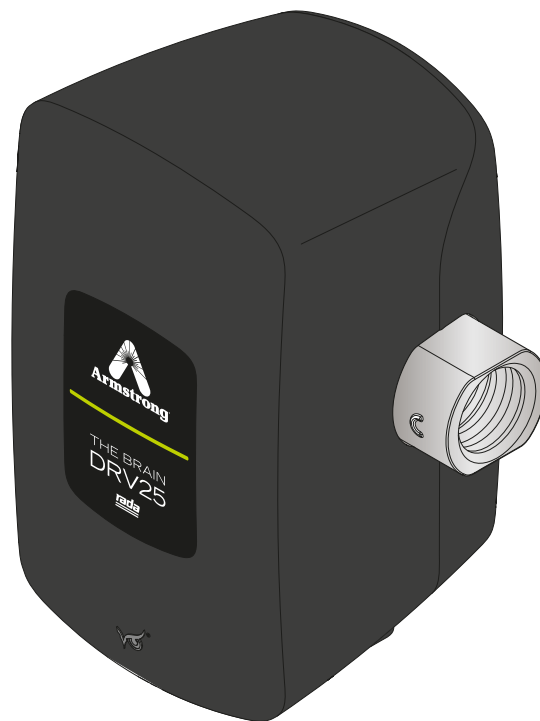




The Brain[®]
DRV25
Digital Recirculation Valve



**The installation and service must be performed by a qualified installer.
For further information, please call our technical department at +32 4240 9090**



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**Keep this manual with installation
for future reference.**

DRV25 Digital Recirculation Mixing Valve

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Introduction

The **Brain® DRV25** is a registered trademark of Armstrong Hot Water Group, a division of Armstrong International.

DRV25 features Rada Technology, Rada is a registered trademark of Kohler Mira Limited of Cheltenham, England.

The DRV25 is a digital recirculating valve for use as part of a warm water recirculation system within a commercial installation.

A dedicated accompanying mobile app can monitor and control temperature limits, disinfection cycle and view error logs. This product can be linked to external control and monitoring devices such as a Building Management System. Data connections can be made via the dedicated BMS port.

Download the “SAGE® by Armstrong” mobile app from either the Apple App Store or Google Play or scan the QR code.



Safety

Icon Legend

If instructions are not followed:



- injury or death and property damage are **imminent**



- injury or death and property damage are **possible**



- potential property damage, expensive repairs, and / or voiding the warranty may result



- Applicable codes must be followed and supersede any other instructions. Generally applicable codes in the US include:
- IPC (International Plumbing Code)
- Read this manual
- Improper installation or operation may cause a flood resulting in property damage, personal injury, or death. Armstrong strongly recommends that a qualified installer be used.
- Service must be performed by a qualified person.
- Improper installation, start-up, operation, maintenance, or service may void the warranty.



Hot water or metal may cause scald burns. Skin exposure to 60°C water or metal for only five seconds may cause a second degree burn.



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General Advisory

The use of the word 'failsafe' to describe the function of any hot and cold water mixing valve is both incorrect and misleading. This DRV (*Digital Recirculation Valve*) incorporates additional shut-off devices to improve the level of safety however, in keeping with every other mechanism it cannot be considered as being functionally infallible.

Where chloramine / chlorine disinfection is practiced, **DO NOT** exceed a chloramine / chlorine concentration of **50 mg/l (ppm)** in water, per one hour dwell time. Such procedures must be conducted strictly in accordance with the information supplied with the disinfectant and with all relevant Guidelines / Approved Codes of Practice.

Water must have levels of chloramine / chlorine lower than or equal to 4mg/l (ppm) for continual usage.

Data Storage

Armstrong International shall not accept liability in contract, tort (including negligence or otherwise) for any loss of profits, business or anticipated savings, or loss or corruption of data, or any indirect or consequential loss arising out of the customer's use of DRV25. The customer shall be solely responsible for the independent backup of all data / information stored on DRV25. Notwithstanding the foregoing, none of the exclusions and limitations stated above are intended to limit any rights the customer may have under local law or other statutory rights which may not be excluded.

Patents

GB - 2 421 297 2 437 891

US - 7669776 8043556

PCT - PCT/GB2006/000159

European - 06702758.1

India - 1231/MUMNP/2007

Australia - 2006207367

Canada - 2595064

China - ZL200680005853.8

Japan - 4933451

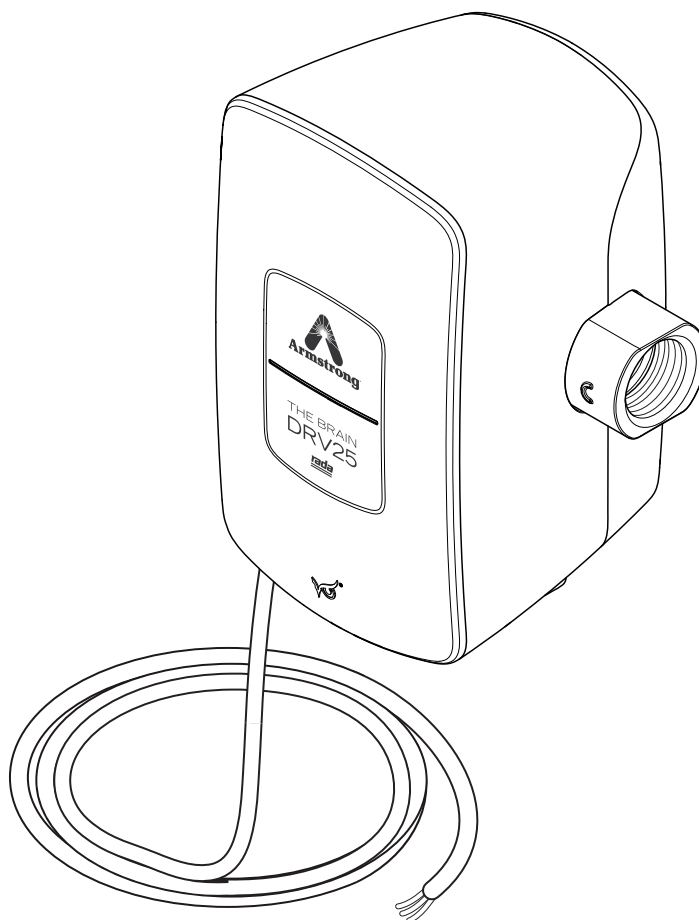
Standards and Codes

The Bluetooth® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Kohler Mira Ltd is under license. Other trademarks and trade names are those of their respective owners.



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Single DRV25 Pack Contents

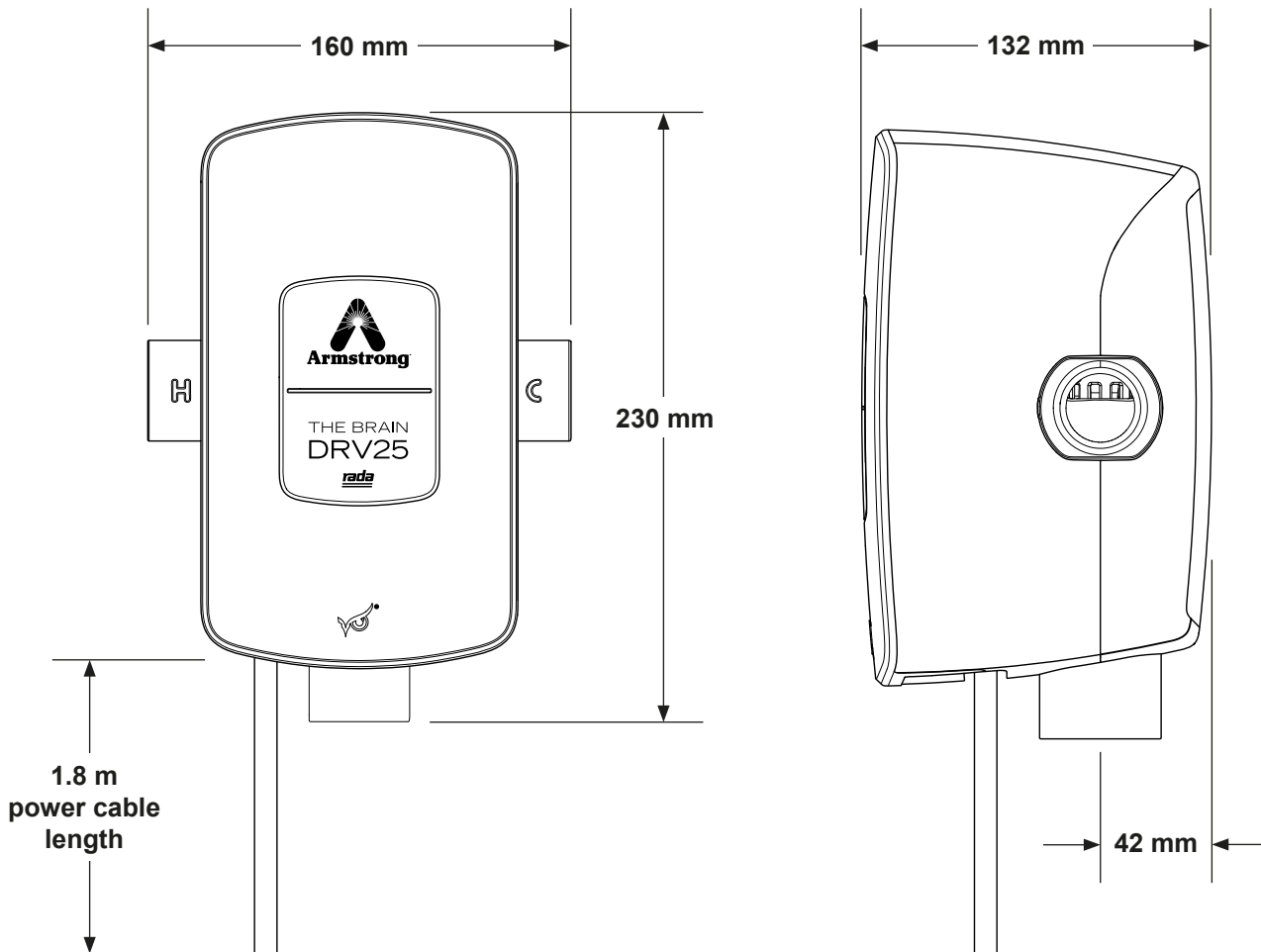


1 x DRV
Digital Recirculation Valve



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DRV25 Dimensions



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Specifications

Technical Specifications

General	
Protection	NEMA 3S
Ambient Temperature	Minimum ambient temperature of 2 °C maximum 50 °C
Ambient Humidity	95% Non-condensing
Connections	1" BSPP (Female)
Installation Environment	Suitable for indoor use only
Normal Environmental Conditions	Altitude up to 2000m
IP Rating	IPx4
Materials	Electronics Casing: PC/ABS Valve: Stainless Steel, engineering plastics and elastomers
Safety	Thermal shutdown upon inlet supply failure and / or power failure
Weight	3.1 kg
Pressures	
Maximum Inlet Supply Pressure	1379 kPa/13.8 bar
Minimum Inlet Supply Pressure	138 kPa/1.5 bar
Supply Pressure Differential	Inlet supply pressures must be nominally equal
Temperatures	
Maximum Inlet Hot Water Supply	85°C, 55°C During group control
Minimum Inlet Hot Water Supply	1°C above set point
Minimum Inlet Cold Water	2°C
Set Point Range	26°C - 85°C
Minimum Recirculation Loop Temperature Loss	1°C
Recirculation Circuit	
Minimum distance to First Outlet	7.6 m
Flow Rates	
Maximum Suggested Flow Rate	69 lpm
Minimum Recirculation Flow Rate	8 lpm
Minimum System Draw-off	0 lpm during recirculation, 8 lpm during group control
Electrical	
Power Supply	120 - 240V AC ~ 50/60Hz
Supply Fuse / Circuit Breaker	Grounding is required. Switched type 3 Amp (no plug), 15 Amp Grounding-type receptacle (plug).
Battery	4 x Duracell High Power Lithium CR2 (3V)
Duty Cycle	Continuously rated
Overvoltage	Category II
Classification	Pollution Degree 2




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Default Settings

DRV25 is preprogrammed to customer requirements prior to shipment

The settings are derived from the **Installation Detail Form (IDF)** filled out by the customer when placing an order.



Installation Details Form (IDF)

Digital Recirculating Valve (DRV) • Digital Mixing Center (DMC) • SAGE® (BS)

In order to enter P.O.'s and guarantee delivery dates, a technically accurate and complete IDF is required.
The review and acceptance of the information on the IDF by Armstrong:

1. Approves the order for processing which triggers an e-mail confirmation
2. Indicates that AHWG supports you by endorsing the application
3. Initiates the warranty
4. Delivers a complete, AHWG supported performance guarantee to the final user of the product
5. Drives the relevant point of specification/influence, point of installation and point of order financial allocation if appropriate

Section 1 - Ordering Processing/Tracking Detail:

Point of Order / Sold To: _____ (eg: ABC Mechanical)

City: _____ State: _____ Rep Firm: _____

Point of Installation: _____ (eg: Heinz Ketchup)

City: _____ State: _____ Rep Firm: _____

Point of Specification: _____ (eg: DEF Consulting Engineers)

City: _____ State: _____ Rep Firm: _____

Other Influence: _____ (eg: Source of Recommendation)

Section 2 – DRV & Installation Site Details

Size: DRV25 DRV40 DRV50 DRV80

Inlet Hot Water Temp to DRV: _____ °C

Inlet Hot Water Pressure to DRV: _____ Kpa/Bar

Inlet Cold Water Temp to DRV: _____ °C

Inlet Cold Water Pressure to DRV: _____ Kpa/Bar

Maximum System Demand: _____ LPM

Continuous Recirc to DRV: _____ LPM

DRV25 for Group Control:

Minimum Recirc: Each DRV25 requires 8 lpm.
Each DRV40 requires 19 lpm. Each DRV50 or
DRV80 requires 38 lpm

Reference Drawing Number: _____

Armstrong Model Number: _____

Section 3 – DRV Setpoint Programming Detail

The Brain® Mixed Water Outlet Temp Setpoint: _____ °C

SAGE® (BS) No: Yes:

If Yes - Select ProtoCessor, or SAGE® for the Web
SAGE® for BAS Interface Protocol Options
BACnet™ IP
BACnet™ Metasys N2
BACnet™ MSTP
LonWorks™
Modbus RTU
Modbus TCP
SAGE® for the Web
Complete SAGE® IDF (Fee-Based Subscription Options)

List Any Non-Standard Options or Details Here:

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The Installation Detail Form (IDF) is available to download at www.armstronginternational.com/brain or consult factory



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Installation

General

Installation must be carried out in accordance with these instructions, and must be conducted by designated, qualified and competent personnel.

The installation **must** comply with all applicable wiring/plumbing codes and local water byelaws.

