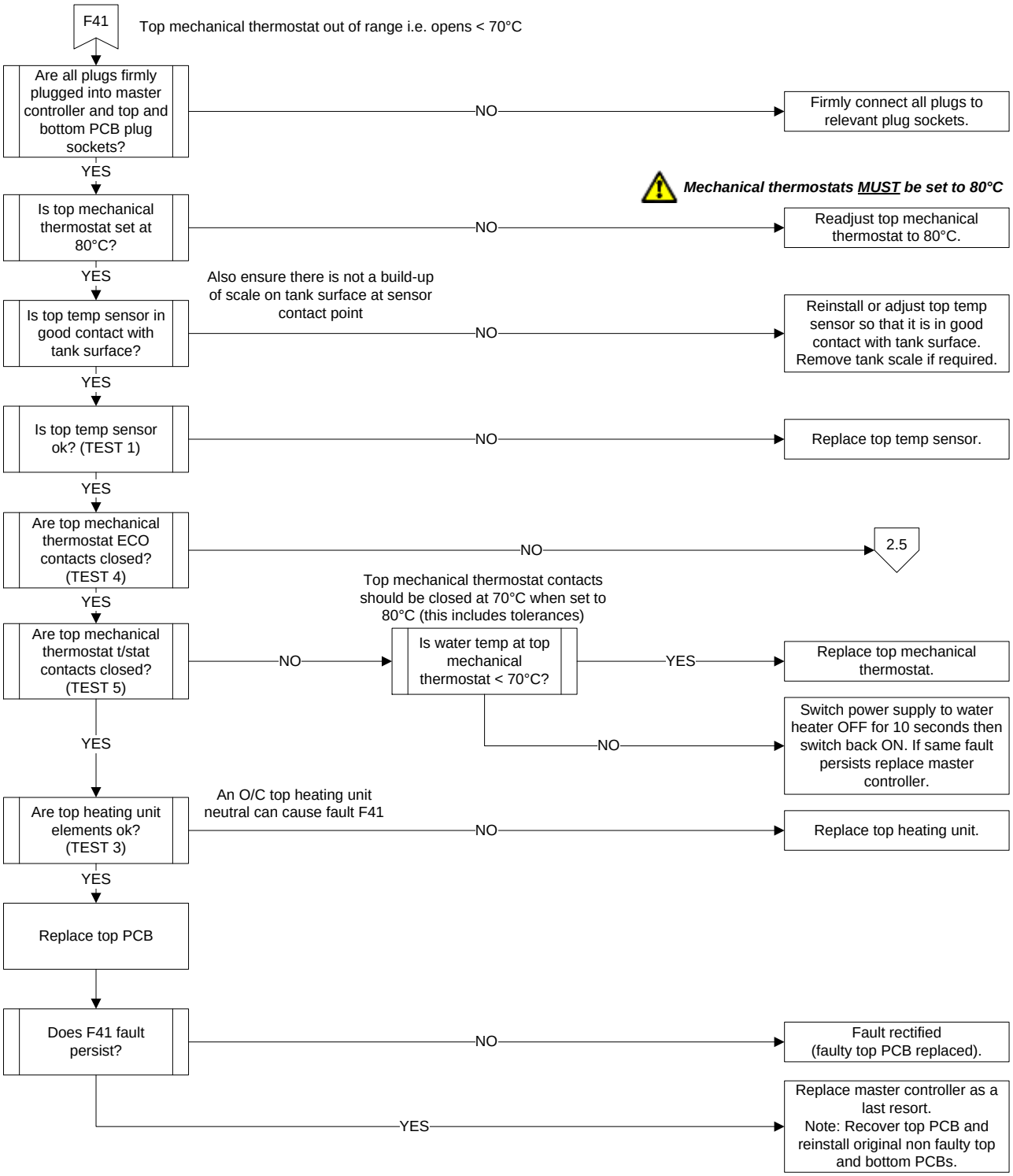
Fault Finding Chart – Fault Code F35



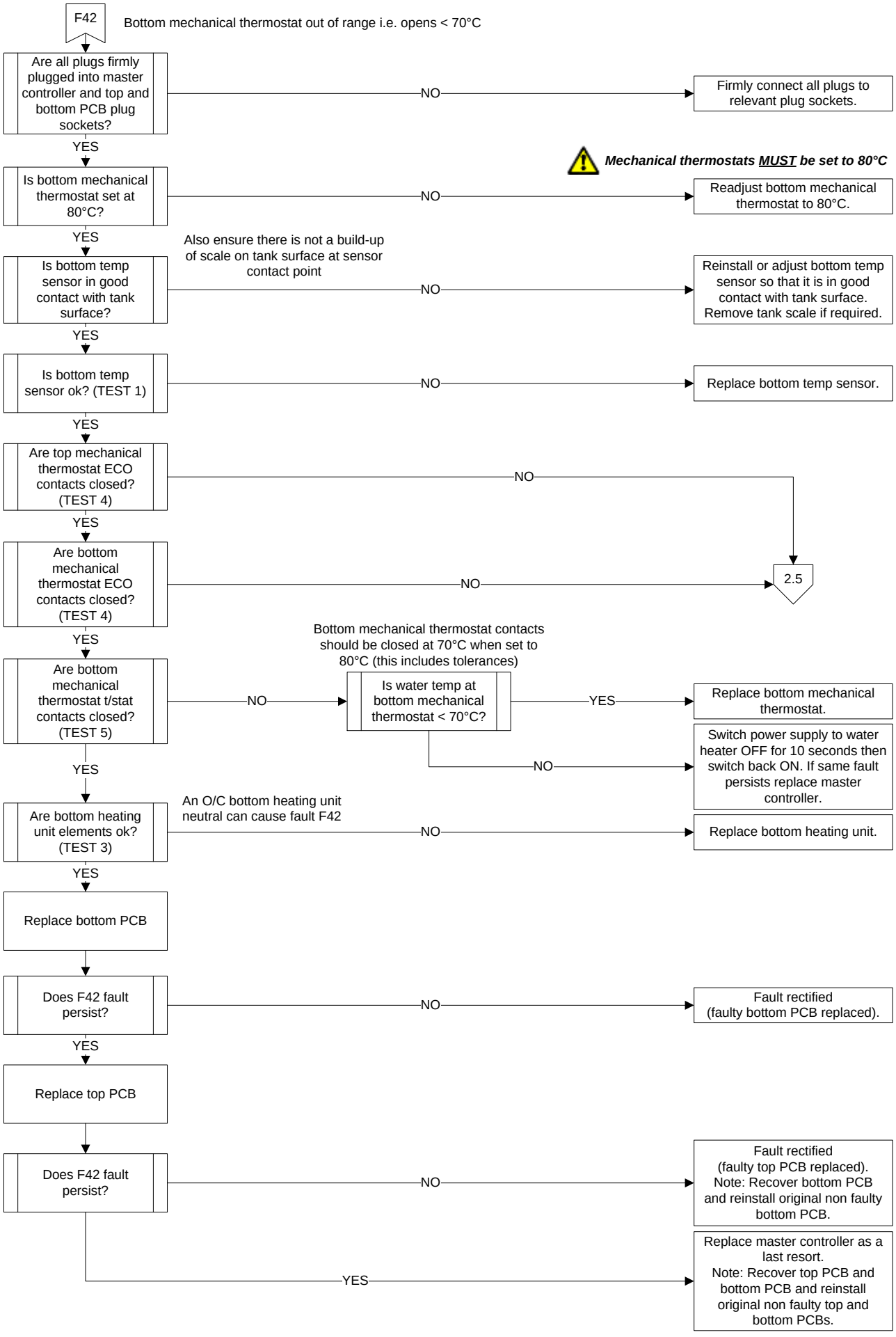
Fault Finding Chart – Fault Code F36



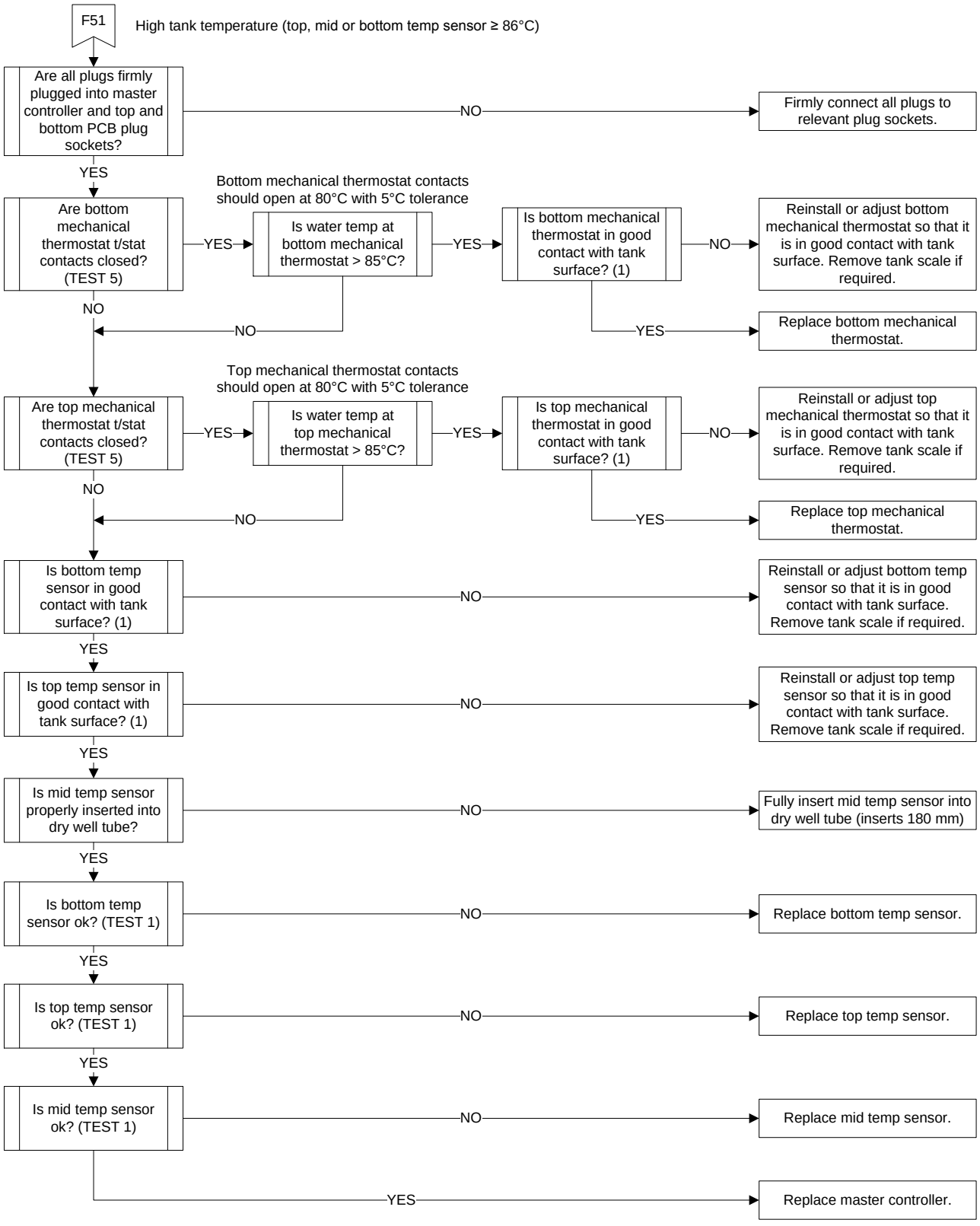
Fault Finding Chart – Fault Code F41



Fault Finding Chart – Fault Code F42

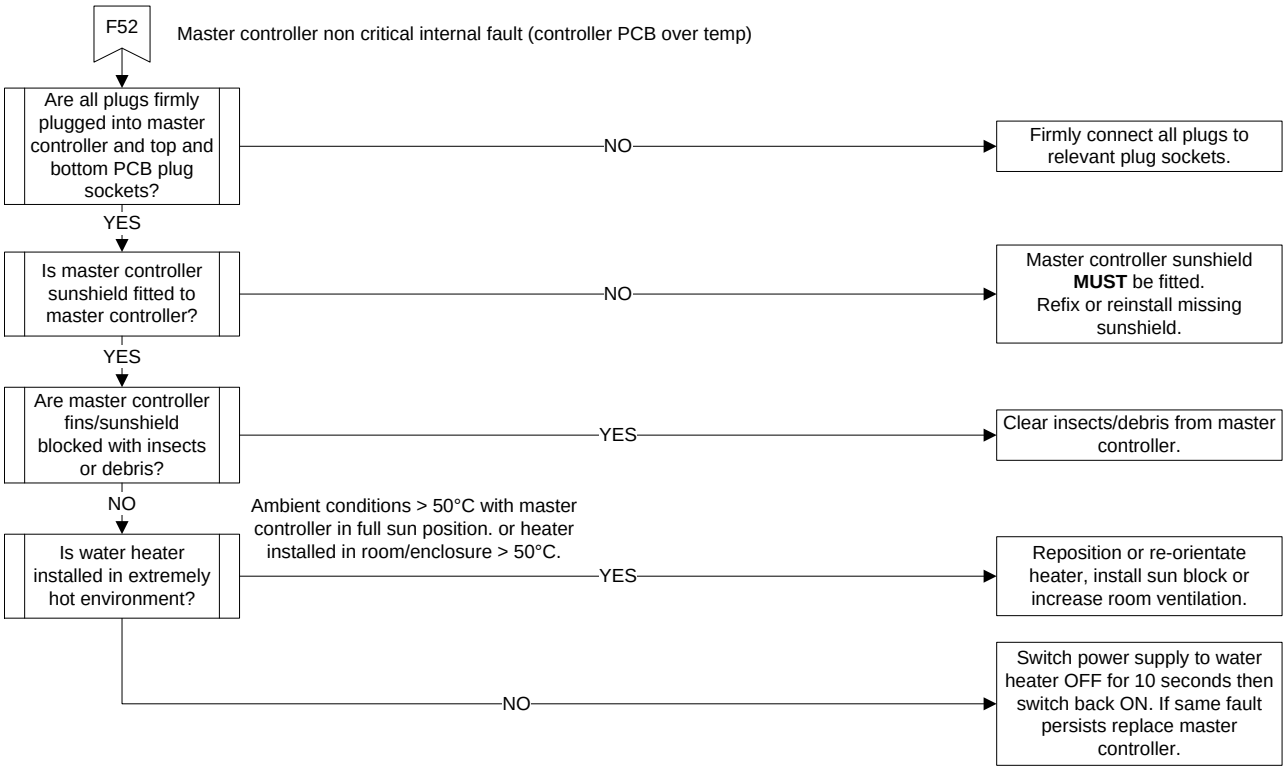


Fault Finding Chart – Fault Code F51

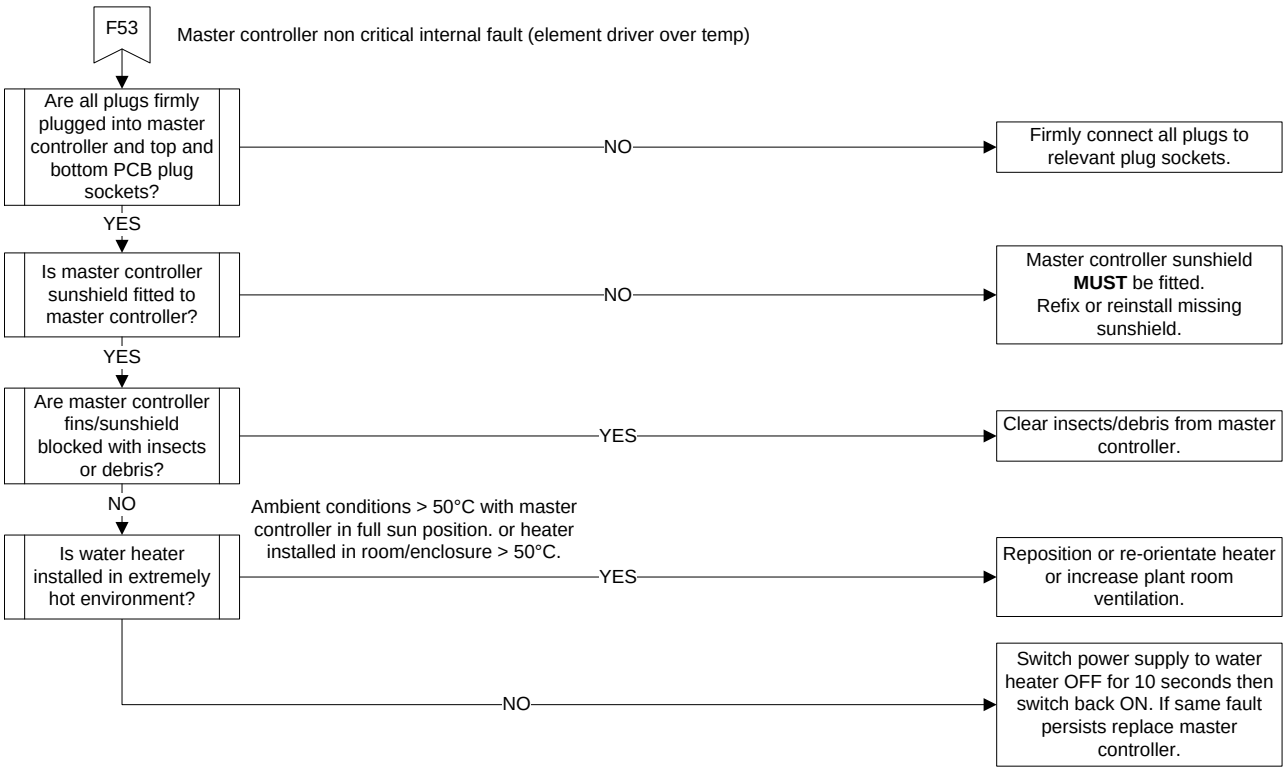


(1) Also ensure there is not a build-up of scale on tank surface at contact point