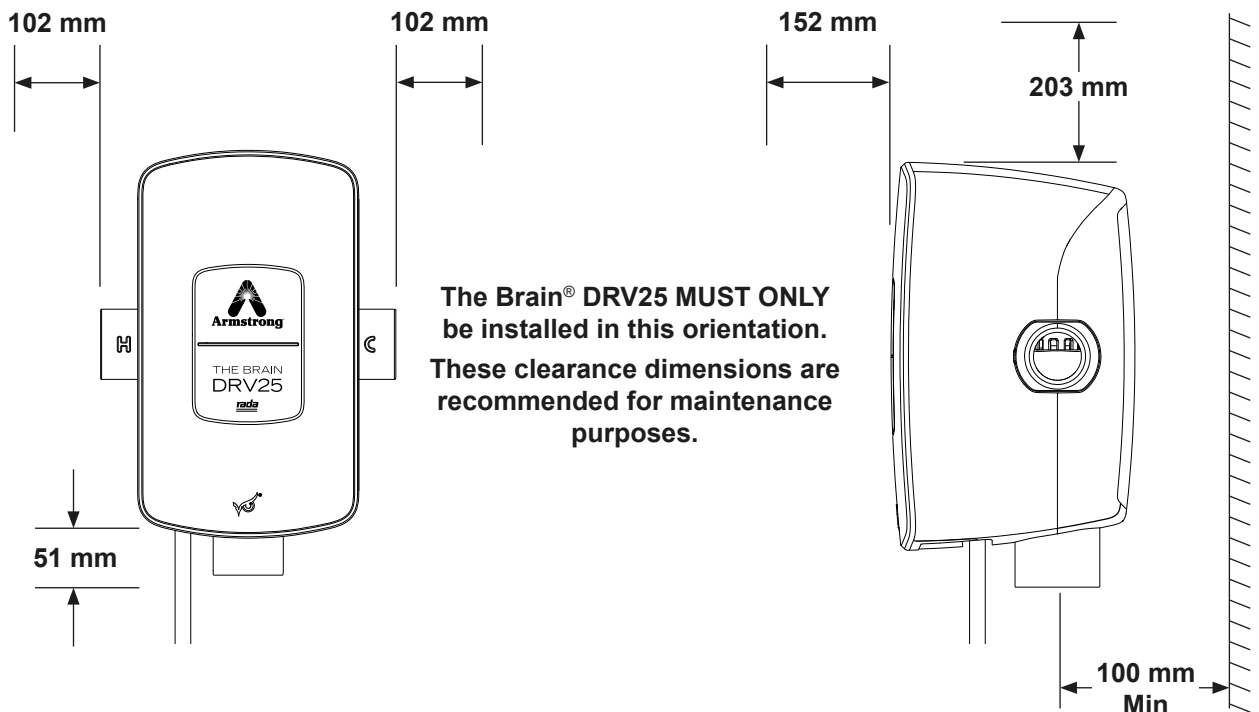
The DRV25 **must** be installed as per the piping diagrams (pages 11, 12 & 13). All plumbing components are to be supplied by the installer. Failure to include these components will compromise the product, system performance and will void the warranty.



Caution! The DRV25 **must** be installed in a dry area where it will not be able to freeze (minimum ambient temperature of 2 °C).

Notes:

1. DRV25 is supplied fully performance and pressure tested.
2. The DRV25 **must** be installed in an area where it is accessible to do any maintenance tasks e.g. removal of the cover, replacing worn parts etc.
3. Suitable connections for ease of maintenance should be used on the inlet and outlet ports. (*Isolation valves and unions.*)
4. The hot and cold water inlet supply pressures must be nominally equal.
5. The cold inlet supply feed to the DRV25 must be “tapped” directly from the cold inlet supply to the water heater.
6. The inlet supply pipework **must** be thoroughly flushed before fitting the DRV25.



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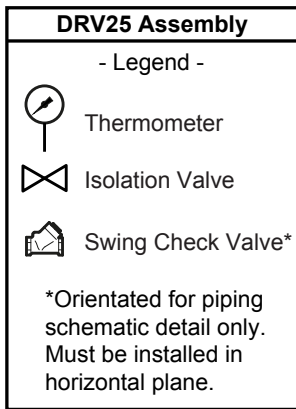
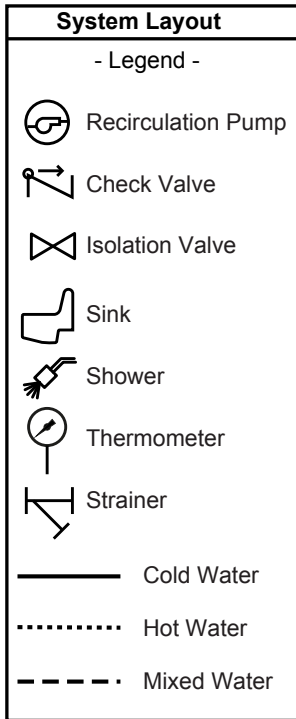
Installation Requirements

- 1** Inlet isolating valves (full flow type) must be installed close to the DRV25 for ease of maintenance. It is recommended that outlet isolating valves (full flow type) are also installed.
- 2** The use of supply / return strainers will reduce debris entering the DRV25. The recommended gauge for such strainers is 40 mesh (mesh aperture dimension = 0.424 mm).
- 3** Inlet pressure tapings which allow measurement of the inlet pressures to the DRV25 under operating conditions are particularly recommended for in-service testing.
- 4** Pipework must be rigidly supported to avoid any strain on the connections.
- 5** Make sure the pipe layout will avoid the build up of trapped air in the system. Air release valves can be used where this is not possible.
- 6** Inlet and outlet threaded joint connections should be made with PTFE thread sealing tape or liquid sealant. Do not use oil-based, non-setting joint compounds.
- 7** To eliminate pipe debris it is essential that supply pipes are thoroughly flushed before connection to the DRV25.



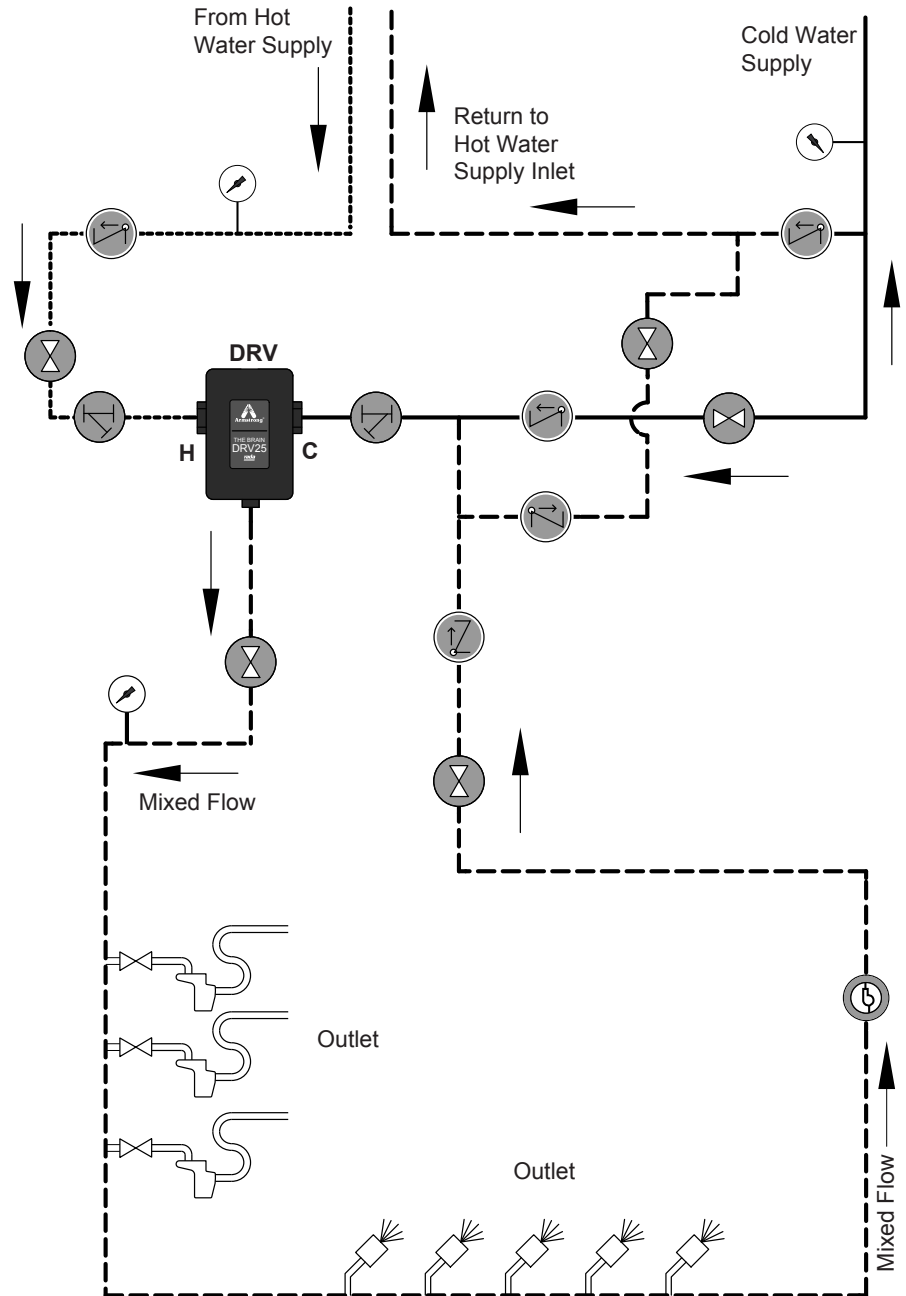
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Piping Diagrams



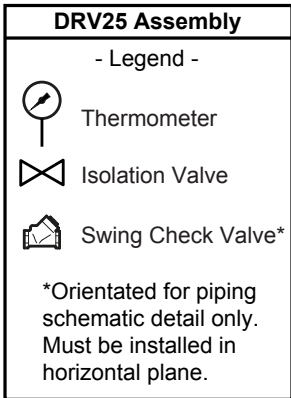
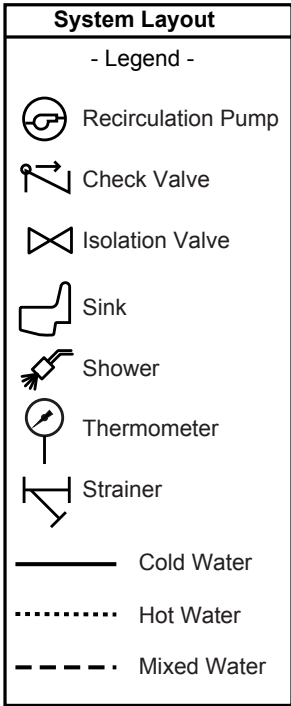
Items are installer supplied


Figure 11-1. DRV25 Single Valve Installation

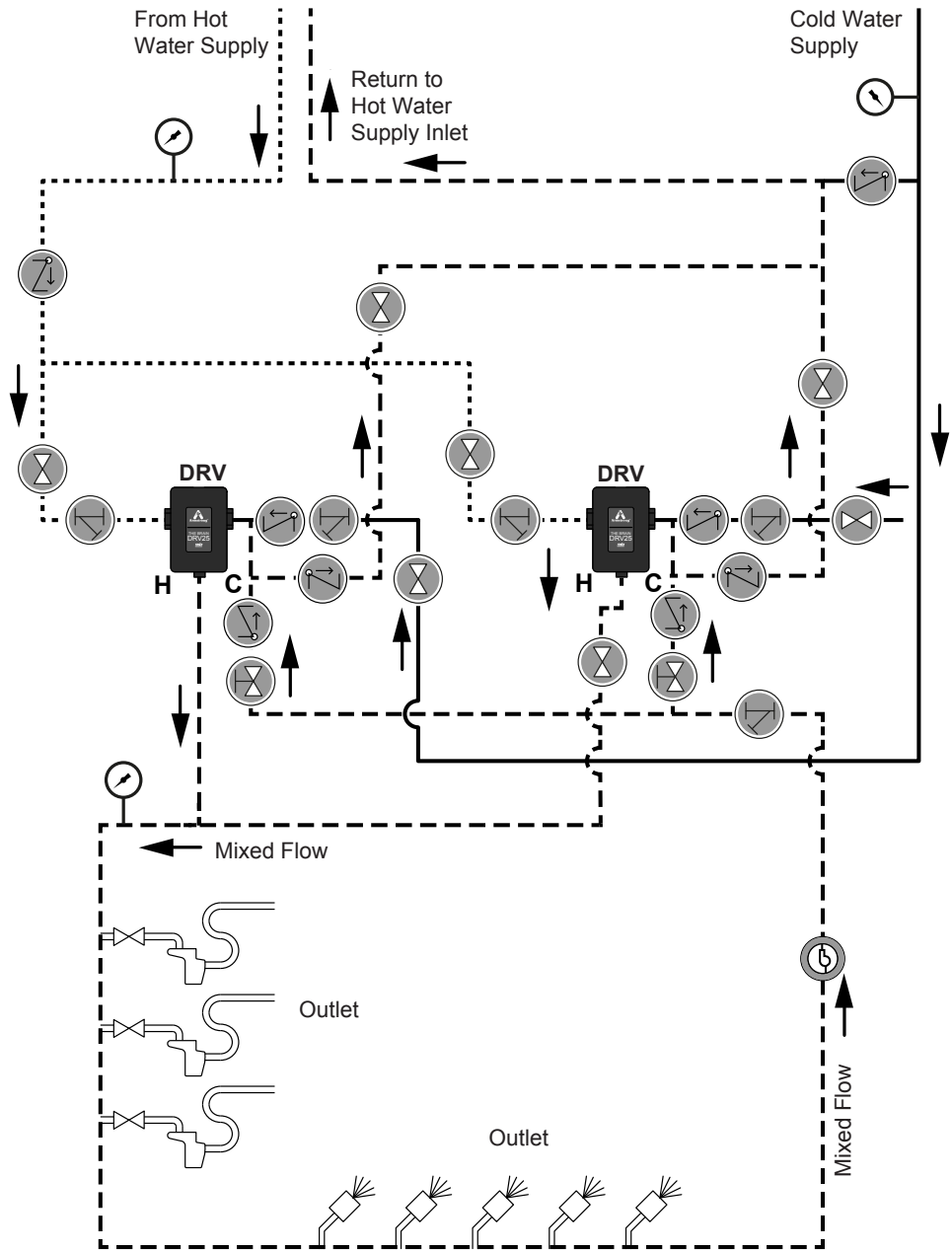


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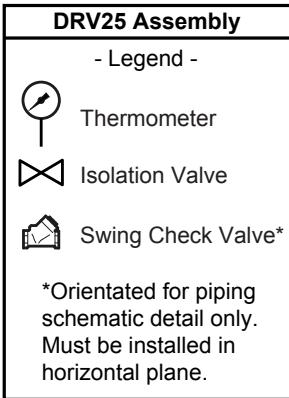
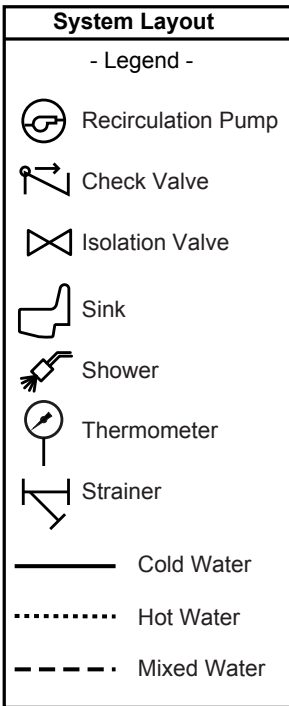
Figure 12-1. DRV25 Dual Valve Installation



 Items are installer supplied



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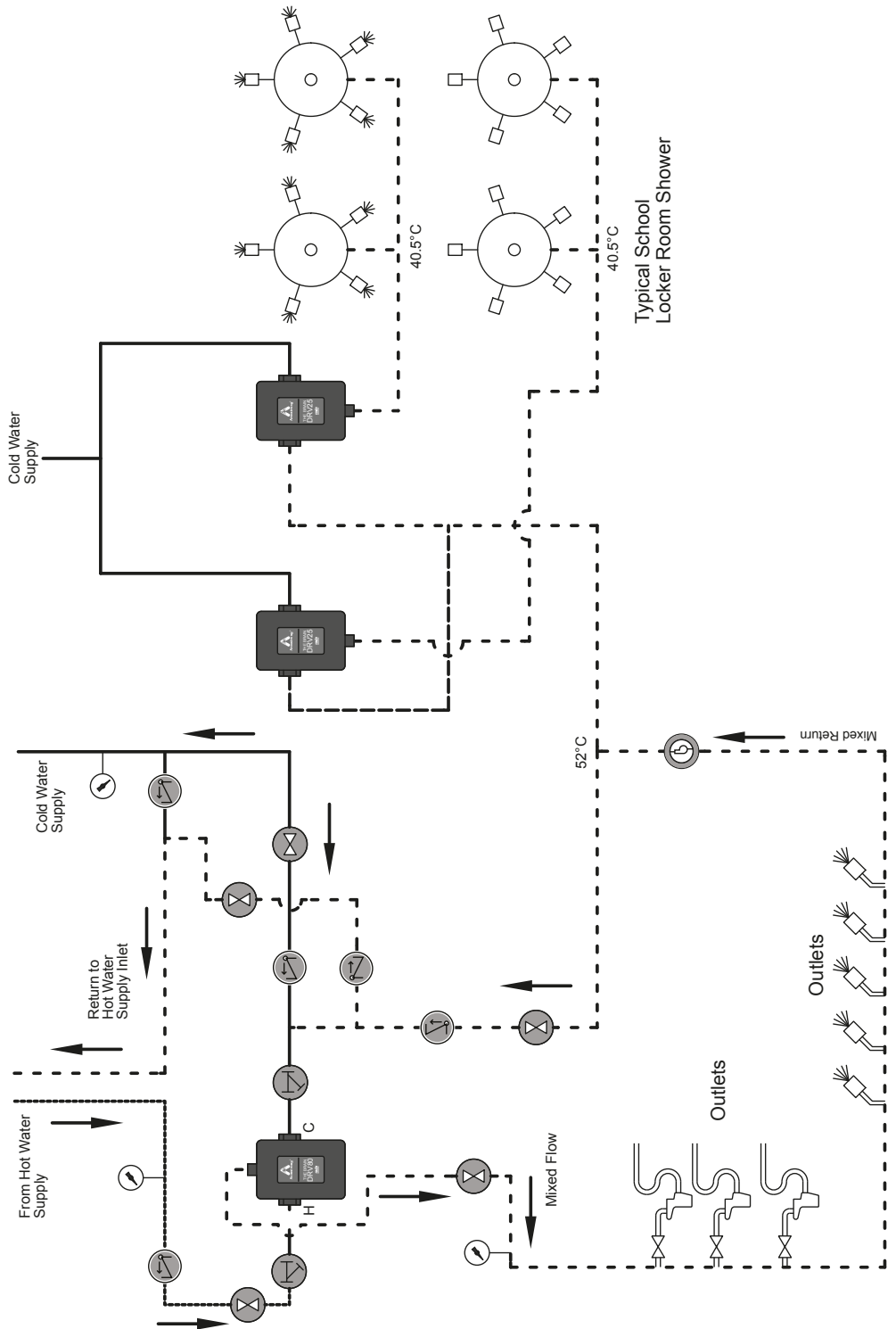
 Items are installer supplied

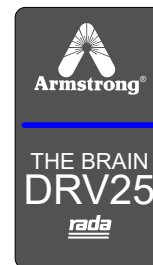
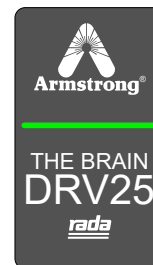
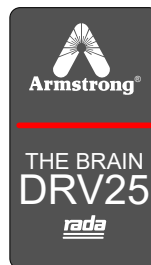
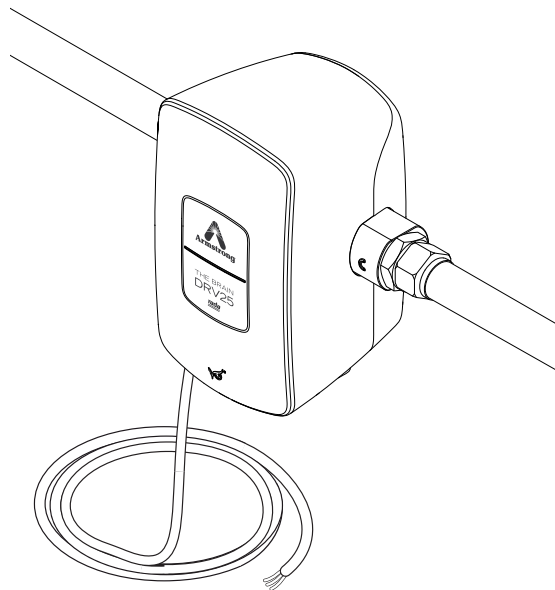
Figure 13-1. DRV25 Group Shower Installation



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Installation - DRV25

- 1** Before fitting to the pipework, it is recommended that connectors are fitted to the inlets and outlet. This will enable the DRV to be easily removed, if required.
- 2** Flush pipework thoroughly (minimum of 5 minutes).
- 3** Fit the DRV to the pipework.
- 4** Grounding is required, connect the power cable to the primary power supply via switched circuit breaker with a 3 Amp fuse.
Do not fit or replace a power cable plug!
- 5** Ensure 4x Duracell® High Power Lithium CR2 batteries are fitted to the inside of the DRV front cover before powering ON (not supplied).
- 6** Ensure the LED on the DRV goes through the initial power up sequence.
- 7** Commission the DRV25 and recirculation system using the following instructions...



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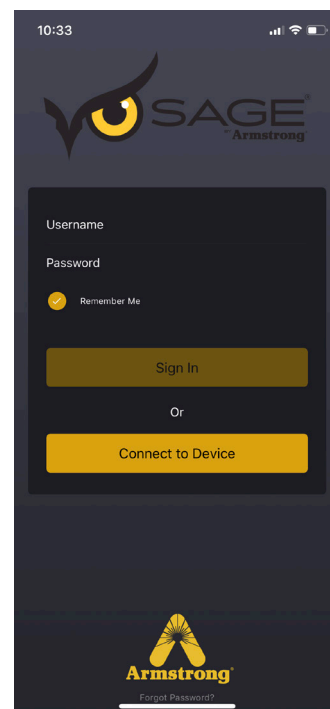
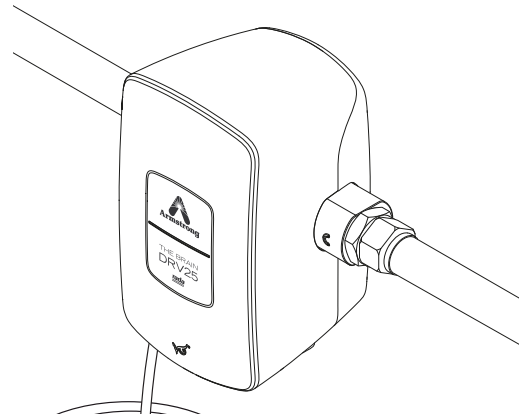
Commissioning

Commissioning must be carried out in accordance with these instructions by designated, qualified and competent personnel.

- 1 Ensure the system is powered off and the power cable is unplugged from the primary power supply.
- 2 Flood the system in the following sequence:
 - Open the cold water supply isolation valve(s).
 - Open the outlet flow isolation valve(s).
 - Open the hot water supply isolation valve(s).
 - Once flooded, connect the power cable to the primary power supply via a switched circuit breaker with a 3 Amp fuse.
- 3 Ensure that the DRV25 is powered and the LED on the front cover is illuminated.
- 4 The LED indicator initially flashes red, green and blue upon power up then changes to green once operational.
- 5 Make sure the hot and cold inlet supplies are at their designated pressures and temperatures.
- 6 Close all the mixed water outlets and turn on the circulating pump.
- 7 Open SAGE® mobile app on your mobile device and tap on the **'Connect to Device'** to pair with the DRV25.

Note! Ensure Bluetooth is enabled on your device.

Note! The "SAGE® by Armstrong" mobile app is available free to download from the Apple App Store and Google Play Store.

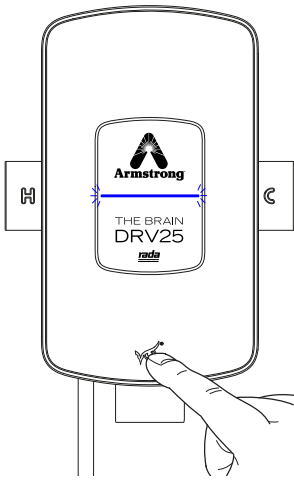


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8 Tap on the **'Pair New Device'** to search available devices using Bluetooth.

9 Select **'Armstrong DRV25'** on the screen.

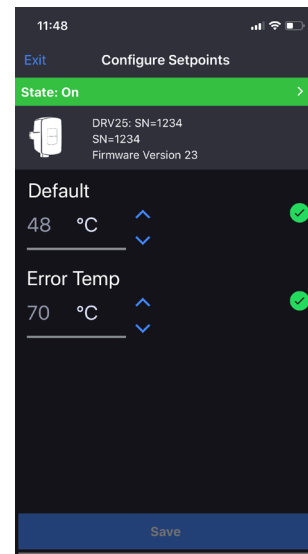
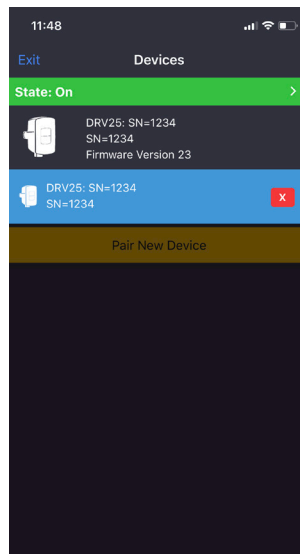
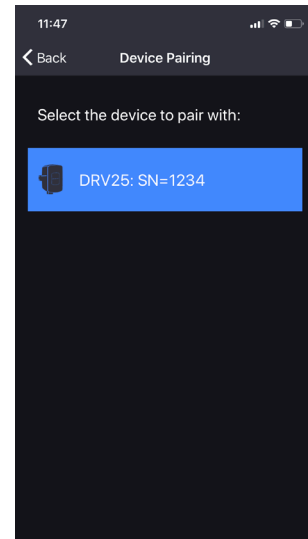
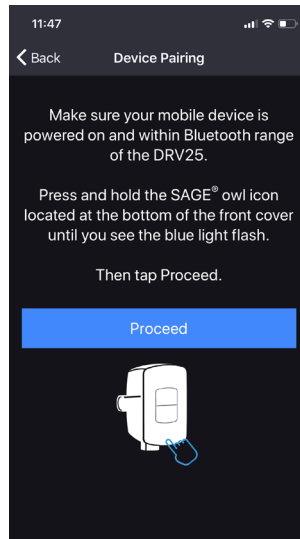
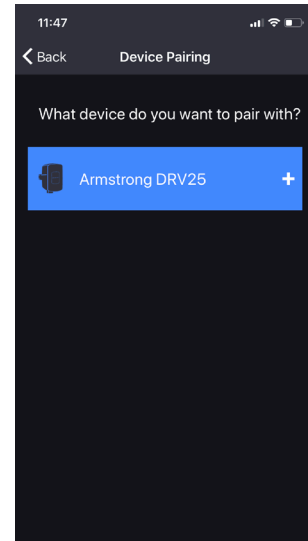
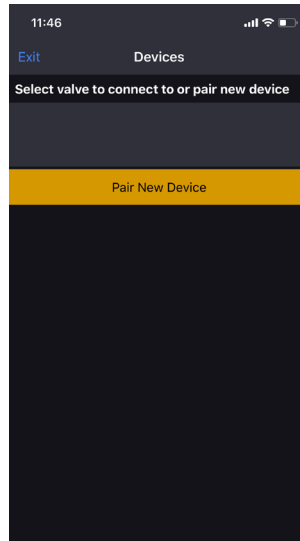
10 Make sure your mobile device is within Bluetooth range and the DRV25 and Bluetooth is enabled. Press and hold the SAGE® Owl logo located at the bottom of the front cover until you see the blue light flash. Then tap **'Proceed'**. At the next screen tap the corresponding DRV25 you wish to pair to.



11 Once paired, tap on the **'Setpoints'** icon to change the default setpoint if required. The setpoint was preprogrammed at the factory according to the installation details specified on the **Installation Detail Form (IDF)**.

12 Amend the other default settings as required and tap on **'Save'** to update new settings.

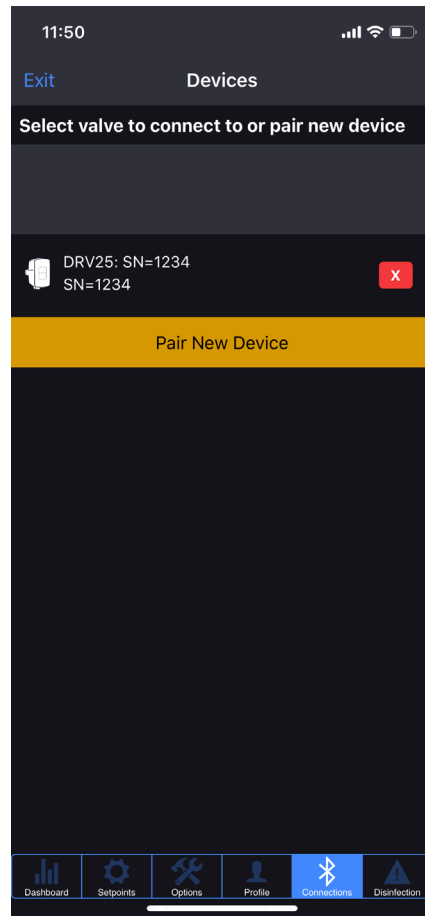
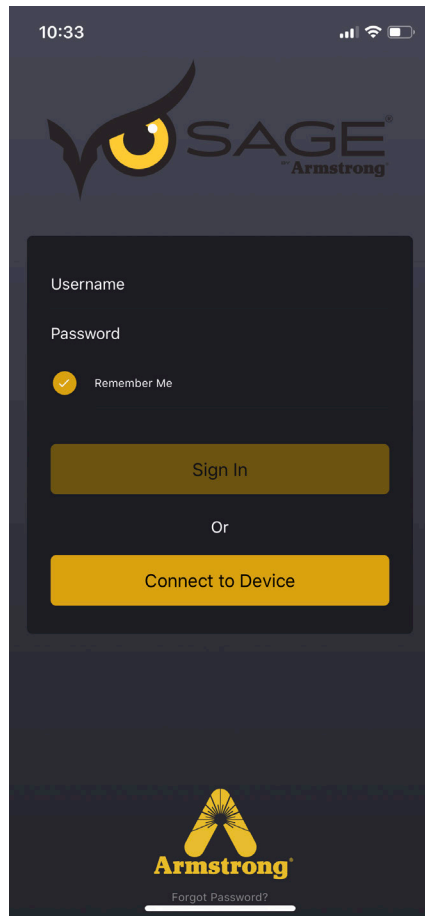
13 Upon connection to the mobile app, the internal real time clock will be re-synchronised to the mobile device and will also occur upon each re-connection. Periodically connect to the DRV25 to re-synchronise the date and time, especially post-daylight savings dates for your installation location.



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Mobile App

Connect to the DRV25



Make sure your mobile device is within Bluetooth range and that Bluetooth is enabled.

Identify the DRV25 on the SAGE® mobile app to connect to and tap the corresponding product.



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Dashboard



Once connected to the mobile device, the control screens can be selected individually by tapping on each of the tabs at the bottom of the screen.

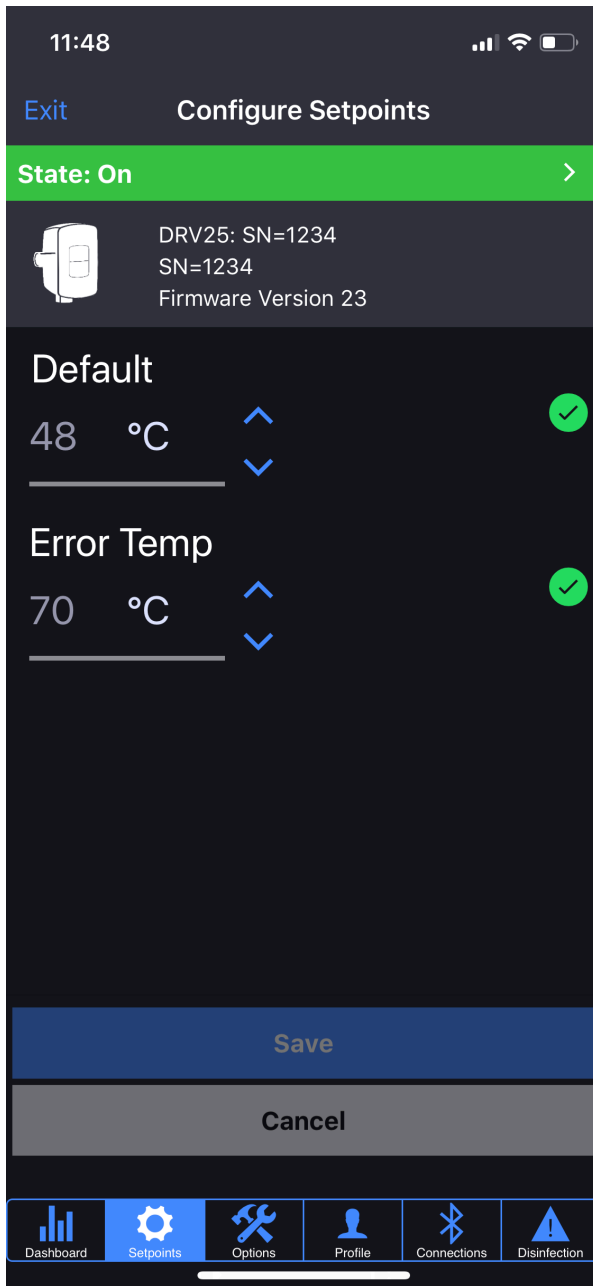
The general status of the DRV25 is displayed by default upon connection.