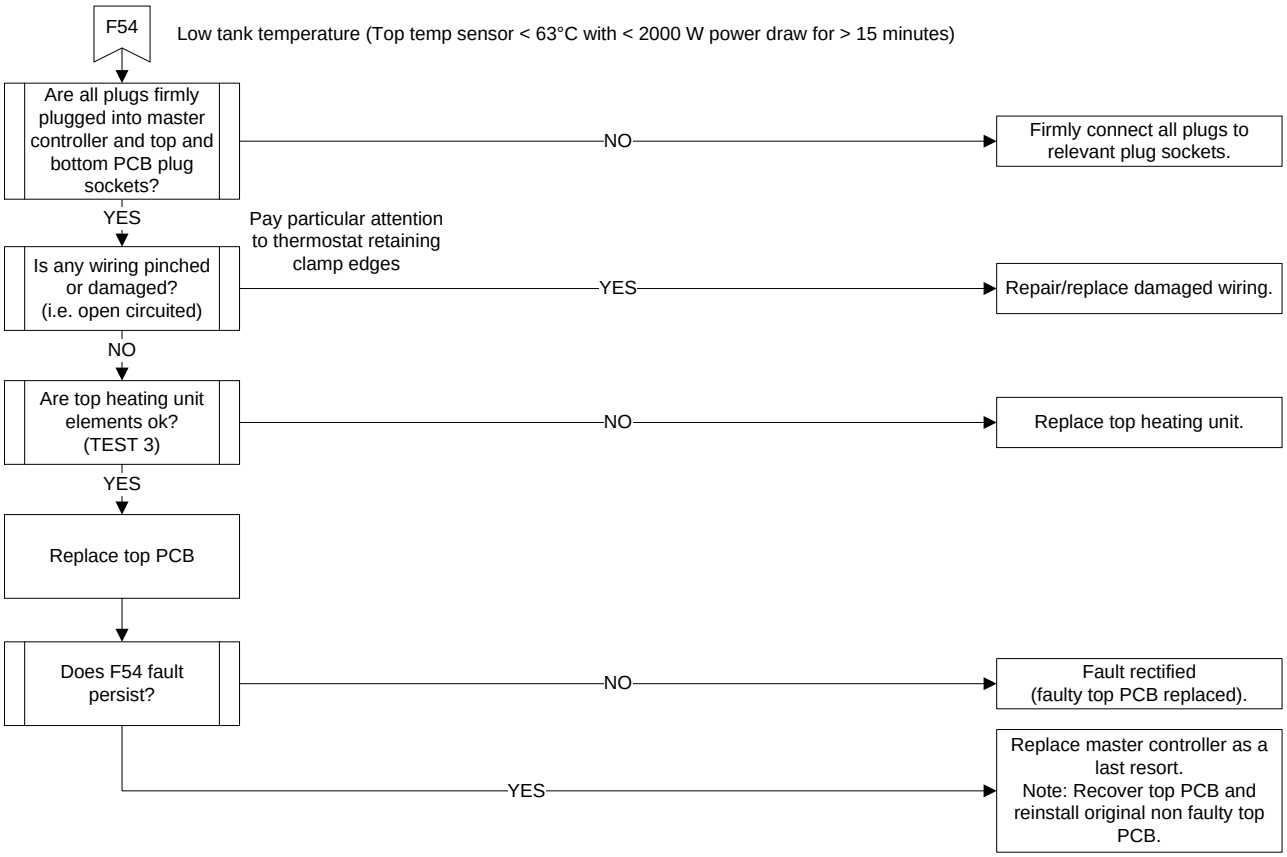
Fault Finding Chart – Fault Code F52



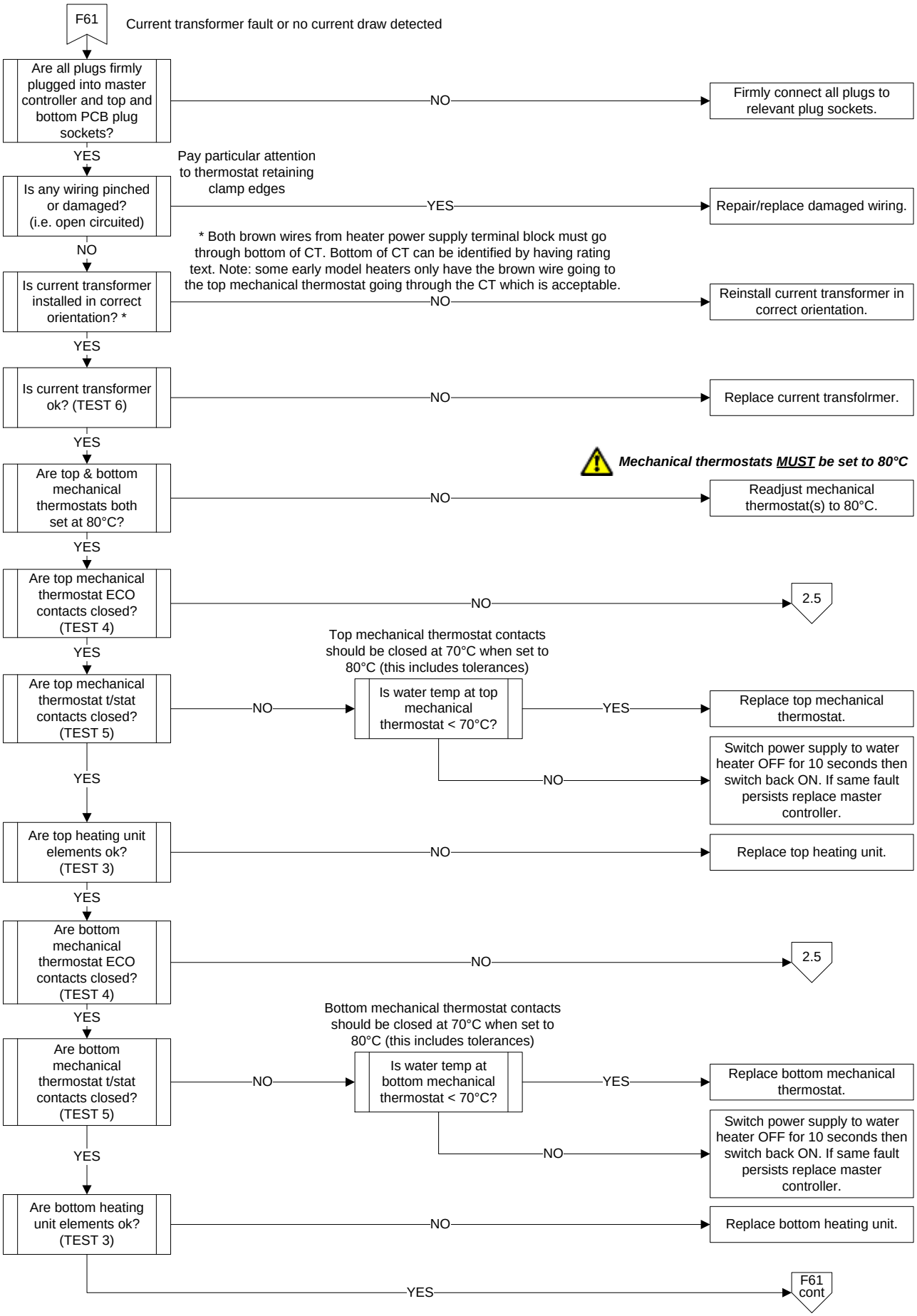
Fault Finding Chart – Fault Code F53



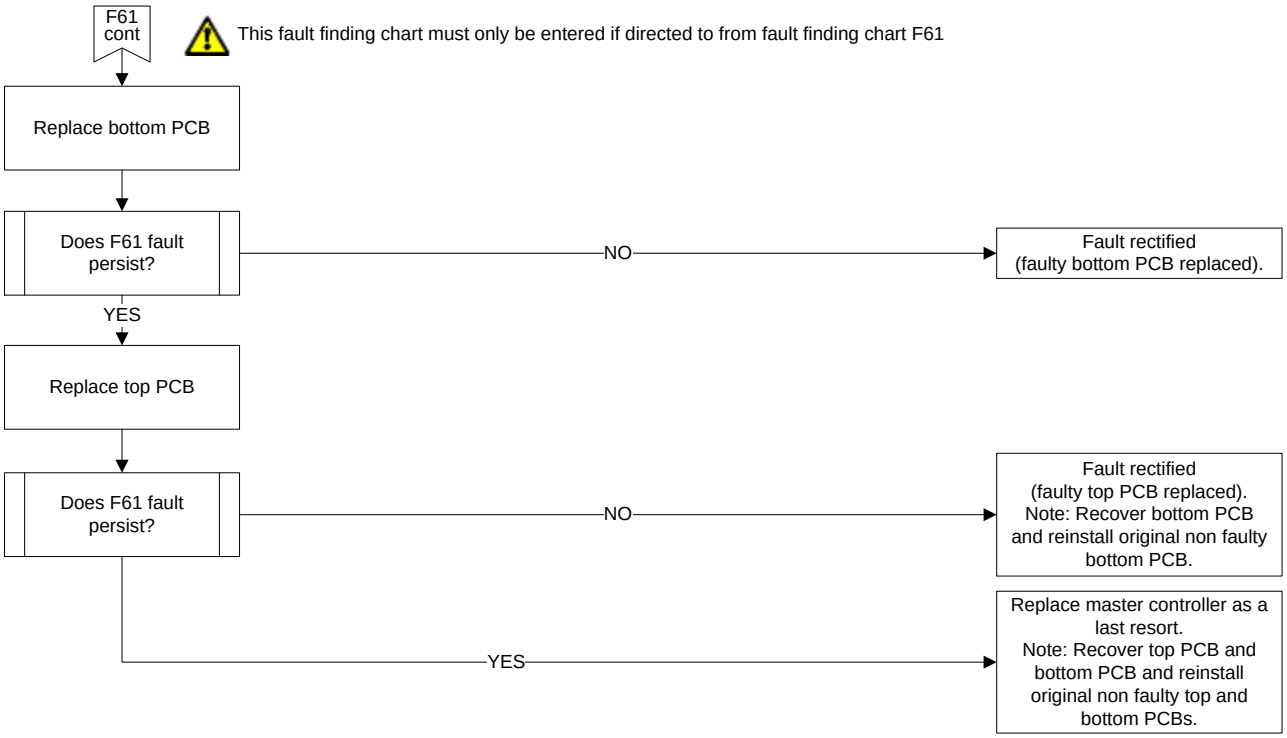
Fault Finding Chart – Fault Code F54



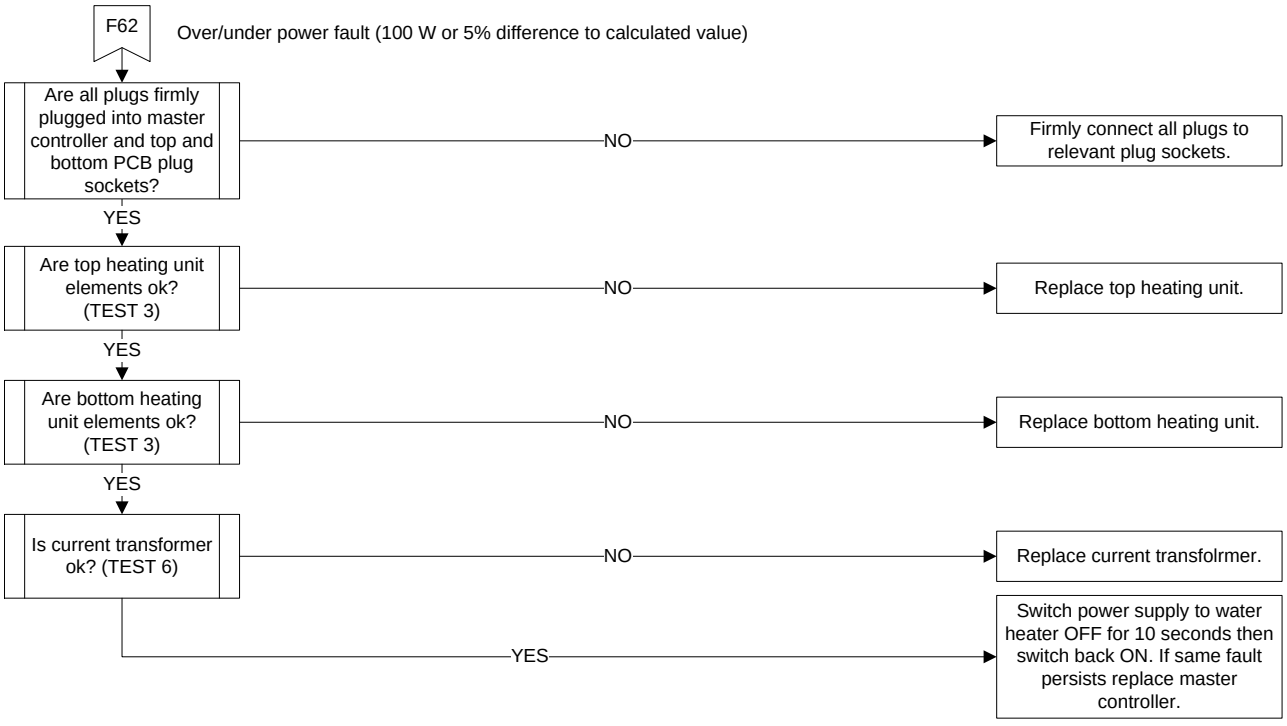
Fault Finding Chart – Fault Code F61



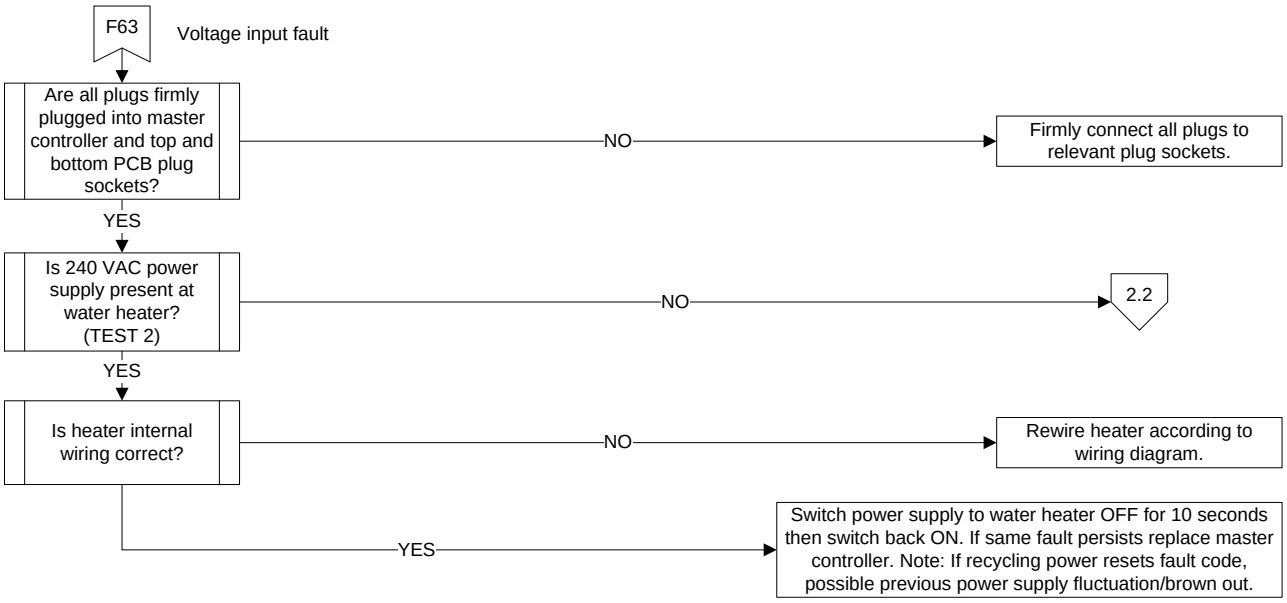
Fault Finding Chart F61 Cont (continued from fault finding chart F61)