The mixed water (outlet) temperature as well as the hot water supply inlet and system return inlet temperatures are displayed and refreshed every few seconds. The DRV25 setpoint is also displayed for reference.



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Configure Setpoints

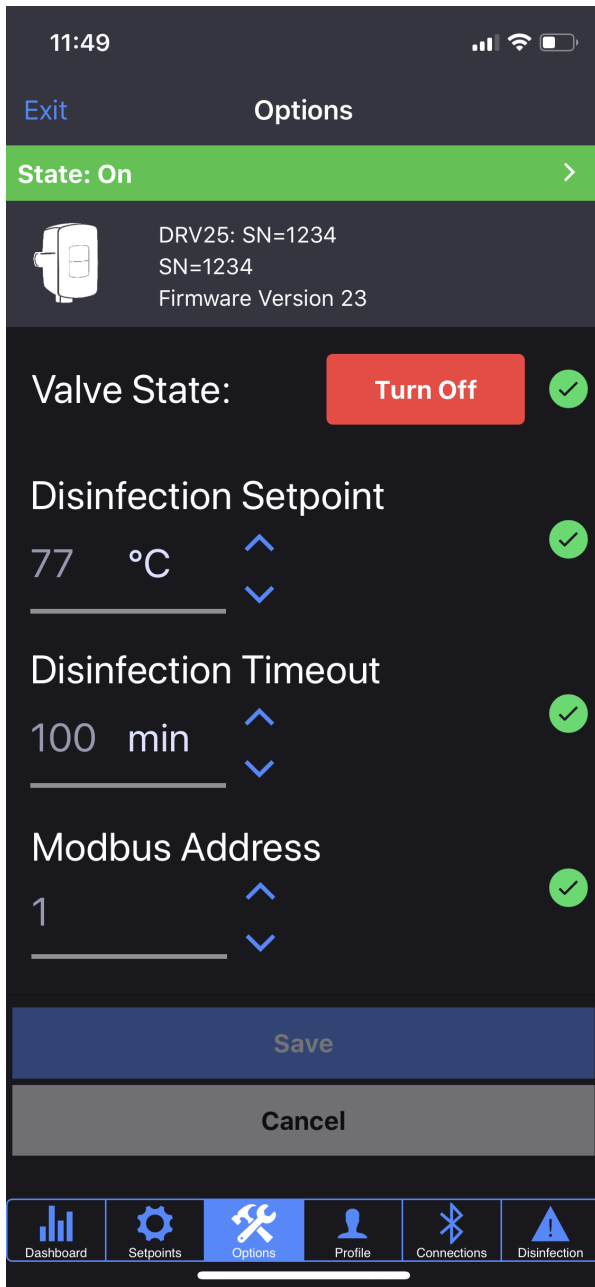


- 1 Adjust the **Default Blend Temperature Setpoint** by tapping on the Up or Down arrow to configure the desired outlet temperature of the DRV25.
- 2 Adjust the **Error Temperature** setting as required. This temperature setting will be the point at which the DRV25 alarms and reverts to recirculation mode due to an over temperature condition.
- 3 Tap on the **Save button** to transfer the new settings to the DRV25.



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Options



Valve State -

Allows the user to manually switch between the **Blend Mode (ON)** and the **Recirculation Mode (OFF)**.

Disinfection Setpoint -

This is the temperature at which the thermal disinfection will be carried out (must not exceed 85 °C).

Disinfection Timeout -

This is the number of minutes the error alarm is disabled to allow for disinfection and cool down of the blend circuit before switching back on automatically, i.e. if **Disinfection Timeout** is set to 100 minutes then the DRV25 has that time to complete the disinfection and cool down before entering an over temperature error condition and switching to full cold.

Please note the following:

- Disinfection Timeout starts when the disinfection cycle is triggered. (Refer to the **“Thermal Disinfection”** section on pages 23 - 28 for more details)
- During the Disinfection Timeout, the disinfection and cool down must be completed manually and the DRV25 returned to Setpoint (normal operation within the setpoint limits).
- The Disinfection Timeout can be set up to a maximum of 1800 minutes (30 hours).

Modbus Address -

This is the Modbus Network address of the DRV25 (1 - 31)

Device ID -

Update the device ID, alias as required to give the DRV25 a more meaningful name. e.g. “Bayfront Loop 1”

Disinfection Enabled -

This is the master disinfection enable switch. It must be set to the ON position before disinfection can be carried out.



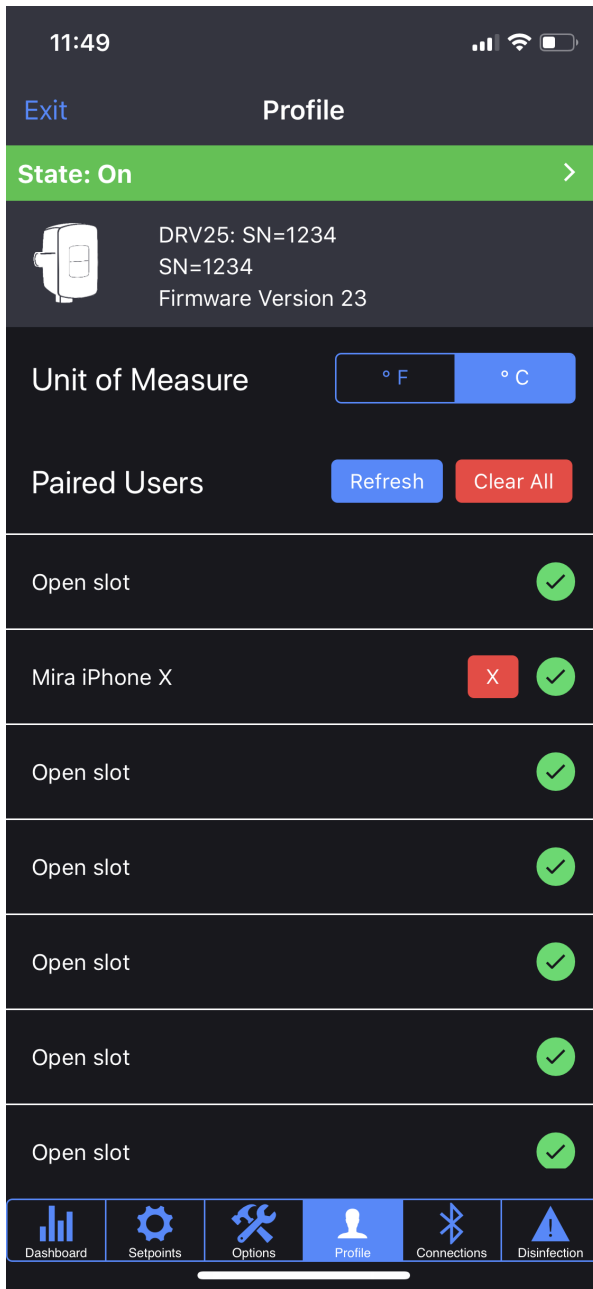
Reboot -

Forces the DRV25 to reboot. This will potentially deliver full hot water whilst this is carried out. This function can be used to clear some error conditions.



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Profile Settings



- 1 The Units of temperature measurement can be changed to °F / °C as required.
- 2 Paired users to the DRV25 can be managed as required.



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Devices

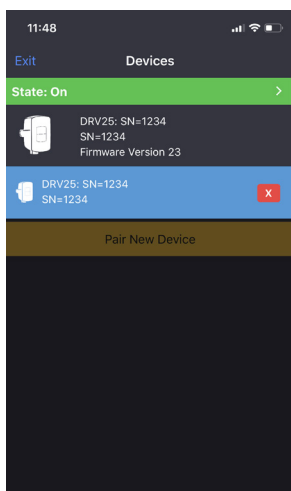
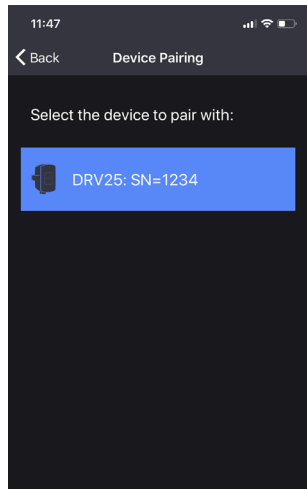
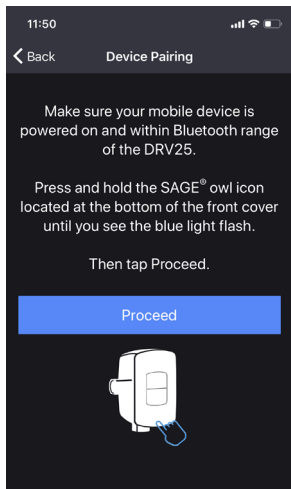
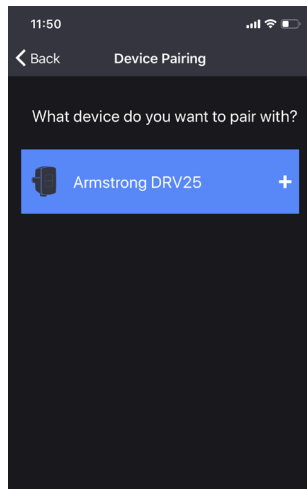
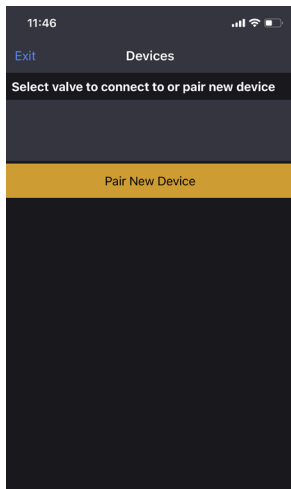
1

Additional DRV25 products can be connected to your mobile device if required. See page 15 **Commissioning** for more details.

Note! Any currently connected DRV25 product must be disconnected prior to pairing to a new device.

2

Tap on the red 'X' to disconnect the current DRV25 connection. A subsequent tap will delete the DRV25 pairing from the mobile app.



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Thermal Disinfection

IMPORTANT! PLEASE READ CAREFULLY

The thermal disinfection mode of the DRV25 is *not* an automated process. It is manually activated by the supervisor to increase the temperature of the blend circuit to equal the temperature of the hot supply. The circuit pipework and outlets can be thermally disinfected as part of a bacterial infection control regimen.

DO NOT USE THE THERMAL DISINFECTION FEATURE IF THE HOT WATER SUPPLY CAN EXCEED 85°C!

THE MAXIMUM TEMPERATURE FOR DISINFECTION SETPOINT MUST BE 85°C.



Warning! Thermal disinfection is a potentially hazardous process to raise the water temperature to a level that will scald or even kill. It is therefore the responsibility of the person supervising the process to make sure it is carried out correctly and safely.

ALL DRV25 ALERTS AND ERRORS ARE DISABLED DURING THE PROCESS!

It is the responsibility of the supervisor to make sure that:

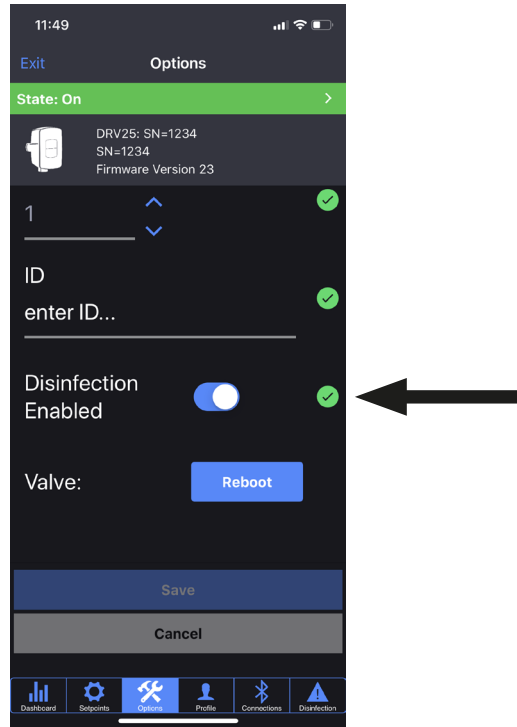
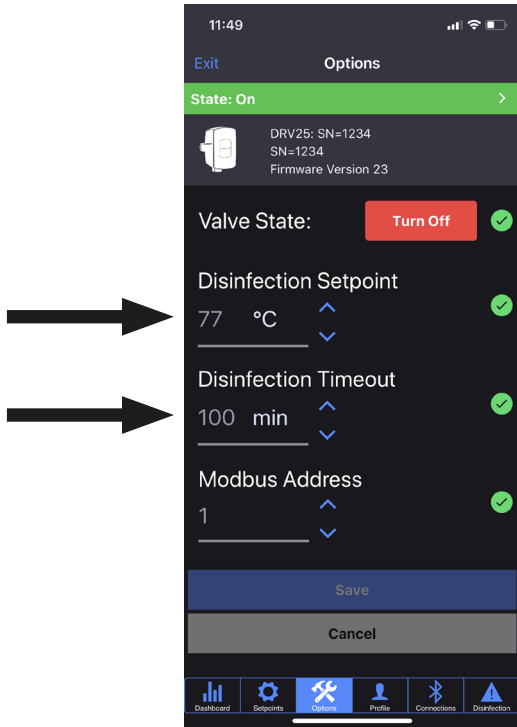
1. An appropriate Risk Assessment is carried out in accordance with the local or national regulations.
2. The water temperature is raised to and held at the required level at all parts of the circuit for the required duration as stated in the Risk Assessment.
3. All outlets are flushed for the correct amount of time if required by the Risk Assessment.
4. Appropriate measures are taken to make sure that none of the outlets are used while the water is at an unsafe temperature.
5. Once thermal disinfection is complete, the supervisor should return the DRV25 to its normal operating mode using the **Cool Down** button within the **Disinfection screen**. This will switch the DRV25 to its full cold position and allow the blend circuit to be reduced gradually to a safe temperature level*. Make sure the blend circuit temperature returns to normal operation within the **Disinfection Timeout** period (see page 20).
6. The Disinfection cycle is monitored constantly and the supervisor is able to stop the cycle using the **Abort** button in the **Disinfection** screen.
7. In the event of the user failing to enter cool down mode within the **Disinfection Timeout** period, the DRV25 will automatically enter the cool down phase for 5 minutes.