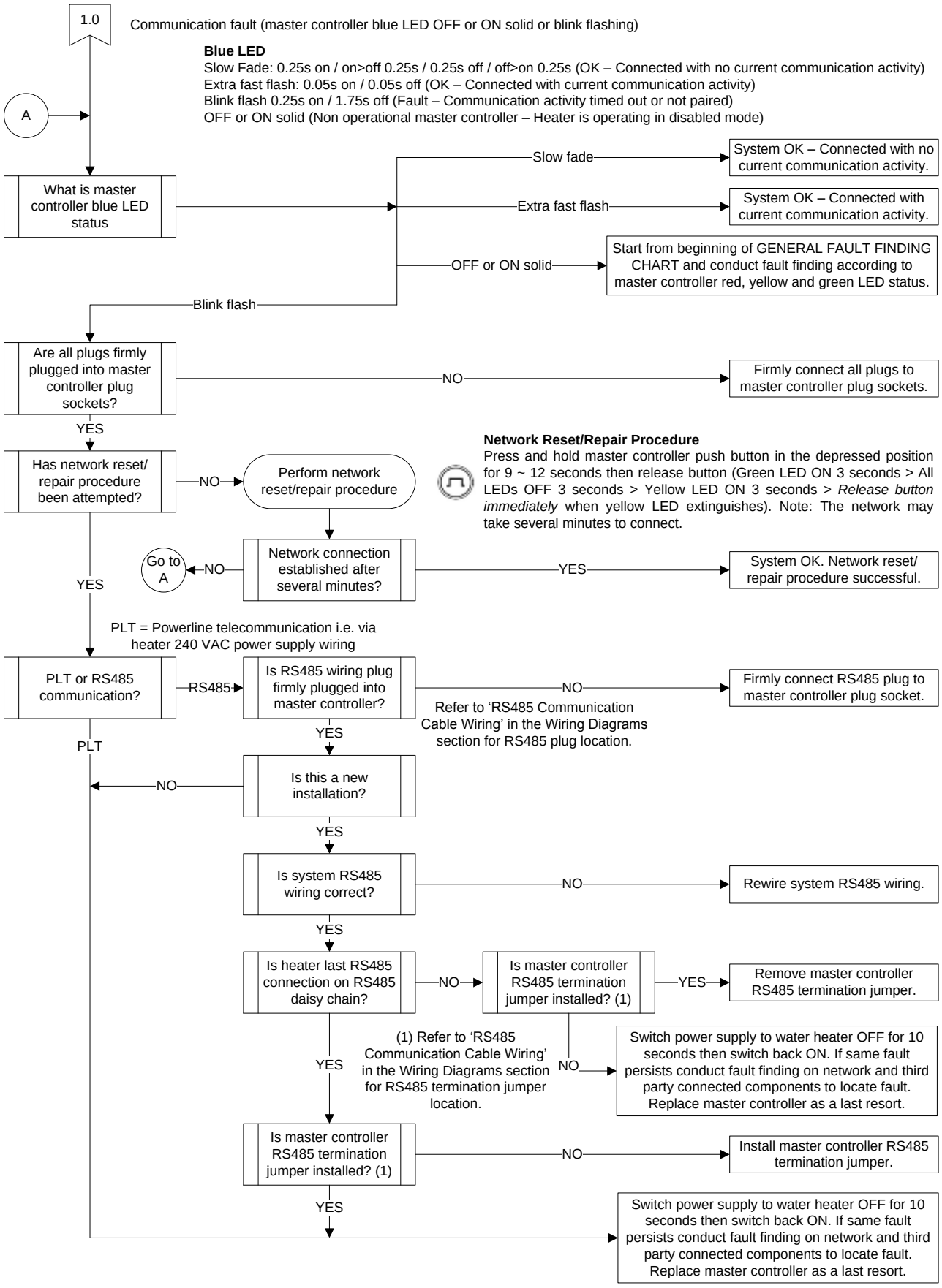
Fault Finding Chart – Fault Code F62



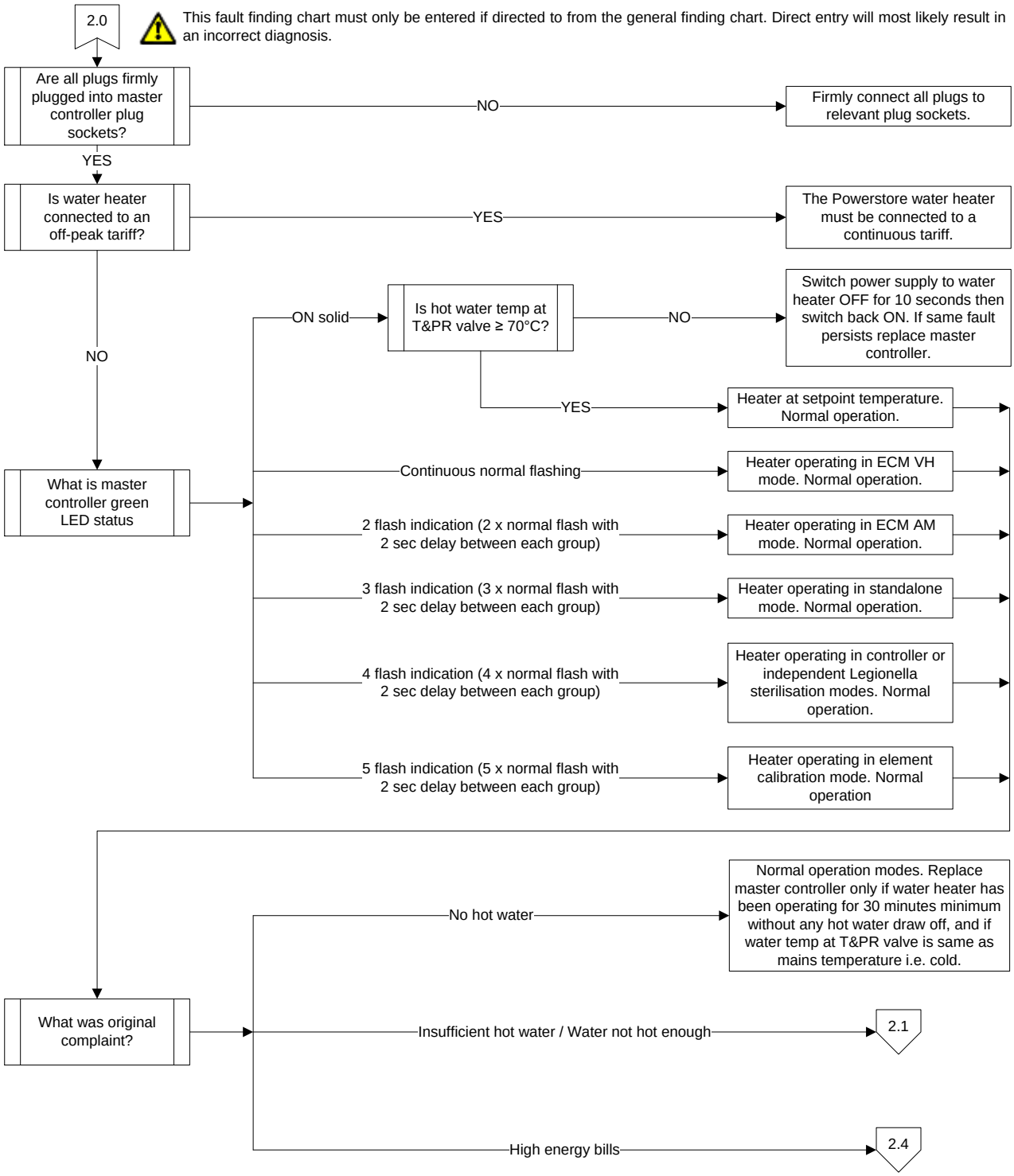
Fault Finding Chart – Fault Code F63



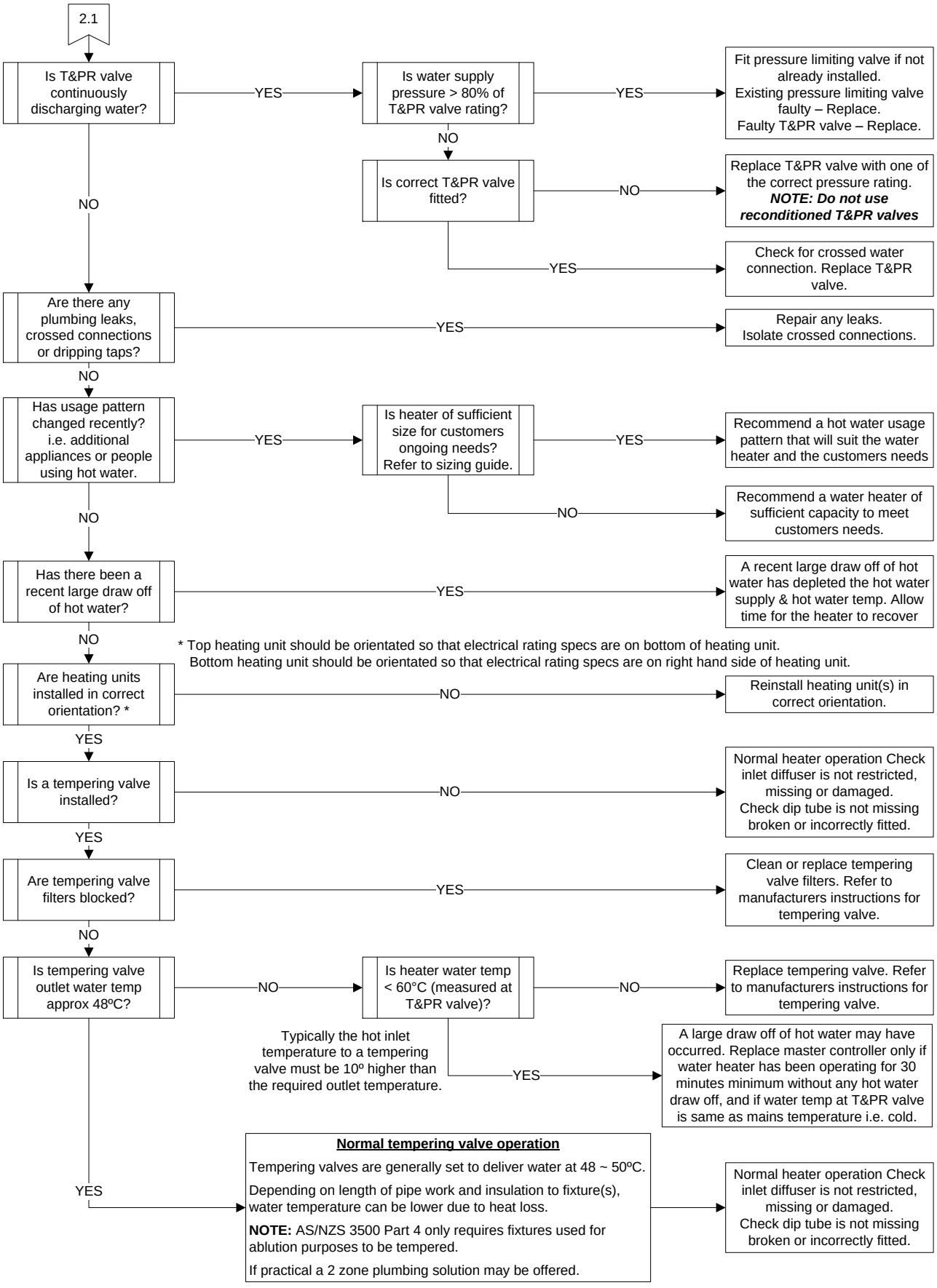
Fault Finding Chart 1



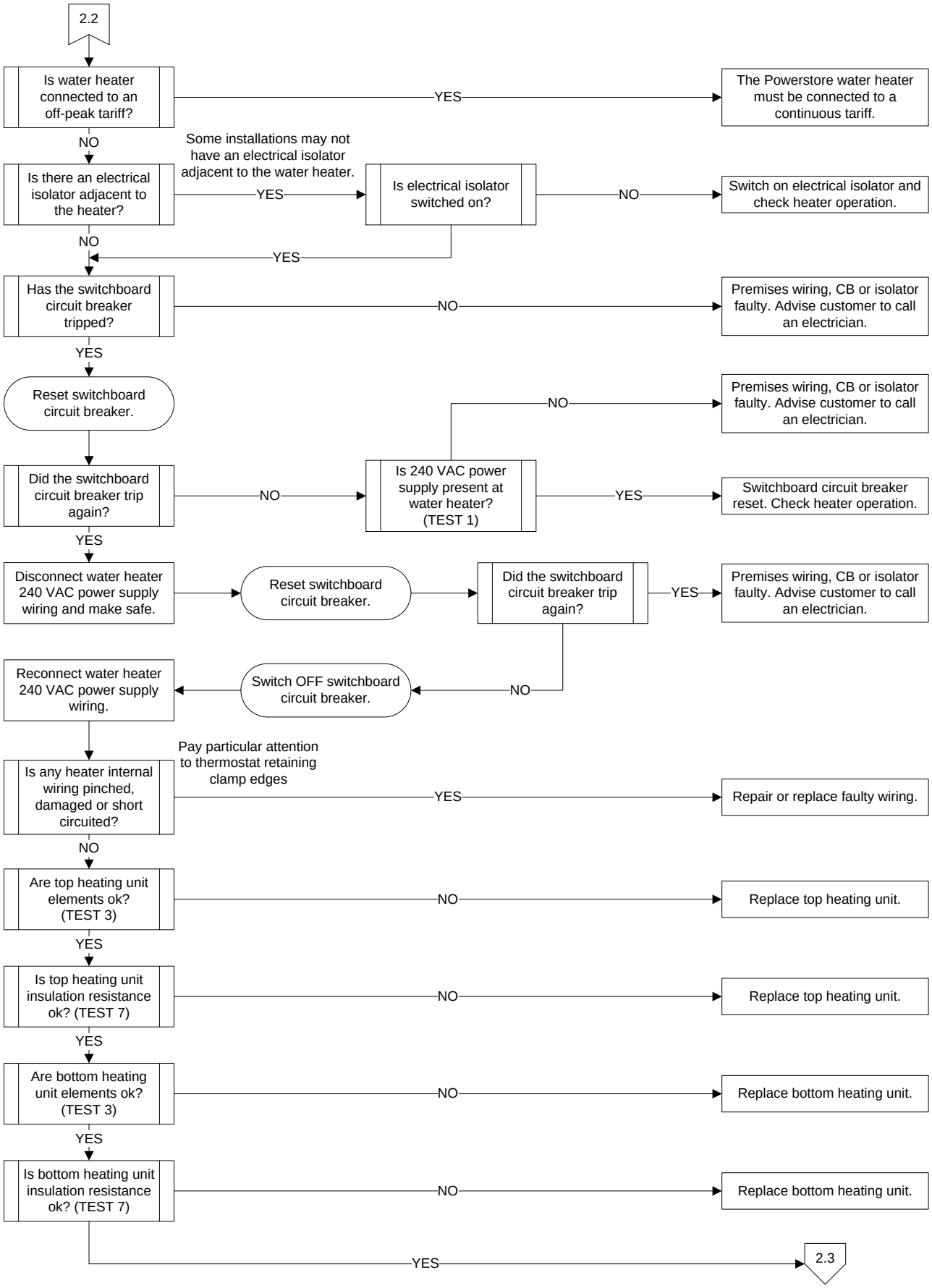
Fault Finding Chart 2



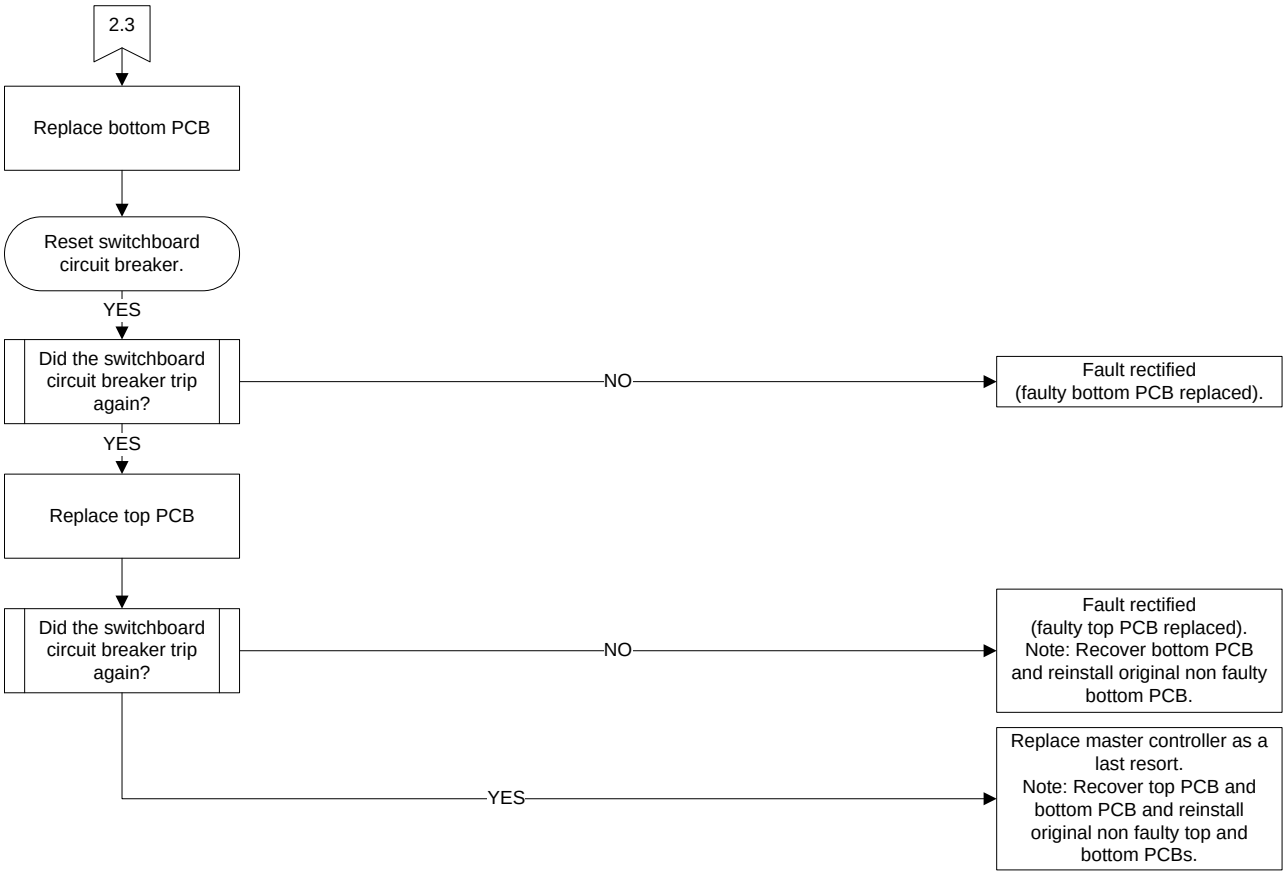
Fault Finding Chart 2.1



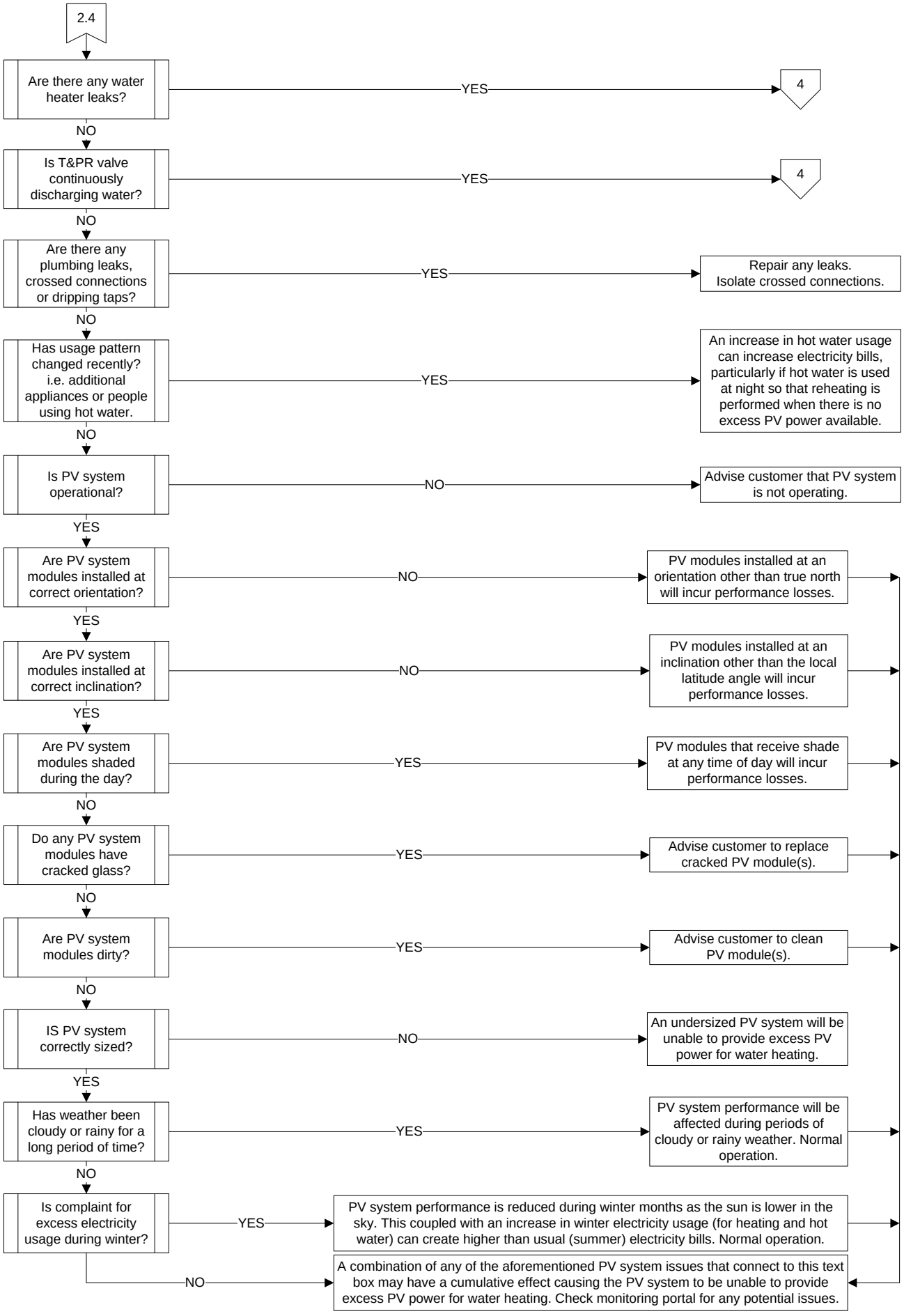
Fault Finding Chart 2.2



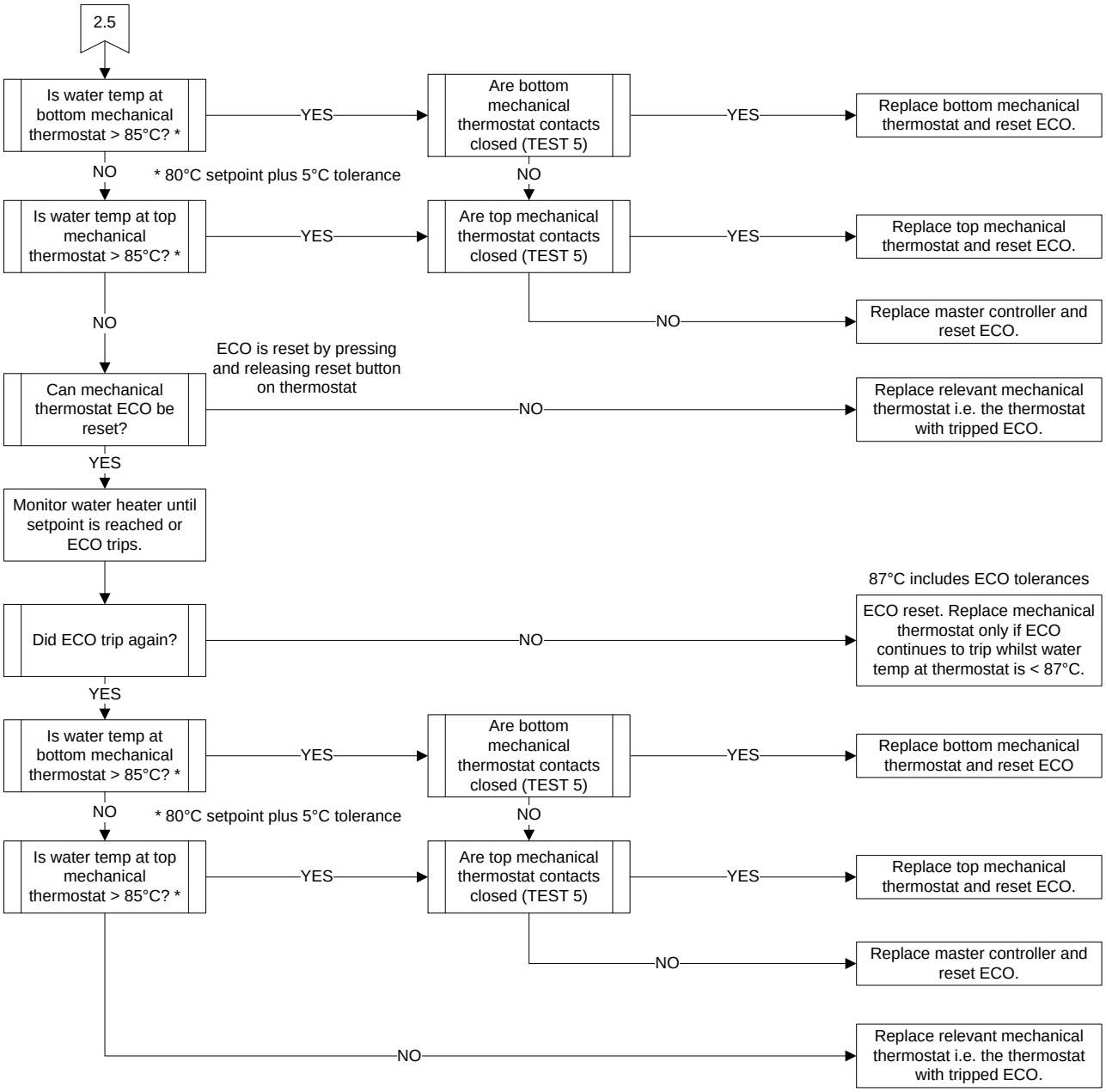
Fault Finding Chart 2.3



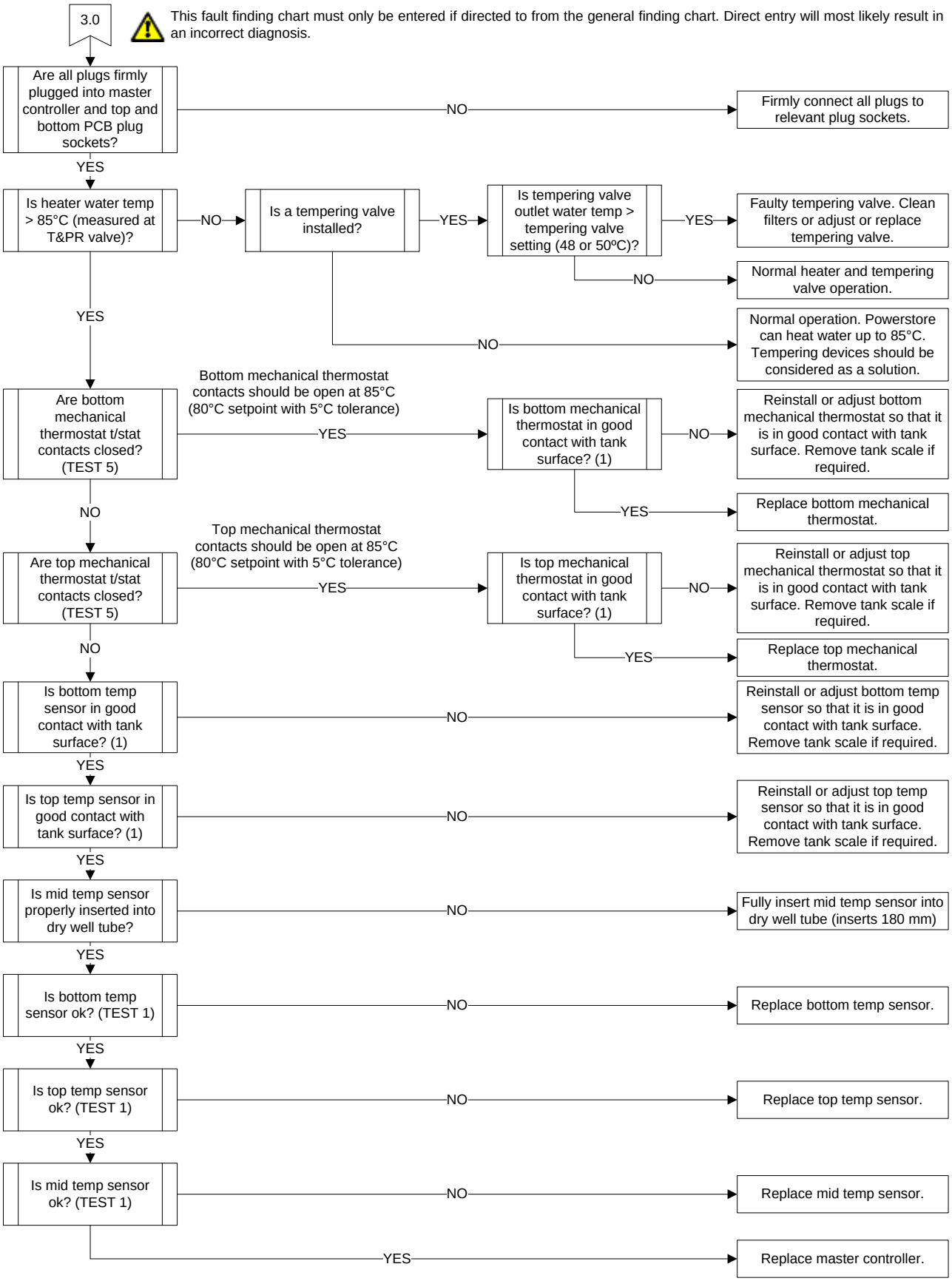
Fault Finding Chart 2.4



Fault Finding Chart 2.5

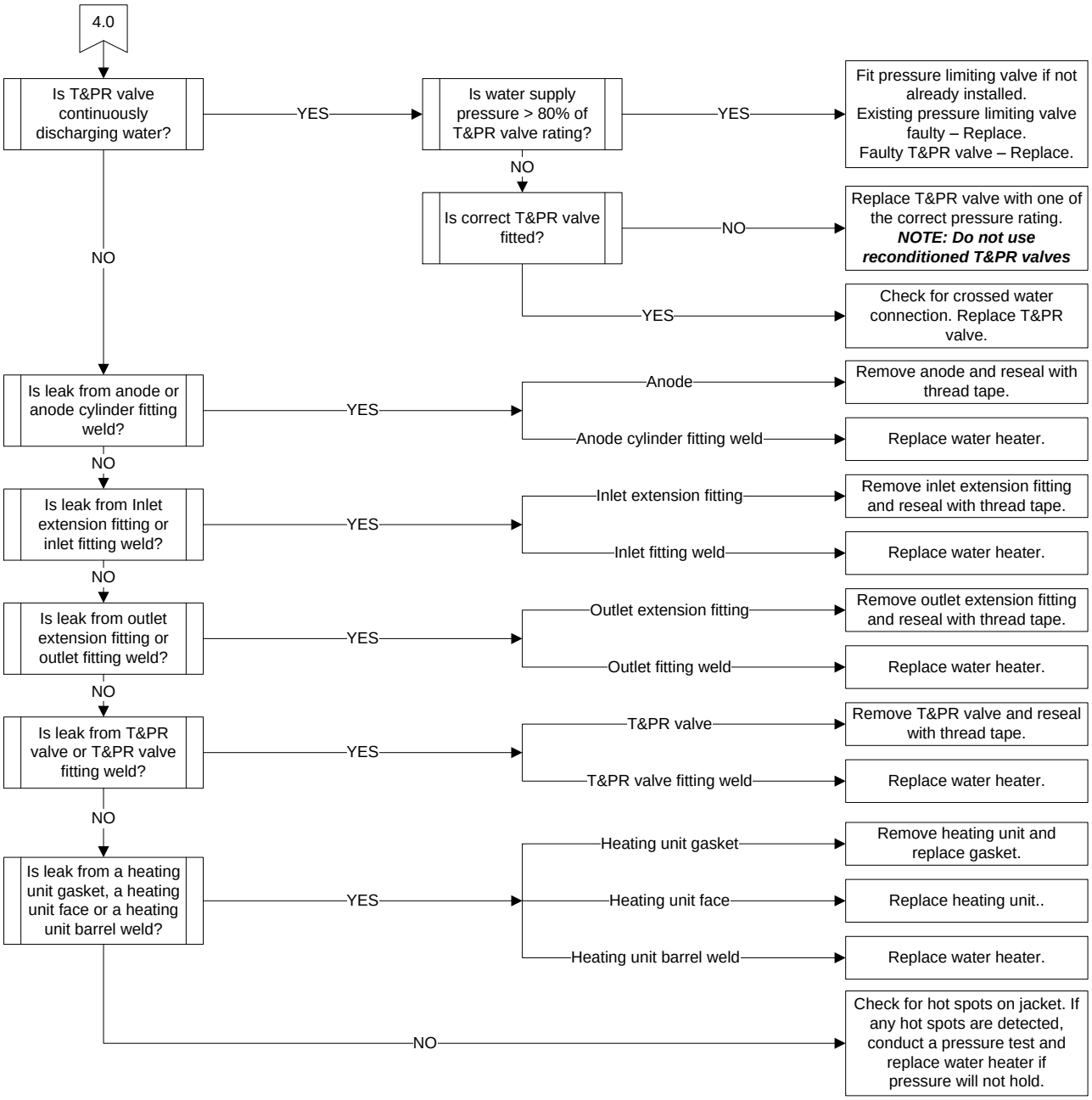


Fault Finding Chart 3

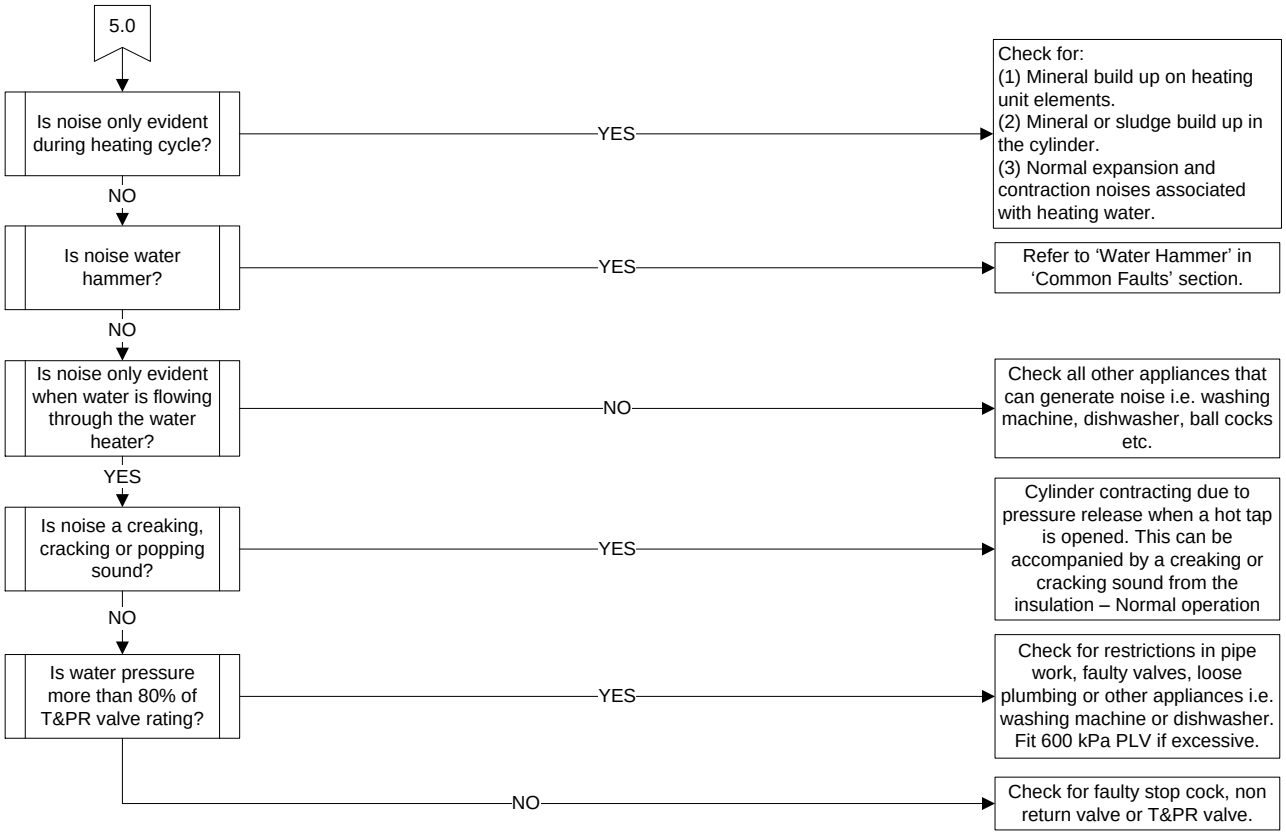


(1) Also ensure there is not a build-up of scale on tank surface at contact point

Fault Finding Chart 4



Fault Finding Chart 5



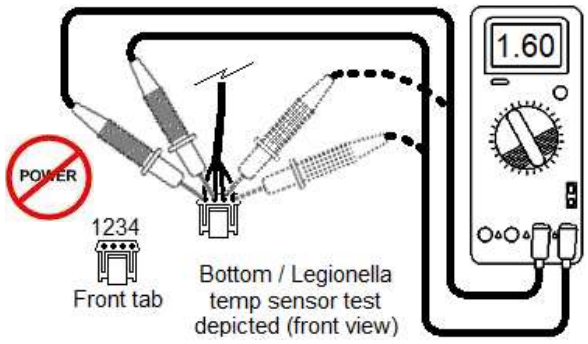
Test 1 – Testing the Temperature Sensors

1. Disconnect relevant temperature sensor plug from relevant PCB plug socket and using a multimeter on the kΩ scale, measure between the sensor plug wiring pins. Use fine probe adaptors (part number WH0020082) and measure at plug side tabs or at rear of plug.

Do not insert meter or fine probe adaptor probes into plug contact points as plug contacts are very small can be easily damaged.

Temperature Sensor	PCB Plug Socket	Plug Wiring Pins
Top Temperature Sensor	Top PCB (on top right side of PCB)	Left & right
Mid Temperature Sensor	Bottom PCB (on top left side of PCB)	Left & right
Bottom Temperature sensor	Bottom PCB (on top right side of PCB)	1 & 2
Legionella Temperature Sensor	Bottom PCB (on top right side of PCB)	3 & 4

2. Measure actual temperature at probe location using a spot temperature device.
3. As the resistance of the sensor will change according to its temperature, the resistance measurements for the sensor will need to be checked against the 'Temperature Sensor Temperature / Resistance Table' below. Allow for a tolerance of ± 1°C.



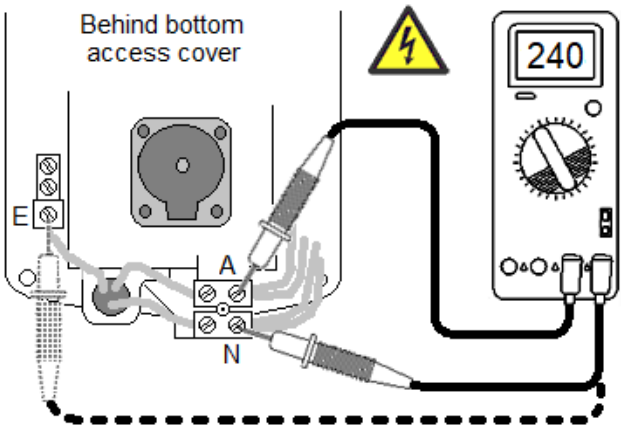
Temperature Sensor Temperature / Resistance Table

The values shown in the table below are for all temperature sensors listed in step 1 table.

ºC	kΩ	ºC	kΩ	ºC	kΩ	ºC	kΩ
0	23.52	23	9.13	46	3.98	69	1.91
1	22.50	24	8.79	47	3.85	70	1.86
2	21.54	25	8.46	48	3.72	71	1.80
3	20.63	26	8.14	49	3.60	72	1.75
4	19.76	27	7.84	50	3.48	73	1.70
5	18.93	28	7.55	51	3.37	74	1.65
6	18.14	29	7.28	52	3.26	75	1.60
7	17.39	30	7.01	53	3.16	76	1.56
8	16.67	31	6.76	54	3.06	77	1.51