Without a draw off, the water in the blend circuit will remain hot for a long time. In order to speed up the temperature reduction, a draw-off must be made during **Cool Down using the last outlet of the blend circuit, or a dump valve fitted near to the end of the blend circuit. Check with local water authorities with regard to water temperature limitations to drain.*

*Failure to complete a sufficient cool down of the blend circuit may result an **Error Temp shut down to full cold**.*



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Disinfection Setpoint and Timeout

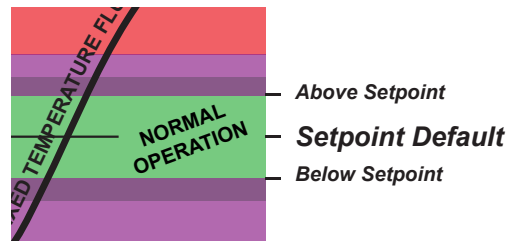
Verify and confirm the **Disinfection Setpoints** and **Timeout** are set correctly in the **Options tab** prior to starting the disinfection cycle (see page 20 for more details). Tap on the **Disinfection** tab to proceed

Disinfection Timeout

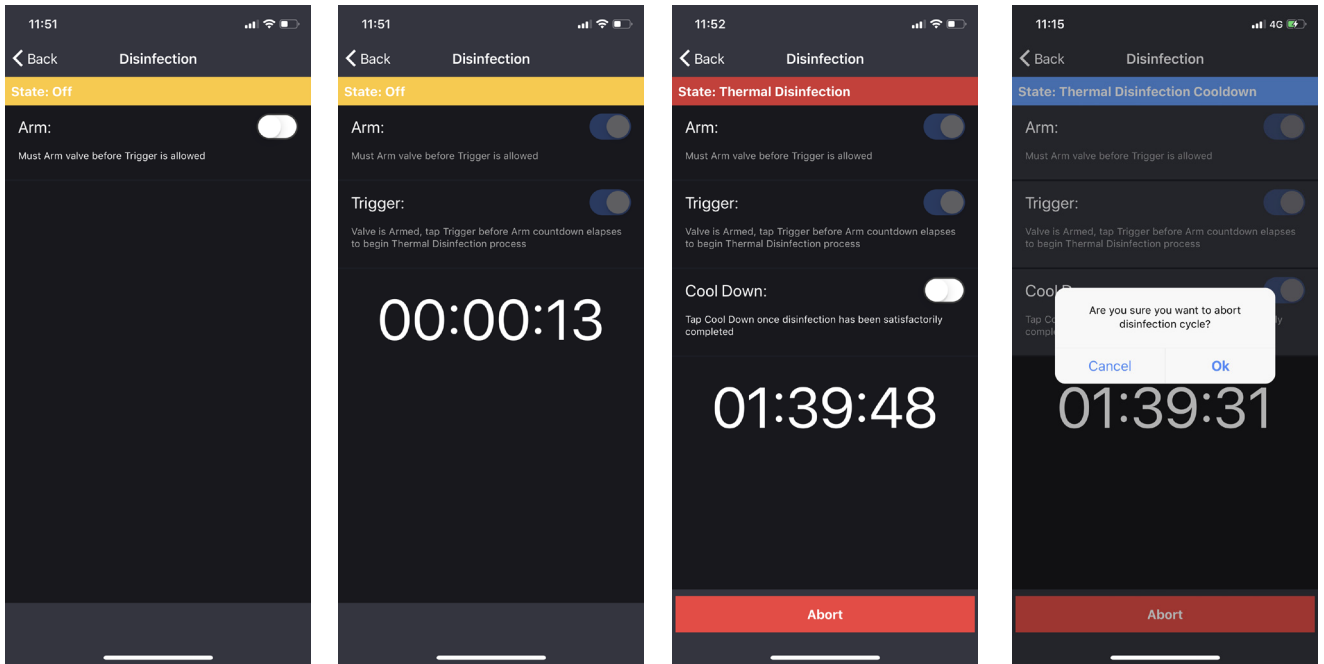
Note: The timeout is the number of minutes the temperature alert and error alarms are disabled to allow for disinfection and cool down of the blend circuit before switching back on automatically, i.e. if **Disinfection Timeout** is set to 100 minutes then the DRV25 has that time to complete the disinfection and cool down before entering an error condition and switching to full cold (recirculation).

Please note the following:

- **Disinfection Timeout** starts when **Trigger** is tapped.
- During the **Disinfection Timeout** the disinfection and cool down must be completed manually and the DRV25 returned to **Setpoint** (normal operation within the setpoint limits).
- The **Disinfection Timeout** can be set up to a maximum of 1800 minutes (30 hours).
- In the event of failing to cool the DRV25, an automatic cool down period of 5 minutes will take effect.



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- 1 Close all outlets in the system.
- 2 Toggle Arm and Trigger to ON position.
Note! Trigger will be available to toggle within 10 seconds of arming to activate the disinfection.
- 3 Disinfection cycle will then commence after a 10 seconds delay. The LED on the front cover will flash red.
- 4 Toggle Cool Down to ON position once disinfection has been satisfactorily completed.
- 5 Ensure each outlet is flushed of high temperature water and the system has returned to safe temperature prior to opening for use. At the end of the Disinfection Timeout period, the DRV25 will return to normal operating mode and the alerts and errors will be re-enabled.
- 6 **EMERGENCY STOP!** - Tap **Abort*** at any time to stop the cycle.

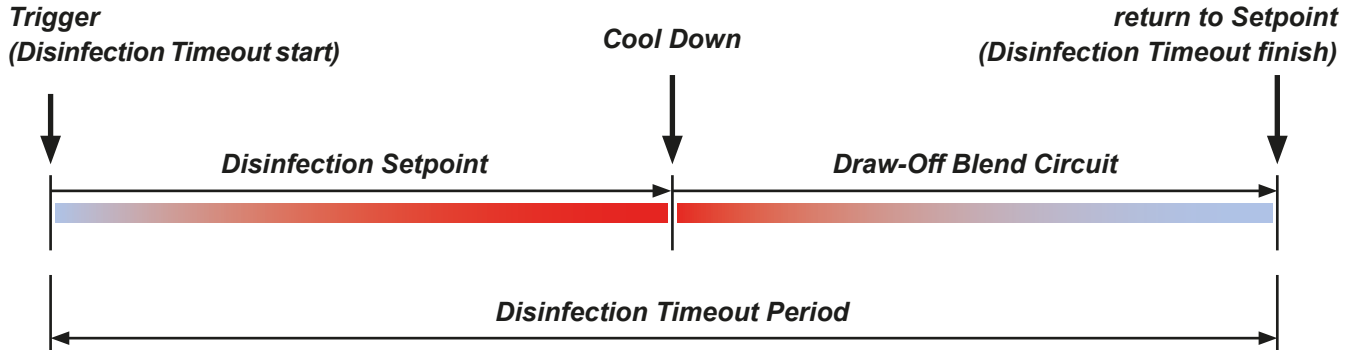


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IMPORTANT! The DRV25 is locked in disinfection mode until one of the following actions has been performed:

- a. The Disinfection Timeout period has expired (automatic).
- b. The Abort button is pressed (manual).

Disinfection Timeline



*Abort

If **Abort** is used when the cycle is disinfecting, the DRV25 switches to full cold / recirculation. Use the mobile app to change the valve state back to ON and make sure the blend circuit is at a safe temperature before allowing any outlets to be used.



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Disinfection Quick Start Guide - 1 (setting parameters for cycle)

Follow these steps to determine the total disinfection cycle time and store that value in the *Disinfection Timeout* parameter of the SAGE® mobile app. At the end, the parameters will be set to run all future disinfection cycles reliably.

You are about to run a test cycle to determine, in total, how long it takes to disinfect the blend circuit. Before you begin, make sure there is an adequate supply of hot water for this test. You will also require a reliable clock or stopwatch to monitor the duration of the test. Make sure all warnings, cautions and responsibilities on page 23 are observed during the test.

❶ Verify and confirm the *Disinfection Setpoints* and *Timeout* are set correctly in the *Options tab*.

❷ Tap on the *Disinfection tab* to proceed.



MAKE SURE ALL OUTLETS ON BLEND CIRCUIT ARE NOT IN USE UNTIL TEST IS COMPLETE!
No one should be allowed to approach within 3 meters of any affected outlets.

❸ Toggle *Arm* to *ON* position.

❹ Toggle *Trigger* to *ON* position and start the stopwatch or note the time of day.

❺ Monitor the temperature and time until a satisfactory disinfection of the blend circuit has been achieved.

❻ Toggle *Cool Down* to *ON* position once disinfection has been satisfactorily completed.

❼ Draw-off hot water from the blend circuit. Use either the last outlet on the circuit or a dump valve fitted near to the end of the circuit.

❽ When the DRV25 temperature is within normal operation, stop the draw-off.

❾ Tap on *Abort & Confirm*.

❿ Stop stopwatch or note the time of day. The time difference is the future *Disinfection Timeout* period.

⓫ Change *Disinfection Timeout* to new value.

⓬ Tap *Save*.

For all further disinfection cycles, use Quick Start Guide - 2.



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Disinfection Quick Start Guide - 2 *(running a routine cycle)*

You are about to run a disinfection cycle of the blend circuit. Before you begin, make sure there is an adequate supply of hot water for the cycle. You will also require a reliable clock or stopwatch to monitor the duration of part of the cycle.

Make sure all warnings, cautions and responsibilities on page 23 are observed during the cycle.

 **MAKE SURE ALL OUTLETS ON BLEND CIRCUIT ARE NOT IN USE UNTIL CYCLE IS COMPLETE!**
No one should be allowed to approach within 3 meters of any affected outlets.

- 1 Tap on the **Disinfection tab** to proceed.
- 2 Toggle **Arm** to **ON** position.
- 3 Toggle **Trigger** to **ON** position.
- 4 Start the stopwatch or make a note of the time of day. Monitor the temperature and time until a satisfactory disinfection of the blend circuit has been achieved.
- 5 Toggle **Cool Down** to **ON** position once disinfection has been satisfactorily completed.
- 6 Draw-off hot water from the blend circuit. Use either the last outlet on the circuit or a dump valve fitted near to the end of the circuit.
- 7 When the DRV25 temperature is within normal operation, stop the draw-off.
- 8 Allow the DRV25 to return to normal operation automatically.

IMPORTANT! - CHANGES TO THE PLUMBING SYSTEM.

Any alteration to the plumbing system that may affect the blend circuit may, as a consequence, also affect the Disinfection Timeout period. Repeat all steps in Quick Start Guide -1 to maintain a reliable disinfection cycle for the system.



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Connectivity

The integral RS485 Serial Port (CN7 on the DRV25 PCBA) can be used to connect to either **SAGE**[®] or directly to a **Building Automation Systems (BAS)** which operates on a **Modbus RTU** protocol.

SAGE[®]

SAGE[®] is an optionally selected control module from Armstrong which enables an interface with **Building Automation Systems (BAS)** which utilize **Modbus**, **Bacnet**[™] or **LonWorks**[™] protocols via the use of specific ProtoCessor cards.

SAGE BS[®] also has an ethernet port and operates as a web server for remote network access.

SAGE[®] includes remote hot water supply, cold / recirculation water supply, blended water outlet temperature outputs and is supplied with a system graphic, memory card for data storage and web based software.

SAGE[®] includes terminals for additional installer supplied RTDs, pressure transducers and pulse type flow meters and this data can be forwarded via the **SAGE BS**[®] interface.

A separate SAGE[®] specific Installation, Operation and Maintenance (IOM) Guide is available upon request. Please consult factory or visit:

<https://www.armstronginternational.com/sites/default/files/resources/files/503-EN.pdf>

Modbus

DRV25 can be configured to communicate directly with a BAS which utilizes Modbus RTU.

When configured for Modbus the DRV25 becomes a **Remote Terminal Unit (RTU)**.

When connected directly to a BAS using Modbus RTU, the DRV25 will be assigned a unique network address which is configurable through the **SAGE**[®] mobile app.

A separate Modbus specific Installation, Operation and Maintenance (IOM) Guide is available upon request. Please consult factory or visit:

www.armstronginternational.com/sites/default/files/resources/documents/IOM-776.pdf

System Performance

For effective DRV25 performance, the DRV must be able to experience a minimum flow and a minimum temperature differential between its inlet and outlet supplies when the system is in **zero demand**.

Zero demand is defined as periods when there is no mixed water outlet usage on the system.

Pre-installation calculations should have already determined the system heat loss characteristics. For optimum performance the DRV25 requires a minimum of 1°C differential between the setpoint (the outlet temperature) and the thermometer which is installed on the system return line.

When there is no system draw-off, the DRV25 reverts to a zero demand. The recirculation temperature is continuously monitored and adjusted appropriately by the DRV25. The circulating pump must operate continuously, the DRV25 requires a minimum flow of 8 lpm.

Pump Capacity

The circulating pump is only required to keep water gently moving around the system. The pump should be sized and selected to overcome the system resistance (feet of head) at the minimum specified flow rate of 8 lpm while also accounting for system heat loss.



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System Safety Measures

System safety measures such as the installation of an aquastat linked to the circulating pump which shuts the pump off if the system exceeds a given temperature setpoint is not required. DRV25 can be programmed to automatically shut off the system hot water supply in the event of an over temperature condition (may require a BrainScan/SAGE system, where available).

Preventative Maintenance and Fitting Spare Parts

 **Warning! Isolate power to the DRV25. Ensure that the circulating pump is not operating.**

DRV25 components should be inspected annually, or more frequently where acknowledged site conditions such as high mineral content water dictate.

Each DRV25 has a serial number that is maintained on file with the technical department at Armstrong.

For any installation, operation, maintenance or technical support details not covered in this guide, please call our Technical Department quoting the model and / or serial number.

ESD Handling

Appropriate electrostatic wrist strap or similar preventative damage measures should be taken when handling the main control PCBA within the product.

Batteries

Batteries are supplied to ensure the DRV switches to **Full Cold** in the event of a primary power supply failure, they should **not** be considered to be a backup power supply.

Battery life is variable depending upon usage. A battery error message appears in the SAGE® mobile app when they require replacing.

Where primary power supply failure occurs regularly or the DRV is installed within a supply system where safety is critical, the batteries **must** be changed at least every 12 months as part of an annual maintenance routine.

In noncritical systems or where battery usage is low, longer replacement cycles may be considered up to a maximum of 5 years.

Note! Care must be taken when removing / replacing the batteries to avoid accidental piercing of the CR2 cells and / or damage to the DRV25 internal looms/connectors.

Inspection of critical components and / or assemblies

O - Rings / Seals

All 'wetted' O -Rings / Seals must be checked or replaced at least every 12 months as part of an annual maintenance routine. In systems where water quality conditions are poor, more frequent replacement may be required.

Note! Do not use silicone grease on internal seals. Refer to page 37 for how to identify the internal seals.

Strainers

All supply strainers must be thoroughly cleaned at least every 12 months as part of an annual maintenance routine. Cleaning includes physically taking the strainer screen / basket out of the body and cleaning as well as flushing water through the body. In systems where water quality conditions are poor, more frequent cleaning may be required.

Thermistors

Remove thermistor loom and clean thermistors with an abrasive pad to remove surface contamination which could affect temperature readings and product performance.

DRV25 Spare Parts

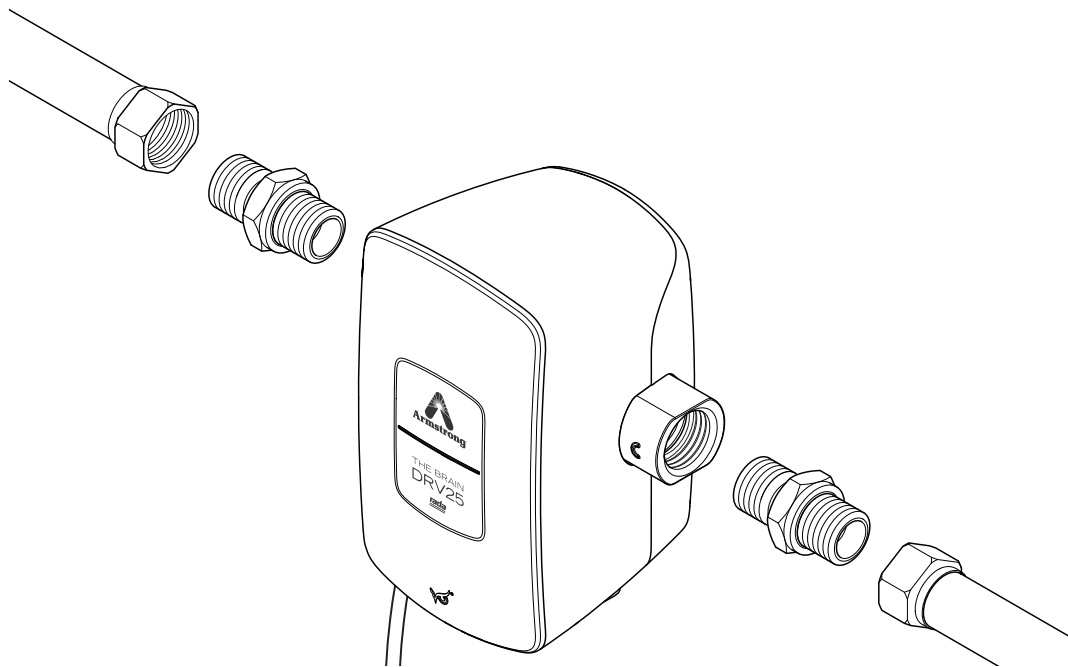
Warning!