9	15.99	32	6.52	55	2.96	78	1.47
10	15.34	33	6.28	56	2.87	79	1.43
11	14.72	34	6.06	57	2.78	80	1.39
12	14.12	35	5.85	58	2.69	81	1.35
13	13.56	36	5.64	59	2.60	82	1.31
14	13.02	37	5.44	60	2.52	83	1.27
15	12.50	38	5.25	61	2.45	84	1.24
16	12.01	39	5.07	62	2.37	85	1.21
17	11.54	40	4.90	63	2.30	86	1.17
18	11.09	41	4.73	64	2.23	87	1.14
19	10.66	42	4.57	65	2.16	88	1.11
20	10.25	43	4.41	66	2.10	89	1.08
21	9.86	44	4.26	67	2.03	90	1.05
22	9.49	45	4.12	68	1.97	91	1.02

Tests 2 ~ 3

Test 2



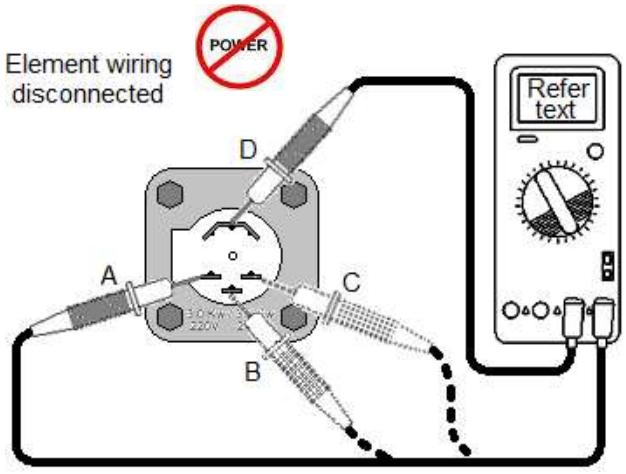
Using a multimeter on the AC voltage scale, measure between the water heater power supply terminal block active terminal, neutral terminal and earth tab. The following results should be obtained:

Active terminal (brown wires) ~ Neutral terminal (blue wires): 240V AC.

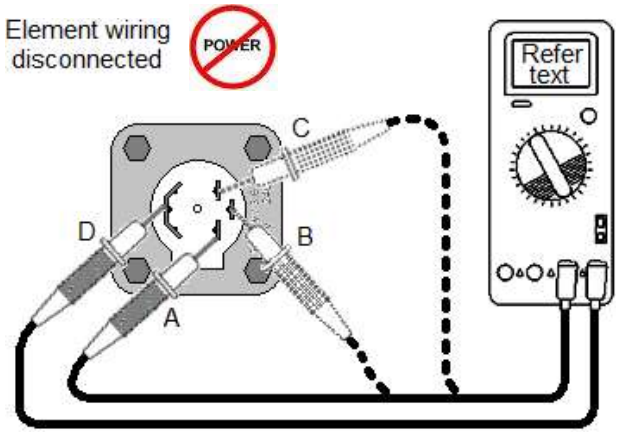
Active terminal (brown wires) ~ Earth tab: 240V AC.

Neutral terminal (blue wires) ~ Earth tab: 0 Volts.

Test 3A (Top heating unit)



Test 3B (Bottom heating unit)



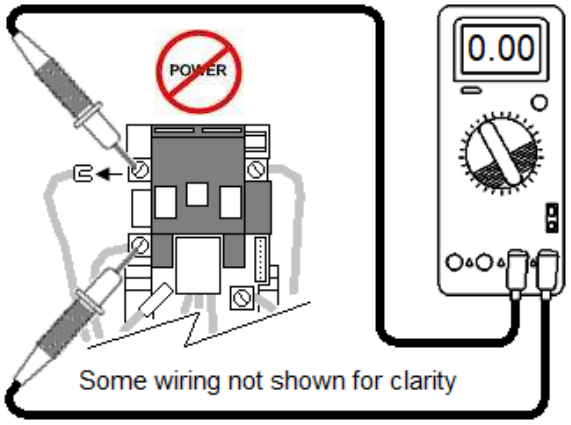
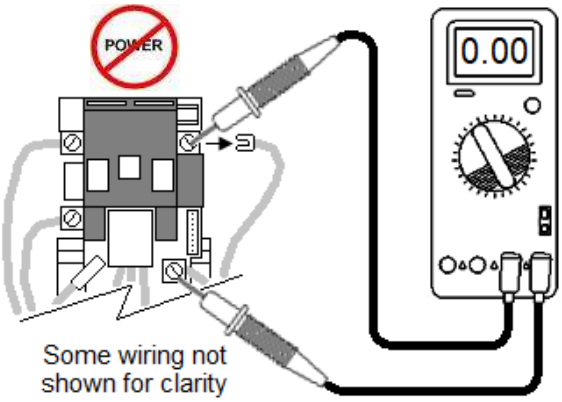
1. Remove single Phillips head screw retaining black element terminal cover and remove cover.
2. Mark and disconnect all element wiring.
3. Using a multimeter on the resistance scale, measure between the element terminals. The following results should be obtained:

   A ~ D (850 W element): 64.5 ~ 75.3 ohms.

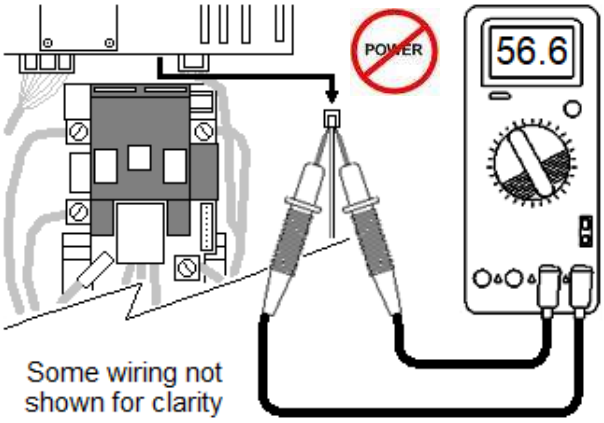
   B ~ D (1050 W element): 52.2 ~ 61.0 ohms

   C ~ D (1700 W element): 32.3 ~ 37.6 ohms.

Fault Finding Tests 4 ~ 6

Test 4	Test 5
	
Disconnect top left hand side wire from mechanical thermostat and using a multimeter on the AC voltage scale, measure between the mechanical thermostat two left side (ECO) terminals. The following result should be obtained when the ECO contacts are closed (not tripped): Less than 1 ohm.	Disconnect top right hand side wire from mechanical thermostat and using a multimeter on the AC voltage scale, measure between the mechanical thermostat two right side (thermostat) terminals. The following result should be obtained when the thermostat contacts are closed: Less than 1 ohm.

Test 6



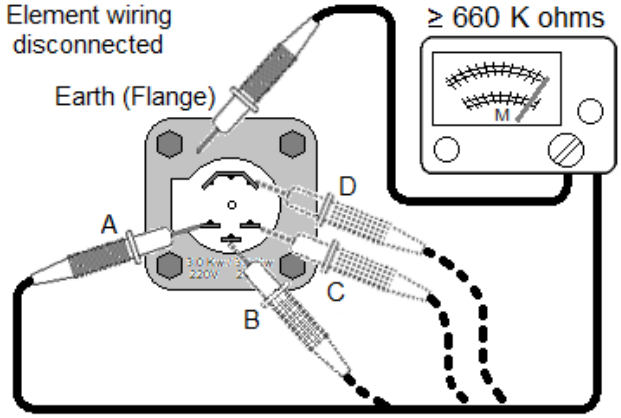
Disconnect current transformer plug from master controller plug socket and using a multimeter on the ohms scale, measure between the sensor plug wiring pins. Use fine probe adaptors (part number WH0020082) and measure at plug side tabs or at rear of plug.

Normal resistance is 54.6 ~ 58.6 ohms.