- Before disassembly observe the following:
- Isolate the electrical supply to the DRV25.

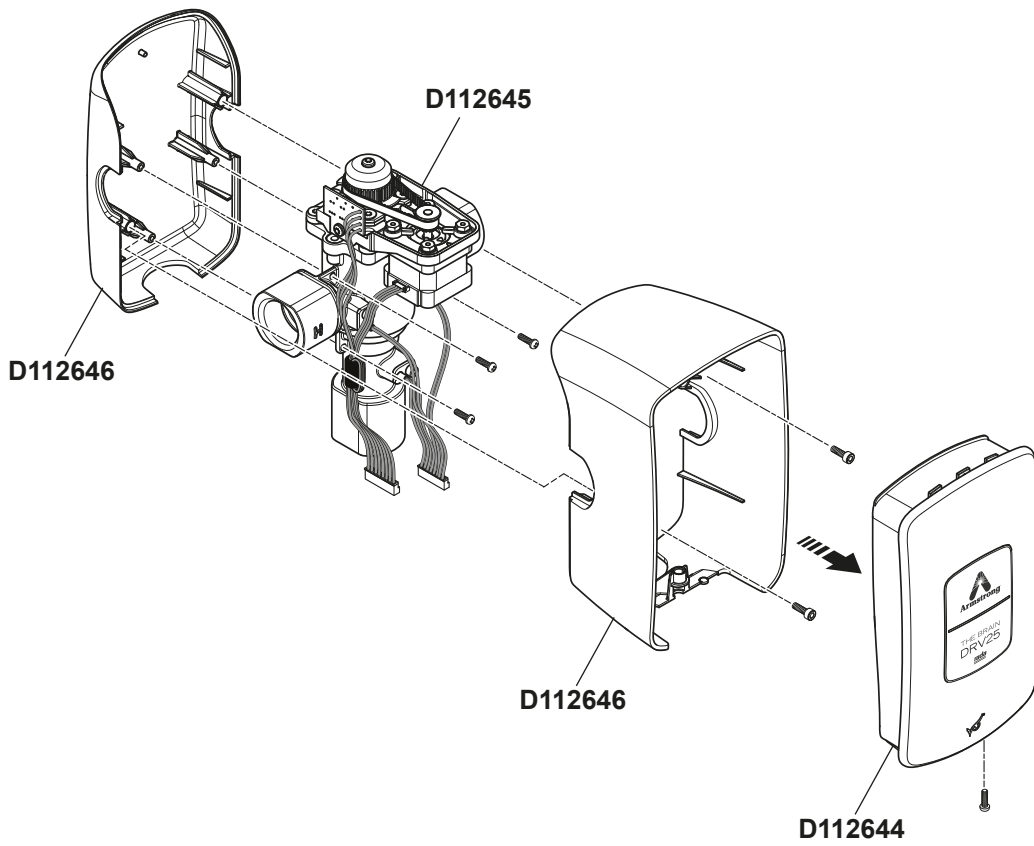


- Isolate the water supplies to the DRV25.
- Allow the hot water inlet to cool sufficiently to reduce the risk of injury through contact with the hot pipe or DRV.



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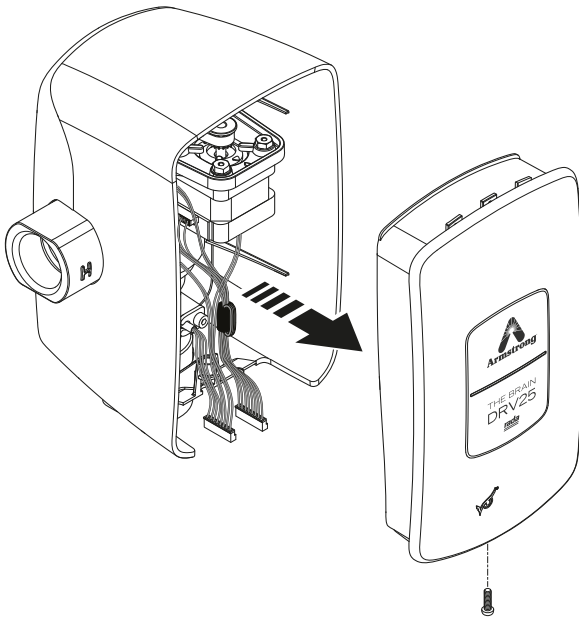
- D112644 Front Cover Assembly
- D112646 Middle Case
- D112645 Drive Mechanism Assembly
- D112646 Rear Case



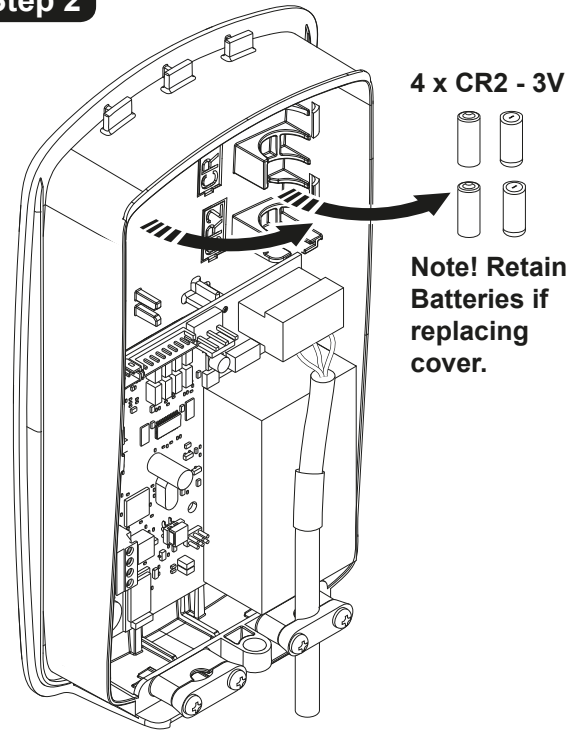
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Disassembly of the PCBA from the Front Cover

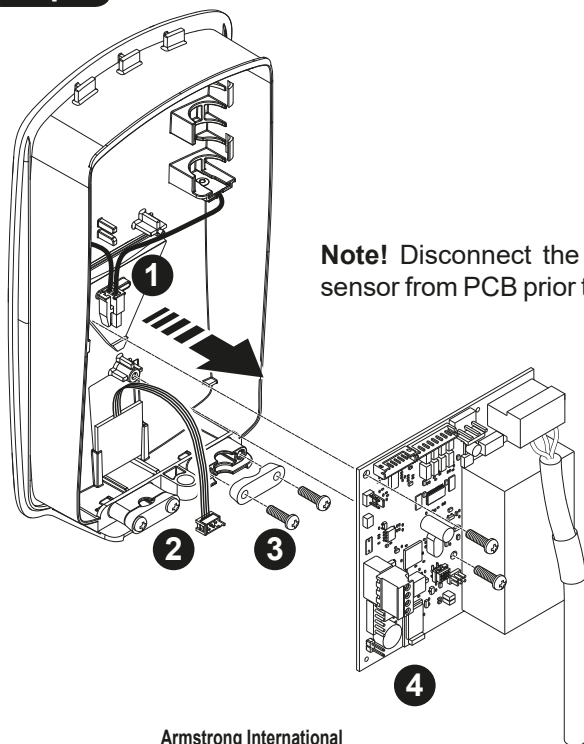
Step 1



Step 2

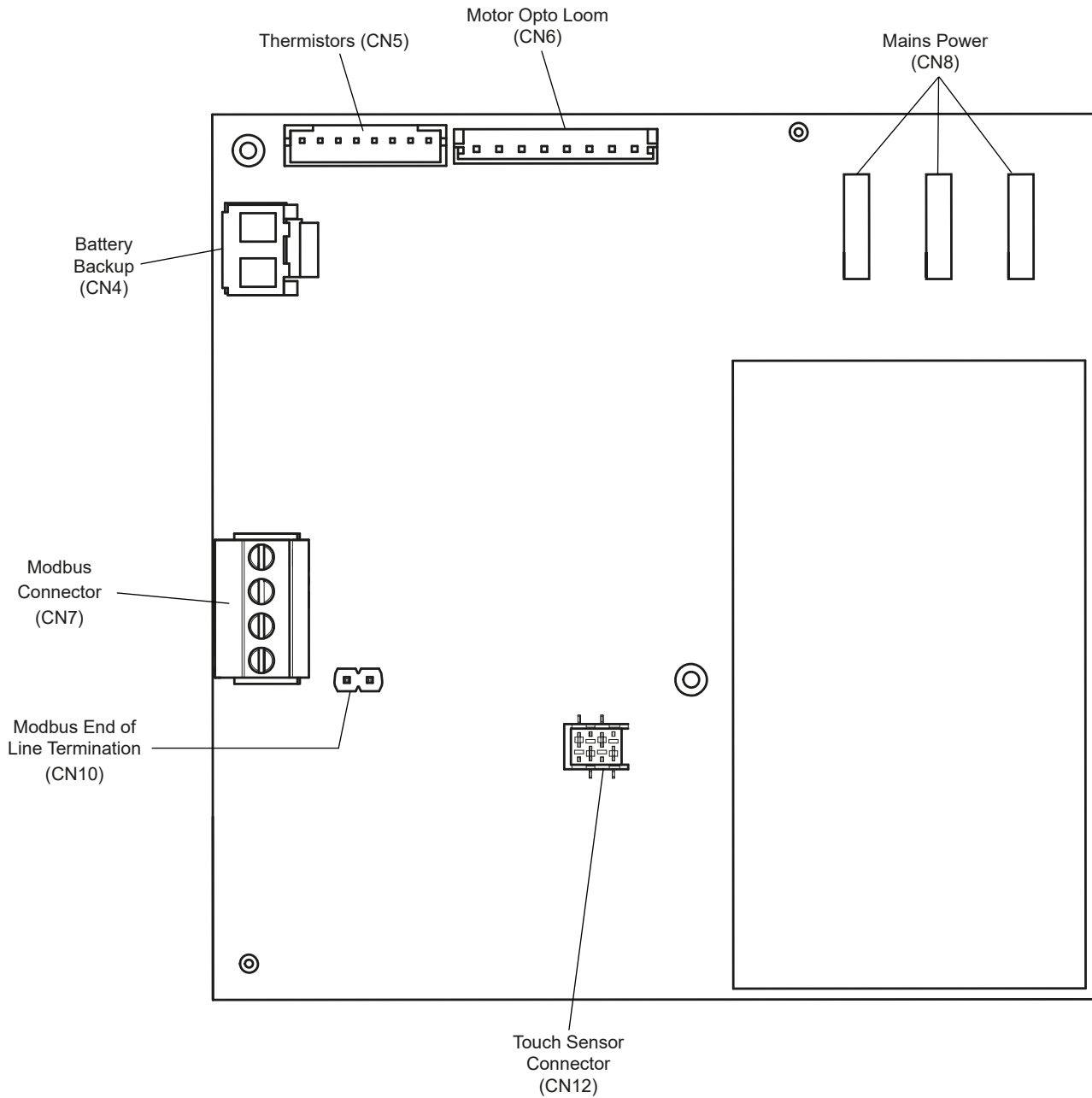


Step 3



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PCB Connections

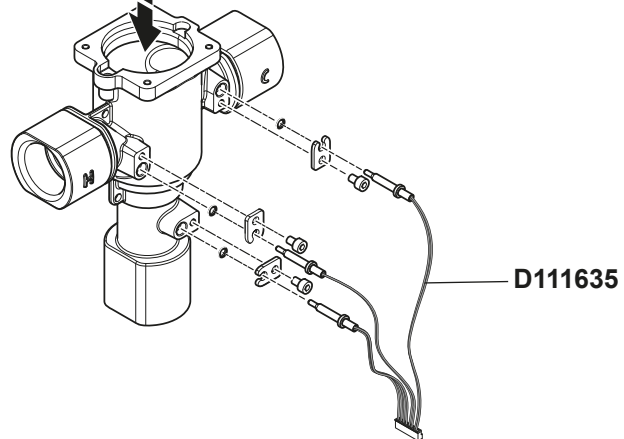
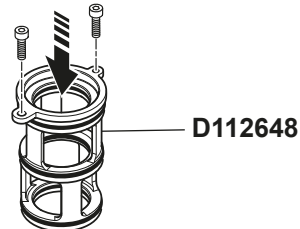
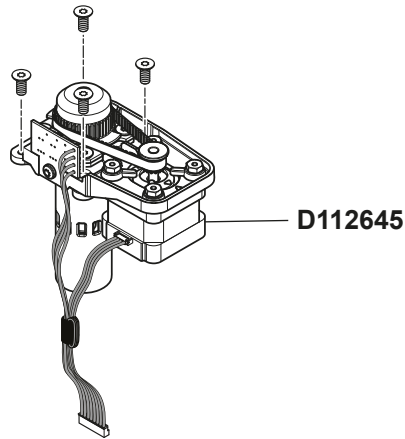
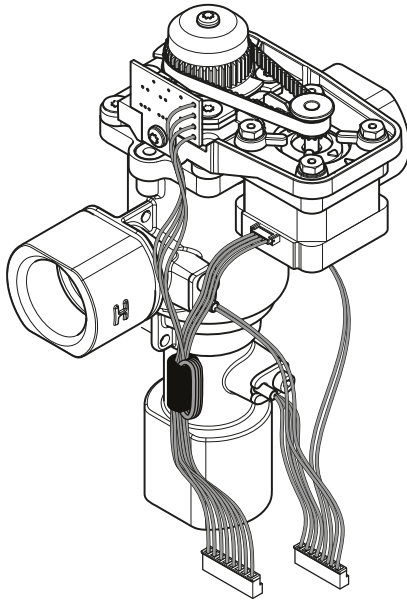


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Drive Mechanism Assembly

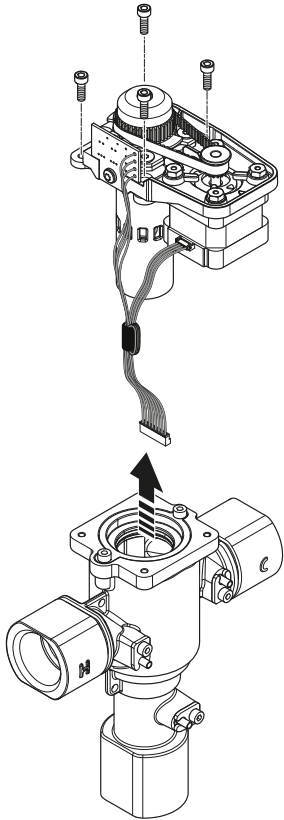
Spare Parts

- D112645 Drive Mechanism Assembly
- D112648 Seal Cartridge Assembly
- D111635 Thermistor Loom

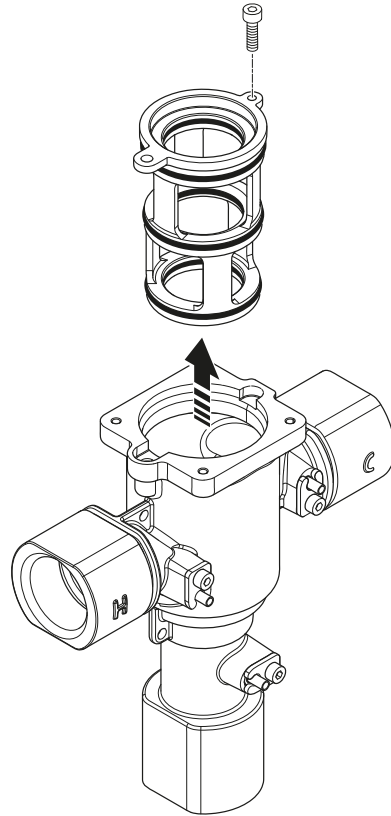


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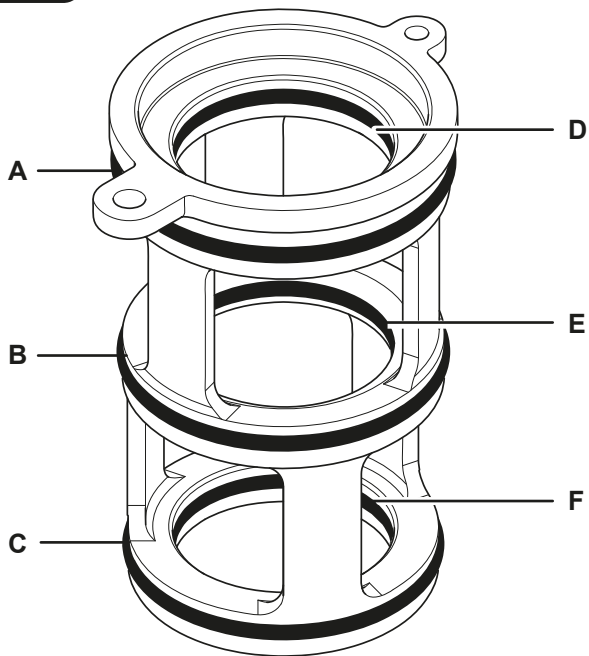
Step 1