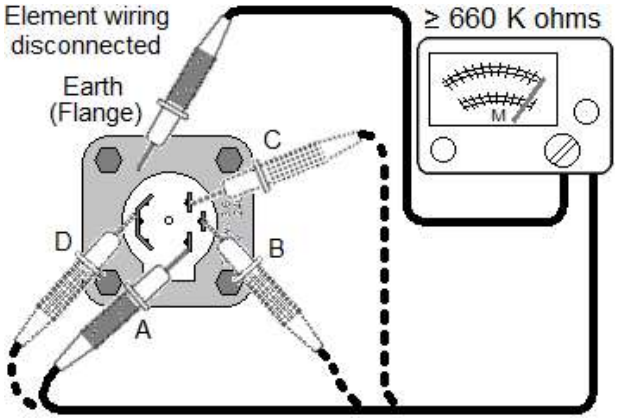
Do not insert meter or fine probe adaptor probes into plug contact points as plug contacts are very small can be easily damaged.

Fault Finding Test 7

Test 7A (Top heating unit)



Test 7B (Bottom heating unit)



1. Remove single Phillips head screw retaining black element terminal cover and remove cover.
2. Mark and disconnect all element wiring.
3. Using a Megger on the 500 VDC scale, measure between each element terminal and the heating unit metal flange (earth) as detailed below. The following results should be obtained:

   A ~ Earth (850 W element): ≥ 660 Kilo ohms.

   B ~ Earth (1050 W element): ≥ 660 Kilo ohms.

   C ~ Earth (1700 W element: ≥ 660 Kilo ohms.

   D ~ Earth (element common neutral): ≥ 660 Kilo ohms.

COMMISSIONING PROCEDURE

1. Check to ensure all valves are in the correct position to permit water flow through the water heater and that the water heater has been filled with water and purged of air.
2. Turn ON circuit breaker/electrical isolator in switchboard marked 'Water Heater'.
3. Turn ON water heater electrical isolator located adjacent to the heater (if installed).

   When power is provided to the water heater, it will automatically operate in initialisation mode for 60 seconds after which time it will operate according to the master controller determined mode of operation.
4. Perform connection/setup procedure with third party external control device. For CET applications, refer to document 'CET Gateway Installation and onSite APP – Guide for Installers'.

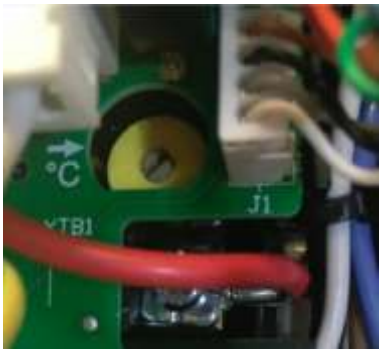
   Note: Solahart Dealers may elect to setup the Solahart Dealer web monitoring portal. Refer to document 'CET Solahart Dealer Portal – User Guide'.
5. Confirm correct heater operation.

Mechanical Thermostat Temperature Adjustment

This procedure details how to check and if required adjust the top and bottom mechanical thermostats to 80°C. A torch may be required to view dial setting.

The top and bottom mechanical thermostats <u>MUST</u> both be set to 80°C. A setting other than 80°C will cause the heater to operate outside design parameters which will drastically reduce the efficiency of the water heater by reducing the amount of excess PV power that can be utilised for water heating.

1. ***Isolate power supply to water heater.***
2. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***
3. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
4. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***
5. Remove two Phillips head screws retaining top access cover and remove cover by pulling bottom of cover out and then down.
6. Using a small flat bladed screwdriver, rotate bottom mechanical thermostat adjustment dial so that °C arrow on PCB points to '80' on yellow adjustment dial (dial is located on right hand side of PCB under white heating unit plug).
7. Using a small flat bladed screwdriver, rotate top mechanical thermostat adjustment dial so that °C arrow on PCB points to '80' on yellow adjustment dial (dial is located on right hand side of PCB under white heating unit plug).



8. Check to ensure all wiring insulation is not damaged by any metal edges (especially on top and bottom thermostat retaining clamp edges) then reassemble in reverse order of steps 5 ~ 1.
9. If either mechanical thermostat was adjusted at steps 6 or 7, ***reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation. Skip this step if no thermostat adjustments were performed.
10. Confirm correct heater operation.

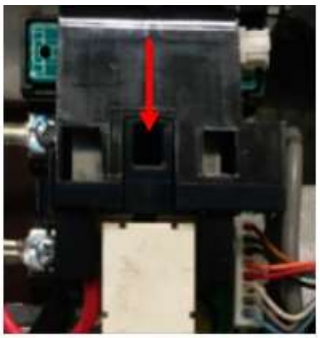
Resetting Mechanical Thermostat ECOs

This procedure details how to reset the top and/or bottom mechanical thermostat ECOs. A torch will be required to view ECO reset button.

Test 4 on page 67 can be performed on either mechanical thermostat to determine if the thermostat's ECO has tripped (opened).

If either ECO has tripped, determine cause of operation before heater is put back in service. Start from beginning of 'General Fault Finding Chart' on page 39 to diagnose fault.

1. ***Isolate power supply to water heater.***
2. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***
3. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
4. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***
5. Remove two Phillips head screws retaining top access cover and remove cover by pulling bottom of cover out and then down.
6. Insert a small Phillips head screwdriver into centre aperture on top PCB black cover and press and release ECO reset button.
7. Insert a small Phillips head screwdriver into centre aperture on bottom PCB black cover and press and release ECO reset button.
8. Check to ensure all wiring insulation is not damaged by any metal edges (especially on top and bottom thermostat retaining clamp edges) then reassemble in reverse order of steps 5 ~ 1.



ECO Reset Button Location

9. ***Reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
10. Determine and rectify cause of ECO trip.
11. Confirm correct heater operation.

COMPONENT REPLACEMENT PROCEDURES

Warnings

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.

Ensure PPE is worn when testing for voltages to reduce the risk of electric shock.

Draining the Water Heater (Procedure 1)

1. ***Isolate power and water supplies to water heater.***
2. ***Relieve pressure from water heater through T&PR valve or a hot tap.***
3. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***
4. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
5. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***
6. Disconnect cold water supply pipe.
7. Fit a drain hose to cold water connection and run other end to a drain or safe location.
8. Open T&PR valve to allow air into the water heater to facilitate drainage.

Bottom Access Cover (Procedure 2)

1. ***Isolate power supply to water heater.***
2. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***
3. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
4. Reassemble in reverse order of above.

Top Access Cover (Procedure 3)

1. ***Isolate power supply to water heater.***
2. Remove two Phillips head screws retaining top access cover and remove cover by pulling bottom of cover out and then down.
3. Reassemble in reverse order of above.

Master Controller (Procedure 4)

1. ***Isolate power supply to water heater.***
2. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***

3. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
4. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***
5. Remove four small Phillips head screws retaining RS485 connection cover (cover below LEDs) and remove cover complete with gasket. Skip this step if RS485 wiring is not fitted.
6. Unplug RS485 plug socket from master controller and withdraw RS485 wiring complete with rubber grommet. Skip this step if RS485 wiring is not fitted.
7. Disconnect three wiring plugs from bottom of master controller by depressing locking tab on each plug and then pulling plug down. Note: Each plug is unique and can only be reconnected to its respective plug socket.
8. Disconnect master controller power supply plug by depressing locking tab on plug then pulling plug and plug socket apart.
9. Remove five large head Phillips head screws retaining master controller to heater jacket and remove master controller with earth wires still attached.
10. Remove two Phillips head screws retaining earth wires and earth wire saddle to rear of master controller.
11. Reassemble in reverse order of above and check the following before replacing bottom access cover and master controller sunshield:
    - Ensure RS485 cover gasket and wiring grommet is correctly positioned.
    - Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).
12. ***Reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
13. Select 'Water Heater' link in CET Gateway App, click on 'Rediscover' tab then click on 'YES DEFINITELY RE-DISCOVER'. The Gateway will probe the network for a working PowerStore controller and will automatically associate the new controller with the installation. The installation of the controller is known to be successful when a green tick is shown in both the 'Configuration' and 'Operation' status columns for the water heater in the 'Status' page of the on-site app (refer to 'CET Gateway Installation and onSite App – Guide for Installers' for more information).
14. Confirm correct heater operation.

Master Controller CT (Procedure 5)

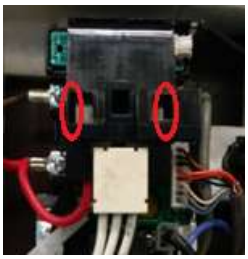
Note: Early model water heaters have only the single brown wire that goes to the top mechanical thermostat going through CT. Later models have both brown wires going through CT. When reassembling for all water heaters, insert both brown wires through CT.

1. ***Isolate power supply to water heater.***
2. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***
3. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.

4. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***
5. Disconnect CT wiring plug from bottom of master controller by depressing locking tab on plug and then pulling plug down.
6. Cut cable tie retaining brown wire(s) inside CT, disconnect brown wires from heater power supply terminal block then slide CT off brown wire(s).
7. Reassemble in reverse order of above.
8. Confirm correct heater operation.

Bottom PCB (Procedure 6)

1. ***Isolate power supply to water heater.***
2. Remove master controller by performing steps 2 ~ 10 of procedure 4.
3. Disconnect mid sensor two pin plug, bottom sensor four pin plug and wiring loom eight pin plug from PCB by depressing locking tab on each plug and then pulling plug away from PCB.
4. Remove PCB cover as follows:
   a) Unclip left side of cover: Insert small flat bladed screwdriver approximately 15 mm into left side aperture (between PCB cover edge and white internal relay) and gently push cover towards left side then pull cover towards front.
   b) Unclip right side of cover: Insert small flat bladed screwdriver approximately 15 mm into right side aperture (between PCB cover edge and white internal relay) and gently push cover towards right side then pull cover towards front.



   c) Remove Cover: Pull bottom of cover out then slide cover up and remove from top of thermostat.
5. Disconnect heating unit wiring plug from PCB by pulling plug away from PCB pins whilst gently rocking plug in an up and down motion.
6. Mark and disconnect all remaining wiring from PCB.
7. Unclip and remove PCB from PCB mounting bracket as follows:
   a) Unclip bottom of PCB: Gently lever bottom PCB retaining tabs down with a small flat bladed screwdriver then pull out bottom of PCB.
   b) Unclip sides of PCB: Gently lever side PCB retaining tabs out with a small flat bladed screwdriver then pull out PCB sides.
   c) Remove PCB: Slide PCB down out of top retaining tabs and remove from mounting bracket.

PCB tabs

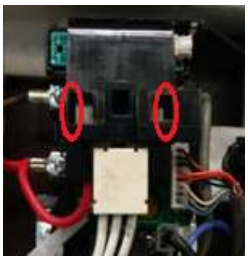
8. Reassemble in reverse order of above and check the following before replacing bottom access cover and master controller sunshield:
   - Ensure mechanical thermostat is fully pushed down into retaining clamp and that thermostat is hard up against cylinder wall.
   - Ensure mechanical thermostat is set to 80ºC and press and release ECO reset button to ensure ECO is reset (ECO reset button is accessed via centre aperture in PCB cover).

- Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).

9. ***Reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
10. Confirm correct heater operation.

Bottom Mechanical Thermostat (Procedure 7)

1. ***Isolate power supply to water heater.***
2. Remove master controller by performing steps 2 ~ 10 of procedure 4.
3. Disconnect mid sensor two pin plug, bottom sensor four pin plug and wiring loom eight pin plug from PCB by depressing locking tab on each plug and then pulling plug away from PCB.
4. Remove PCB cover as follows:



   a) Unclip left side of cover: Insert small flat bladed screwdriver approximately 15 mm into left side aperture (between PCB cover edge and white internal relay) and gently push cover towards left side then pull cover towards front.

   b) Unclip right side of cover: Insert small flat bladed screwdriver approximately 15 mm into right side aperture (between PCB cover edge and white internal relay) and gently push cover towards right side then pull cover towards front.

   c) Remove Cover: Pull bottom of cover out then slide cover up and remove from top of thermostat.
5. Disconnect heating unit wiring plug from PCB by pulling plug away from PCB pins whilst gently rocking plug in an up and down motion.
6. Mark and disconnect all remaining wiring from PCB and mechanical thermostat.
7. Cut cable tie retaining wiring to bottom right side of PCB.
8. Slide mechanical thermostat complete with PCB up and out of thermostat retaining clamp (push up on thermostat not PCB).
9. Remove scale or corrosion from cylinder surface (if any).
10. Flip over thermostat so that rear of thermostat can be accessed and use a small flat bladed screwdriver to unclip mechanical thermostat from PCB mounting bracket by levering retaining tabs on rear of mounting bracket and gently pulling thermostat out from mounting bracket (tabs are located on sides and bottom of PCB mounting bracket).
11. Remove right angle spade terminal from thermostat and install on corresponding terminal on replacement thermostat.

Tabs

12. Reassemble in reverse order of above and check the following before replacing bottom access cover and master controller sunshield:
    - Ensure mechanical thermostat is fully pushed down into retaining clamp and is hard up against cylinder wall.
    - Ensure mechanical thermostat is set to 80ºC and press and release ECO reset button to ensure ECO is reset (ECO reset button is accessed via centre aperture in PCB cover).

- Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).

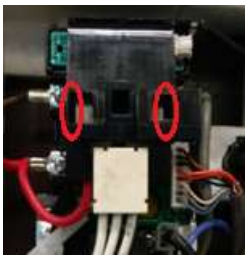
13. ***Reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
14. Confirm correct heater operation.