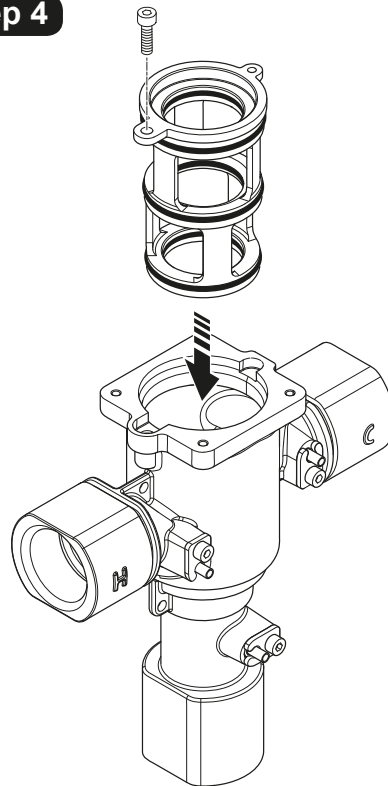
Step 2



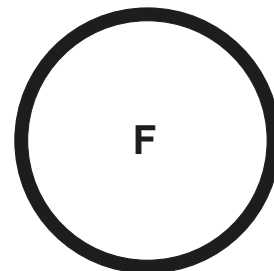
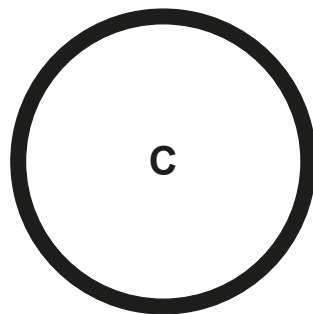
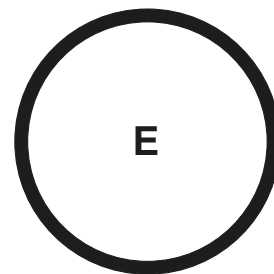
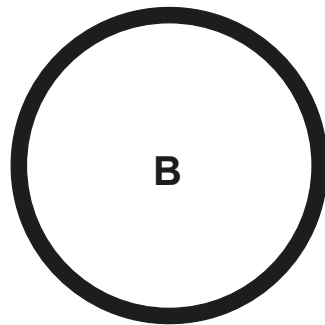
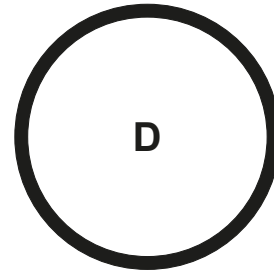
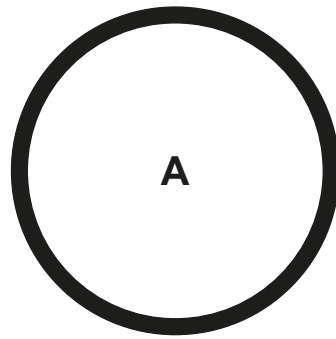
Step 3



Step 4



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D111634 Service Kit



Only use silicone based lubricants on black rubber seals A, B and C.

Seals shown 1:1 when printed at Full Scale

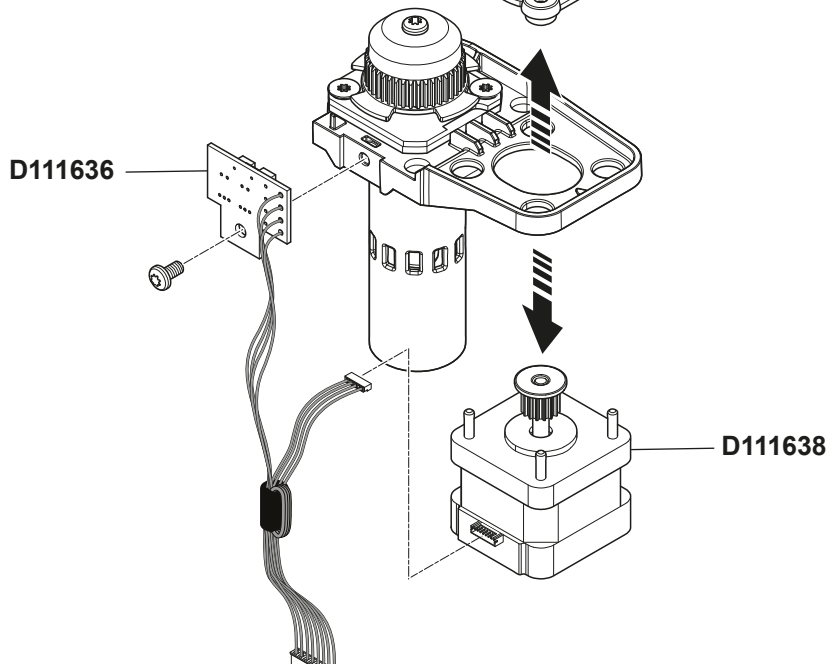
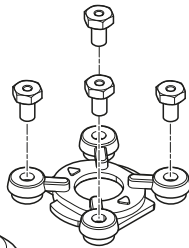
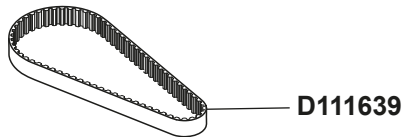
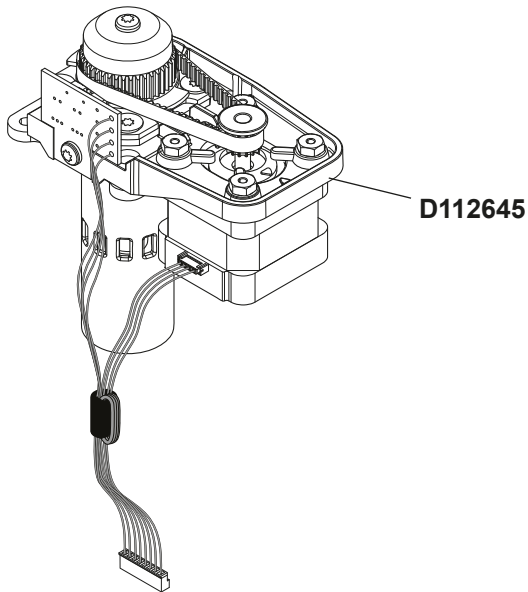


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Drive Assembly

Spare Parts

- D111639 Drive Belt
- D111636 Dual Opto Motor Loom
- D111638 Stepper Motor Assembly
- D112645 Drive Mechanism Assembly



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Troubleshooting

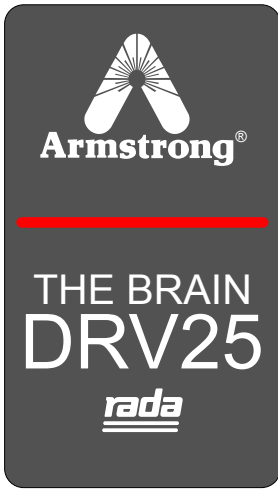
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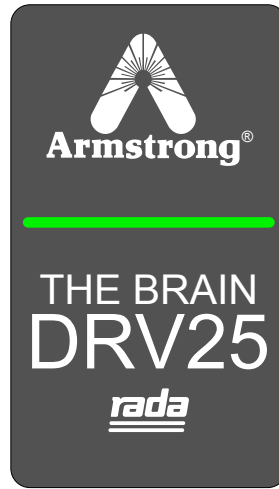


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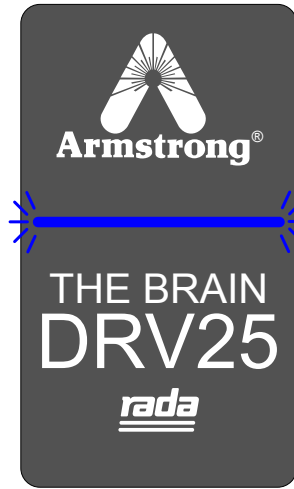
DRV25 LED Indications



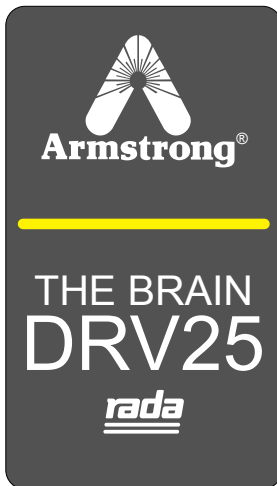
Error Condition



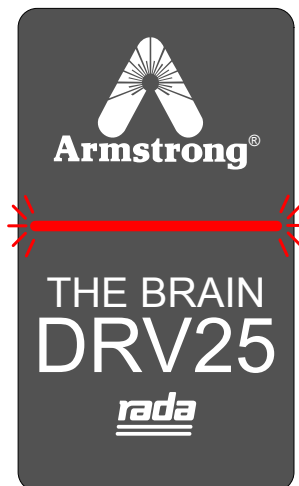
On & Good



BLE Pairing Mode



Off
(Recirculation)



Thermal Disinfection

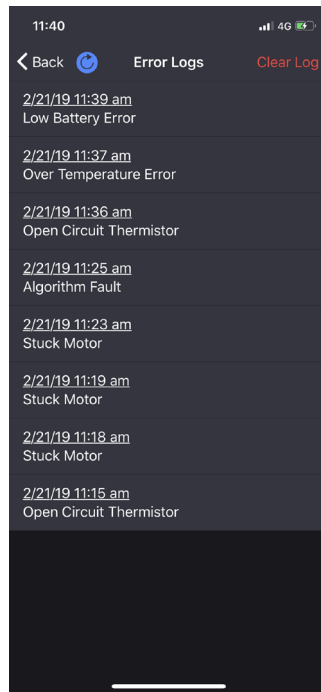


Emergency Mode



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DRV25 Errors



A rolling list of 10 errors is maintained within the DRV25 memory to show historical error events. These records are date and time stamped for reference and can be used to help diagnose on-going issues with the product or system and can be accessed through the SAGE® App.

Battery Error



The following errors indicate the batteries are discharged / flat or disconnected. Check for the following:

- Batteries are securely connected through connector CN4 to PCBA
- Battery connections show signs of wear or debris / corrosion
- Batteries are at minimal power or flat
- Replace batteries (see **Preventative Maintenance and Fitting Spare Parts** on page 30. **DO NOT** use rechargeable batteries). Ensure only Duracell Lithium CR2 batteries are used (**P/N - D112402**).

If the battery terminals show signs of corrosion or damage, replace:

P/N - D112644 Front Cover Assembly with PCBA
see pages 32-34.



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Emergency Mode / Motor Error



Maintenance to the DRV25 internal mechanism is required. DRV25 continues to operate safely, but with reduced performance. Check for the following:

- Motor damage or signs of wear
- Proportioning Assembly damage or signs of wear
- Debris in the Drive Assembly

If this mode is not addressed then it is likely the DRV25 will stop working and develop into a critical motor error.

The following symptoms indicate motor / cable loom failure or a malfunction of the positioning sensor. In the first instance, power cycle/reboot the DRV25. If the error persists, check for the following:

- Internal PCBA connectors to DRV25 are disconnected, damaged or possibly wet
- Dirt or debris around motor
- Motor is disconnected
- Opto encoder is not coupled to the motor
- Proportioning Assembly is sticking or has seized
- Motor is loose
- Drive belt is loose or dislodged

Replace in the following order if the problem still persists after each:

1. P/N - D111636 **Dual Opto Motor Loom**
2. P/N - D111639 **Drive Belt**
3. P/N - D112644 **Front Cover Assy with PCBA**
4. P/N - D111638 **Stepper Motor**
5. P/N - D112645 **Drive Mechanism Assy**

see pages 32-38.



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PCB Errors (Terminal)



The following errors indicate the PCB has failed. Replace the Front Cover Assembly with PCBA.

P/N - D112644 Front Cover Assembly with PCBA see pages 32 & 33.

- Unconfigured error
- A2D range error
- General A2D error
- EEPROM error

PCB Errors (Recoverable)



The following errors indicate the PCB has failed, but may be recoverable. Turn power off for 10 seconds and restart. If the error persists, replace the Front Cover Assembly with PCBA.

P/N - D112644 Front Cover Assembly with PCBA see pages 32 & 33.

- A2D timeout
- RAM error
- Real time check error
- Flash error
- Algorithm error
- Controller fault
- Stack error
- Scheduling error
- Capacitive touch sensor error



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Open Circuit Thermistor



Indicates thermistor / cable loom failure. Turn power off for 10 seconds and restart. If the error persists, check for the following.

- Internal PCBA connections to DRV25 are disconnected, damaged or possibly wet
- Thermistors are loose

If the problem persists, replace the thermistor loom.

P/N - D111635 Thermistor Loom

see pages 32-35.

Over Temperature



Outlet temperature exceeds the **Error Temp** value. This condition causes the DRV25 to switch to full cold. Check for the following:

- Check error temperature limit is set correctly for system
- Internal seal damage
- Debris in the internal mechanism
- Internal mechanism damaged / disconnected
- Thermistor loom damaged

If the problem persists, replace the thermistor loom.

P/N - D111635 Thermistor Loom

see pages 32-37.



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Common Faults

Problem: “Blend temperature rises when system is in zero demand...”

Check blend circuit flow rate.

Flow rate is less than 8 lpm. Reset circuit flow rate and check for the following:

- Air locks
- Blocked strainers
- Closed valves
- Pump failure

Check mixed return temperature under demand.

Minimum recirculation loop temperature loss = 1°C

Checkvalves

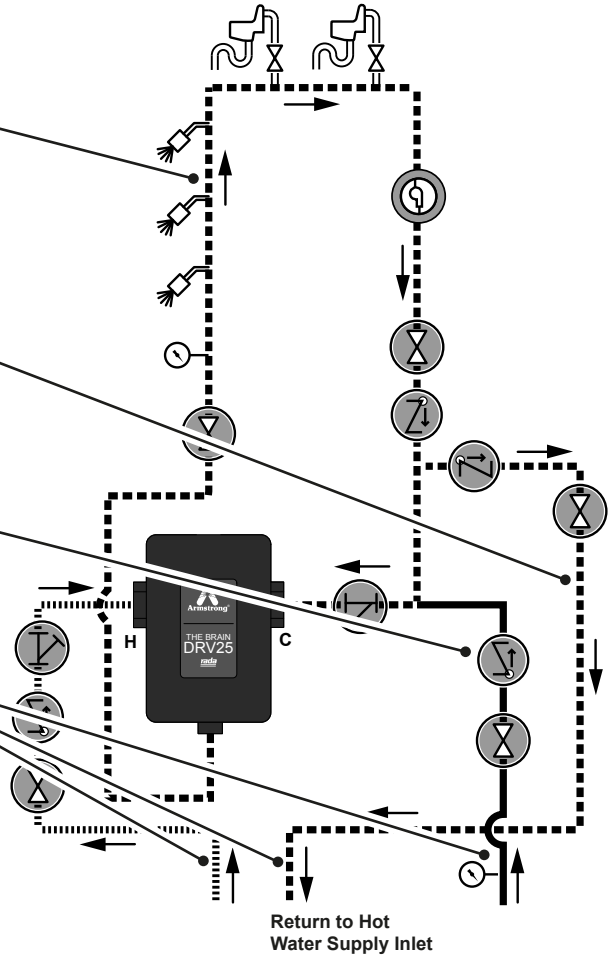
Check circuit to make sure checkvalves are correctly positioned and operating normally. (See Piping Diagrams on pages 11 - 13)

Water pressure

Make sure supply pressures are balanced. Make sure mixed return is flowing correctly to water heater.