Bottom Heating Unit (Procedure 8)

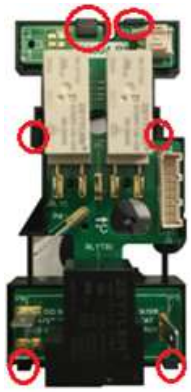
1. ***Isolate power and water supplies to water heater.***
2. Drain water heater by performing steps 2 ~ 8 of procedure 1.
3. Remove single Phillips head screw retaining heating unit terminal cover and remove cover.
4. Mark and disconnect all wiring from heating unit and disconnect earth wire from thermostat retaining clamp.
5. Using a 12 mm socket, remove 4 bolts retaining heating unit and thermostat retaining clamp and remove thermostat retaining clamp.
6. Withdraw heating unit complete with gasket from cylinder. Care must be taken to ensure heating unit loop does not catch on cylinder opening and open out inside the cylinder. ***Do not cut off heating unit and leave a portion inside the cylinder.***
7. Clean around cylinder heating unit face, fit replacement gasket to replacement heating unit then slide heating unit into cylinder. ***Ensure heating unit is in correct orientation*** (electrical rating specs should be on bottom of heating unit).
8. Reassemble in reverse order of steps 5 ~ 3 and check the following:
   - Ensure mechanical thermostat is fully pushed down into retaining clamp and that thermostat is hard up against cylinder wall.
   - Ensure mechanical thermostat is set to 80ºC and press and release ECO reset button to ensure ECO is reset (ECO reset button is accessed via centre aperture in PCB cover).
   - Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).
9. Remove drain hose and reconnect cold water supply pipe.
10. Restore water supply and fill heater. Release air by ***gently*** lifting easing lever on T&PR valve until water runs freely from T&PR valve drain line without sputtering.
11. Check for water leaks.
12. Purge air from system via premises hot taps.
13. Using a multimeter on the resistance scale, measure between the internal cylinder wall and the main earth connection of the water heater. The resulting reading **MUST NOT** be more than 0.5 ohms. If a reading greater than 0.5 ohms is obtained, ensure heating unit metal surround is in good contact with cylinder flange then retest.
14. Refit bottom access cover and master controller sunshield.
15. Restore power and ***reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
16. Confirm correct heater operation.

Top PCB (Procedure 9)

1. ***Isolate power supply to water heater.***
2. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***
3. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
4. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***
5. Remove two Phillips head screws retaining top access cover and remove cover by pulling bottom of cover out and then down.
6. Disconnect top sensor two pin plug and wiring loom eight pin plug from PCB by depressing locking tab on each plug and then pulling plug away from PCB.
7. Remove PCB cover as follows:
   a) Unclip left side of cover: Insert small flat bladed screwdriver approximately 15 mm into left side aperture (between PCB cover edge and white internal relay) and gently push cover towards left side then pull cover towards front.
   b) Unclip right side of cover: Insert small flat bladed screwdriver approximately 15 mm into right side aperture (between PCB cover edge and white internal relay) and gently push cover towards right side then pull cover towards front.



   c) Remove Cover: Pull bottom of cover out then slide cover up and remove from top of thermostat.
8. Disconnect heating unit wiring plug from PCB by pulling plug away from PCB pins whilst gently rocking plug in an up and down motion.
9. Mark and disconnect all remaining wiring from PCB.
10. Disconnect heating unit black neutral wire from mechanical thermostat.
11. Unclip and remove PCB from PCB mounting bracket as follows:
    a) Unclip bottom of PCB: Gently lever bottom PCB retaining tabs down with a small flat bladed screwdriver then pull out bottom of PCB.
    b) Unclip sides of PCB: Gently lever side PCB retaining tabs out with a small flat bladed screwdriver then pull out PCB sides.
    c) Remove PCB: Slide PCB down out of top retaining tabs and remove from mounting bracket.



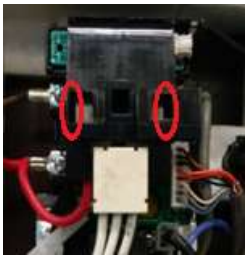
PCB tabs

12. Reassemble in reverse order of above and check the following before replacing access covers and master controller sunshield:
    - Ensure mechanical thermostat is fully pushed down into retaining clamp and that thermostat is hard up against cylinder wall.
    - Ensure mechanical thermostat is set to 80ºC and press and release ECO reset button to ensure ECO is reset (ECO reset button is accessed via centre aperture in PCB cover).
    - Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).

13. ***Reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
14. Confirm correct heater operation.

Top Mechanical Thermostat (Procedure 10)

1. ***Isolate power supply to water heater.***
2. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***
3. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
4. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***
5. Remove two Phillips head screws retaining top access cover and remove cover by pulling bottom of cover out and then down.
6. Disconnect top sensor two pin plug and wiring loom eight pin plug from PCB by depressing locking tab on each plug and then pulling plug away from PCB.
7. Remove PCB cover as follows:
   a) Unclip left side of cover: Insert small flat bladed screwdriver approximately 15 mm into left side aperture (between PCB cover edge and white internal relay) and gently push cover towards left side then pull cover towards front.
   b) Unclip right side of cover: Insert small flat bladed screwdriver approximately 15 mm into right side aperture (between PCB cover edge and white internal relay) and gently push cover towards right side then pull cover towards front.



   c) Remove Cover: Pull bottom of cover out then slide cover up and remove from top of thermostat.
8. Disconnect heating unit wiring plug from PCB by pulling plug away from PCB pins whilst gently rocking plug in an up and down motion.
9. Mark and disconnect all remaining wiring from PCB and mechanical thermostat.
10. Slide mechanical thermostat complete with PCB up and out of thermostat retaining clamp (push up on thermostat not PCB).
11. Remove scale or corrosion from cylinder surface (if any).
12. Flip over thermostat so that rear of thermostat can be accessed and use a small flat bladed screwdriver to unclip mechanical thermostat from PCB mounting bracket by levering retaining tabs on rear of mounting bracket and gently pulling thermostat out from mounting bracket (tabs are located on sides and bottom of PCB mounting bracket).
13. Remove right angle spade terminal from thermostat and install on corresponding terminal on replacement thermostat.

Tabs

14. Reassemble in reverse order of above and check the following before replacing access covers and master controller sunshield:

- Ensure mechanical thermostat is fully pushed down into retaining clamp and that thermostat is hard up against cylinder wall.
- Ensure mechanical thermostat is set to 80ºC and press and release ECO reset button to ensure ECO is reset (ECO reset button is accessed via centre aperture in PCB cover).
- Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).

15. ***Reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
16. Confirm correct heater operation.

Top Heating Unit (Procedure 11)

1. ***Isolate power and water supplies to water heater.***
2. Partially drain water heater to below level of top heating unit by performing steps 2 ~ 8 of procedure 1. ***Ensure adequate water is drained to prevent damaging electrical components with water when heating unit is removed later in this procedure.***
3. Remove two Phillips head screws retaining top access cover and remove cover by pulling bottom of cover out and then down.
4. Remove single Phillips head screw retaining heating unit terminal cover and remove cover.
5. Mark and disconnect all wiring from heating unit.
6. Using a 12 mm socket, remove 4 bolts retaining heating unit and thermostat retaining clamp and remove thermostat retaining clamp.
7. Withdraw heating unit complete with gasket from cylinder. Care must be taken to ensure heating unit loop does not catch on cylinder opening and open out inside the cylinder. ***Do not cut off heating unit and leave a portion inside the cylinder.***
8. Clean around cylinder heating unit face, fit replacement gasket to replacement heating unit then slide heating unit into cylinder. ***Ensure heating unit is in correct orientation*** (electrical rating specs should be on right hand side of heating unit).
9. Reassemble in reverse order of steps 6 ~ 4 and check the following:
   - Ensure mechanical thermostat is fully pushed down into retaining clamp and that thermostat is hard up against cylinder wall.
   - Ensure mechanical thermostat is set to 80ºC and press and release ECO reset button to ensure ECO is reset (ECO reset button is accessed via centre aperture in PCB cover).
   - Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).
10. Remove drain hose and reconnect cold water supply pipe.
11. Restore water supply and fill heater. Release air by ***gently*** lifting easing lever on T&PR valve until water runs freely from T&PR valve drain line without sputtering.
12. Check for water leaks.
13. Purge air from system via premises hot taps.
14. Refit top and bottom access covers and master controller sunshield.

15. Restore power and ***reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
16. Confirm correct heater operation.

Bottom/Legionella Temperature Sensor (Procedure 12)

The bottom temperature sensor is a single unit dual sensor comprised of bottom temperature sensor and Legionella temperature sensor.

1. ***Isolate power supply to water heater.***
2. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***
3. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
4. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***
5. Disconnect master controller power supply plug so that bottom temperature sensor can be accessed (depress locking tab on plug then pull plug and plug socket apart).
6. Disconnect bottom sensor four pin plug from PCB (depress locking tab on plug then pull plug away from PCB).
7. Depress locking arms on rear of bottom temperature sensor and withdraw sensor from housing.
8. Reassemble in reverse order of above and check the following before replacing bottom access cover and master controller sunshield:
    - Ensure mechanical thermostat is fully pushed down into retaining clamp and that thermostat is hard up against cylinder wall.
    - Ensure mechanical thermostat is set to 80ºC and press and release ECO reset button to ensure ECO is reset (ECO reset button is accessed via centre aperture in PCB cover).
    - Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).
9. ***Reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
10. Confirm correct heater operation.

Mid Temperature Sensor (Procedure 13)

1. ***Isolate power supply to water heater.***
2. Remove single extra large head Phillips head screw retaining master controller sunshield and remove sunshield. ***Note: Sunshield must be reinstalled during reassembly.***
3. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
4. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***

5. Disconnect mid sensor two pin plug from PCB (depress locking tab on plug then pull plug away from PCB).
6. Remove mid temperature sensor by pulling sensor wiring down so that sensor withdraws from conduit type dry well (pull on sensor wiring not sensor plug). Sensor is inserted 180 mm into dry well conduit.
7. Reassemble in reverse order of above and check the following before replacing bottom access cover and master controller sunshield:
   - Ensure mechanical thermostat is fully pushed down into retaining clamp and that thermostat is hard up against cylinder wall.
   - Ensure mechanical thermostat is set to 80ºC and press and release ECO reset button to ensure ECO is reset (ECO reset button is accessed via centre aperture in PCB cover).
   - Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).
8. ***Reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
9. Confirm correct heater operation.

Top Temperature Sensor (Procedure 14)

1. ***Isolate power supply to water heater.***
2. Remove two Phillips head screws retaining bottom access cover and remove cover by pulling bottom of cover out and then down.
3. ***Using a multimeter set on the AC voltage scale, check to ensure a voltage is not present at heater power supply terminals.***
4. Remove two Phillips head screws retaining top access cover and remove cover by pulling bottom of cover out and then down.
5. Disconnect top sensor two pin plug from PCB (depress locking tab on plug then pull plug away from PCB).
6. Depress locking arms on rear of top temperature sensor and withdraw sensor from housing.
7. Reassemble in reverse order above and check the following before replacing access covers and master controller sunshield:
   - Ensure mechanical thermostat is fully pushed down into retaining clamp and that thermostat is hard up against cylinder wall.
   - Ensure mechanical thermostat is set to 80ºC and press and release ECO reset button to ensure ECO is reset (ECO reset button is accessed via centre aperture in PCB cover).
   - Check to ensure all wiring insulation is not damaged by any metal edges (especially on thermostat retaining clamp edges).
8. ***Reset master controller*** (refer to 'Fault/Service Reset Procedure' on page 35). The master controller will restart in initialisation mode (1 minute) after which time it will determine and enter the relevant mode of operation.
9. Confirm correct heater operation.

Temperature & Pressure Relief Valve (Procedure 15)

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

1. ***Isolate power and water supplies to water heater.***
2. Partially drain water heater to below level of T&PR valve by performing steps 2 ~ 8 of procedure 1.
3. Disconnect T&PR valve drain line.
4. Unscrew and remove T&PR valve.
5. Confirm replacement T&PR valve is correct rating and refit using thread tape.
6. Reconnect T&PR valve drain line.
7. Remove drain hose and reconnect cold water supply pipe.
8. Restore water supply and fill heater. Release air by ***gently*** lifting easing lever on T&PR valve until water runs freely from T&PR valve drain line without sputtering.
9. Check for water leaks.
10. Purge air from system via premises hot taps.
11. Refit top and bottom access covers and master controller sunshield.
12. Restore power and check heater operation.

Dip Tube (Procedure 16)

1. ***Isolate power and water supplies to water heater.***
2. Partially drain water heater to below level of hot water outlet by performing steps 2 ~ 8 of procedure 1.
3. Disconnect hot water pipe from heater hot water outlet.
4. Unscrew and remove brass extension fitting.
5. Using a flat blade screwdriver, gently split outer rim at top and bottom of dip tube face and prise dip tube out of cylinder fitting.
6. Fit replacement dip tube into cylinder fitting ensuring the flat section lines up with fitting (dip tube facing up) then gently drive dip tube into fitting a short distance.
7. Apply thread tape to brass extension fitting and refit; this will push dip tube into the correct location.
8. Remove drain hose and reconnect cold water supply pipe.
9. Restore water supply and fill heater. Release air by ***gently*** lifting easing lever on T&PR valve until water runs freely from T&PR valve drain line without sputtering.
10. Check for water leaks.
11. Purge air from system via premises hot taps.
12. Refit top and bottom access covers and master controller sunshield.
13. Restore power and check heater operation.

Anode (Procedure 17)

1. ***Isolate power and water supplies to water heater.***
2. Drain water heater by performing steps 2 ~ 8 of procedure 1.
3. Remove anode cap and using a 27 mm socket or tube spanner, remove anode.
4. Apply thread tape to replacement anode and refit. **Note:** It may be necessary to cut anode to length prior to fitting (anode length should be 1395 mm).
5. Remove drain hose and reconnect cold water supply pipe.
6. Restore water supply and fill heater. Release air by ***gently*** lifting easing lever on T&PR valve until water runs freely from T&PR valve drain line without sputtering.
7. Check for water leaks.
8. Purge air from system via premises hot taps.
9. Refit anode cap.
10. Refit top and bottom access covers and master controller sunshield.
11. Restore power and check heater operation.

DOCUMENT REVISION HISTORY

Title: PowerStore Electric (VE) Service Instructions		**Document Nº:** TM096
Rev	**Details of change**	**Issued**
00	Service Instructions issued for PowerStore Variable Power Electric Water Heater	12/19

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.