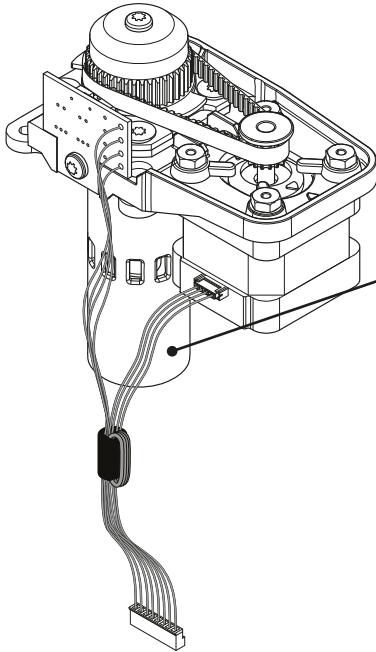
Separator seal

Check separator seal & replace if deteriorated



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Problem: “Outlet temperature fluctuates more than $\pm 1^{\circ}\text{C}$...”



Check internal mechanism

Mechanism is jamming or slow to control.
Clean and descale the following parts:

- Proportioning Assembly
- Renew separator seal and lubricate internal mechanism.

Check blend circuit flow rate.

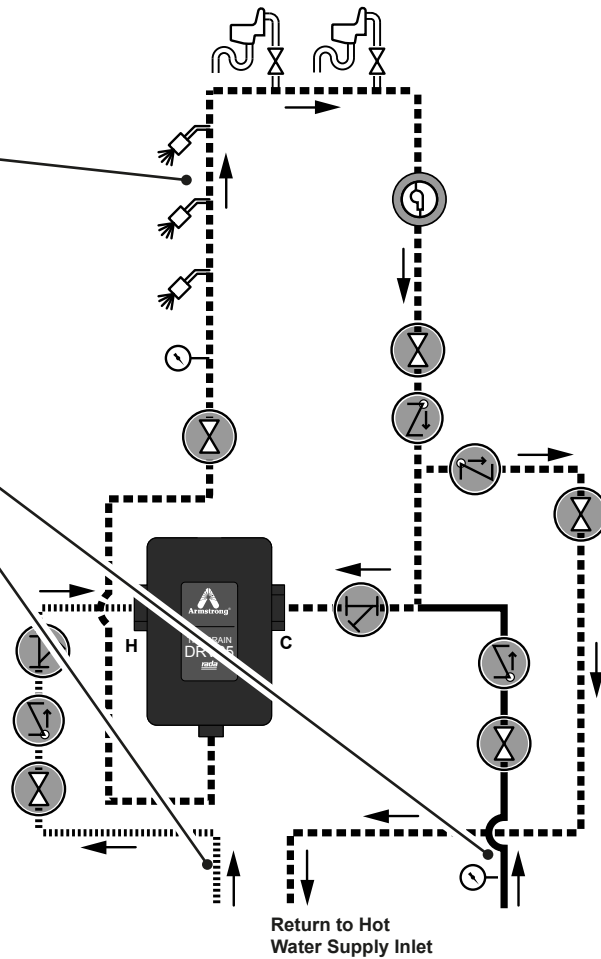
Flow rate is less than 8 lpm. Reset circuit flow rate and check for the following:

- Air locks
- Blocked strainers
- Closed valves
- Pump failure

Water pressure

Make sure supply pressures are balanced.
Check for the following:

- Air locks
- Blocked strainers
- Closed valves

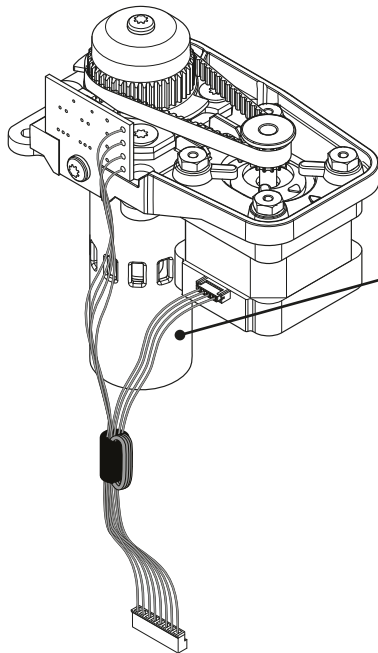


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Problem: “SAGE® mobile app displays an over temperature error...”

For the most probable causes and solutions see **DRV25 Errors** on page 39.

If any other error message is displayed see **DRV25 Errors** on pages 39-44.



Check internal mechanism

Mechanism is jamming or slow to control.
Clean and descale the following parts:

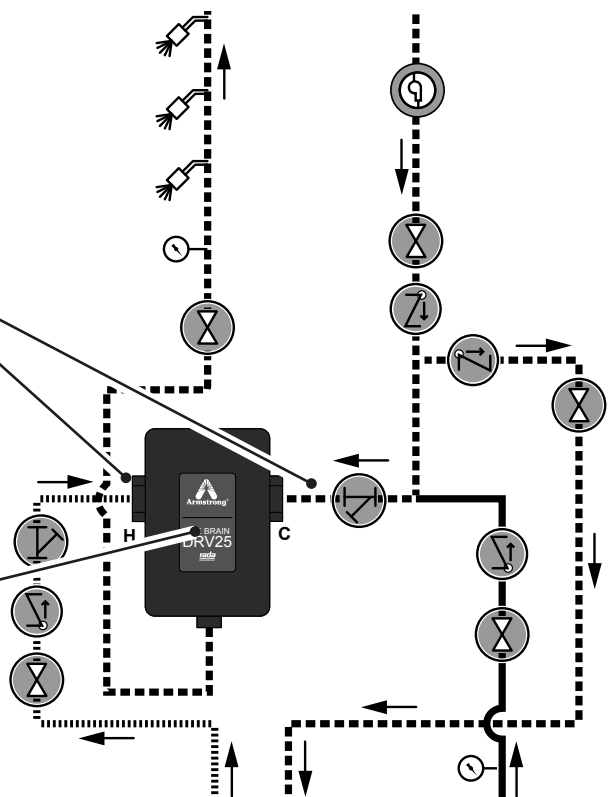
- Proportioning Assembly
- Renew separator seal

Inlet water temperatures

Check water supplies are connected to the correct inlet ports.
Check inlet supply temperature

Reset DRV25

Turn power off for 10 seconds and restart.

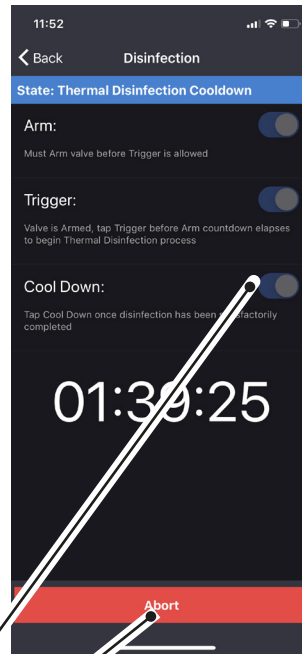
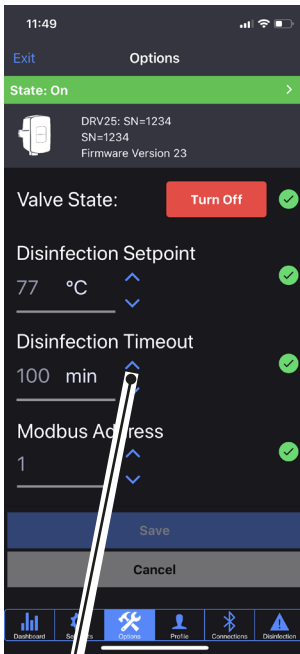


Return to Hot
Water Supply Inlet



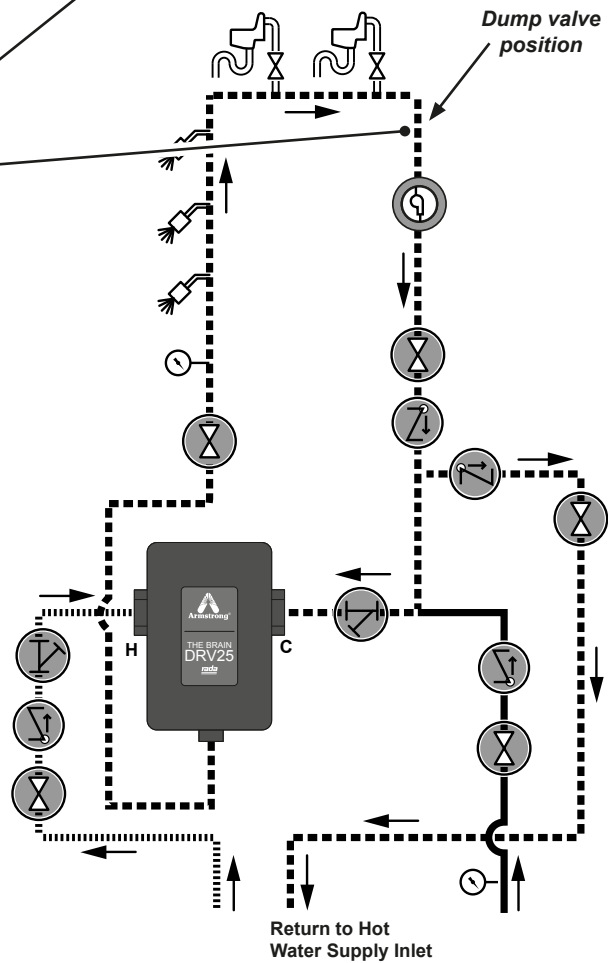
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Problem: “Blend circuit does not fully return to normal within the Disinfection Timeout period...”



Blend circuit / Control software
 Check the following:

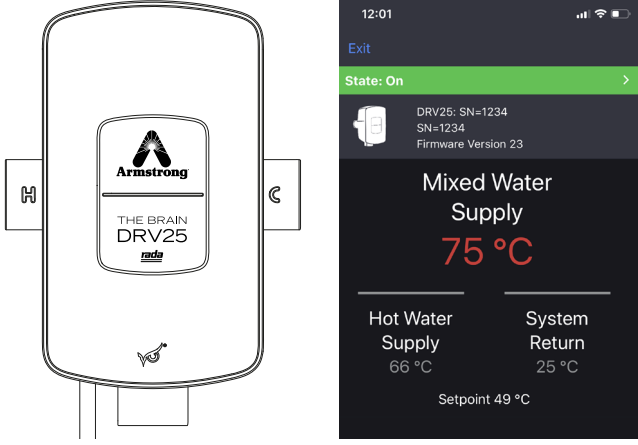
- Disinfection Timeout value.
- Cool Down start and finish times.
- Early abort of disinfection cycle.
- Use of a dump valve to speed up cool down time.



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Problem: “Unable to adjust outlet temperature...”

DRV25 Errors



For the most probable causes and solutions see **DRV25 Errors** on pages 39-44.

If any other error message is displayed see **DRV25 Errors** on pages 39-44.

Check blend circuit flow rate.
 Flow rate is less than 8 lpm. Reset circuit flow rate and check for the following:

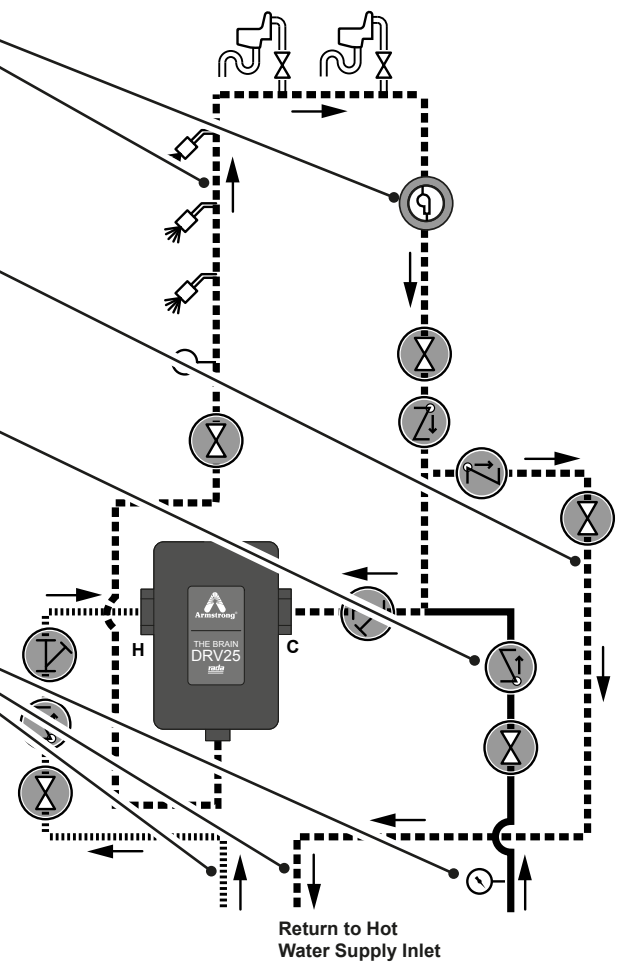
- Air locks
- Blocked strainers
- Closed valves
- Pump failure

Check mixed return temperature.
 Minimum recirculation loop temperature loss = 1°C

Check valves
 Check circuit to make sure checkvalves are correctly positioned and operating normally. (See **Piping Diagrams** on pages 11-13)

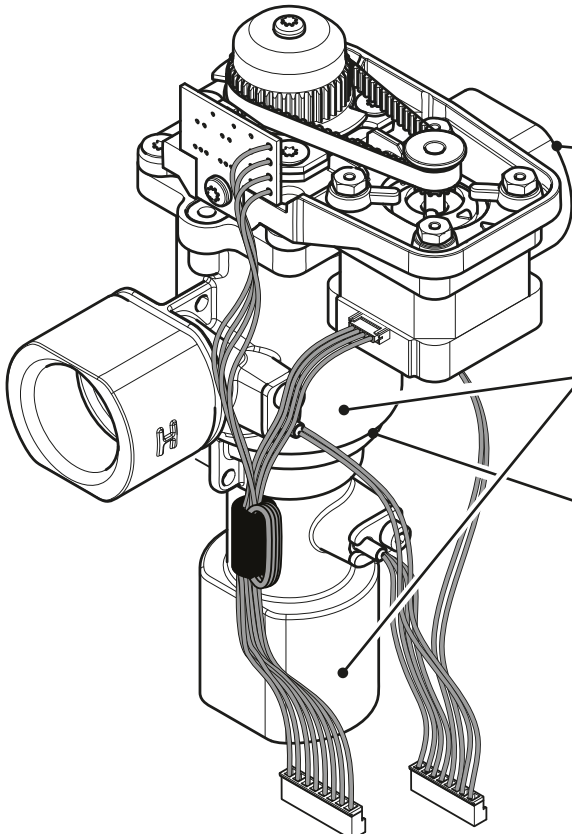
Water pressure / flow
 Make sure supply pressures are balanced. Make sure mixed return is flowing correctly to water heater. Check for the following:

- Air locks
- Blocked strainers
- Closed valves



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Problem: “Water leaking from DRV25...”



Check inlet and outlet connections

Check inlet and outlet thread joints. Check a correct seal has been made with PTFE thread sealing tape or liquid sealant. Oil-based, non-setting joint compounds should not be used.

DRV body failure

DRV25 replacement required.

Check all DRV seals

Check all internal seals for wear and / or damage. Clean and refit seals (see page 36).



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Limited Warranty and Remedy

Armstrong Hot Water, Inc. ("Armstrong") warrants to the original user of those products supplied by it and used in the service and in the manner for which they are intended, that such products shall be free from defects in material and workmanship for a period of one (1) year from the date of installation, but not longer than 15 months from the date of shipment from the factory [unless a Special Warranty Period applies, as listed below]. This warranty does not extend to any product that has been subject to misuse, neglect, or alteration after shipment from the Armstrong factory. Except as may be expressly provided in a written agreement between Armstrong and the user, which is signed by both parties, Armstrong **DOES NOT MAKE ANY OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

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Special Warranty Periods are as follows:

The Brain - Model DRV25 shall have a 5-year parts warranty on all components other than preventative maintenance service items mentioned on page 30, which includes batteries and all 'wetted' O-rings / Seals.

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