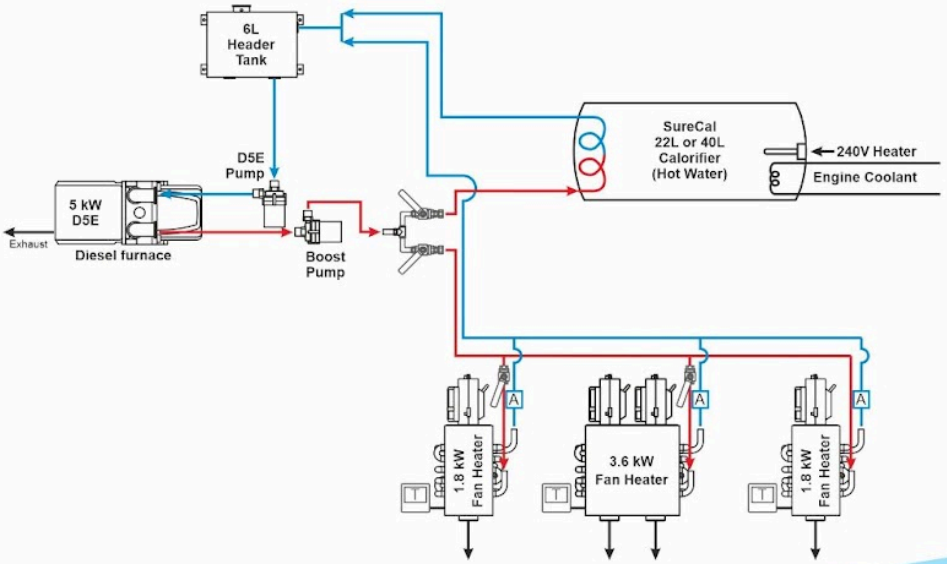
dieselheat

Marine Hydronic Installation and Operation Guide V1



Feb 2025

Introduction

This guide is to assist customers to install a custom marine hydronic hot water and air heating system which has been designed by Dieselheat using Eberspacher D5E or M12 hydronic furnace.

Every marine hydronic system is unique so appropriate documentation for an install includes:

- this manual
- the system schematic prepared by Dieselheat
- the technical manual for the selected diesel furnace

We strongly recommend reading this guide before commencing installation of your hydronic system, as usual if anything is not clear please contact Dieselheat and we will endeavour to assist.

Carbon Monoxide Risk

A properly installed diesel furnace with a marine exhaust presents a very low risk of carbon monoxide poisoning.

Dieselheat still strongly recommends the use of a CO Monitor in all boats to guard against CO from the engine, cooker (gas or diesel) and diesel furnace should there be a failure in an exhaust or ventilation connection on the engine or any appliance.

AS A PRECAUTION ALWAYS INSTALL A CARBON MONOXIDE MONITOR.

Hydronic System Theory

Coolant Circulation

Hydronic systems typically have one to four coolant circulation loops designed to:

- Distribute coolant to air heating heads and hot water cylinders.
- Allow certain loops or subsections to be shut down when air heating is not in use, preventing unwanted heat.
- Balance coolant flow across different parts of the system.
- Maintain an always-open loop to ensure continuous coolant circulation through the diesel furnace.

Coolant naturally follows the path of least resistance, so system design should include valves to balance flow between different coolant loops. This ensures all loops receive adequate coolant circulation, which is an important part of system design and commissioning.

Booster Pumps

The standard coolant pump included with diesel hydronic furnaces supports a maximum pipe length of approximately 20 meters.

For multi-loop systems or longer pipe runs, a booster pump is used to enhance flow. These pumps are wired independently but must be switched on and off along with the furnace.

System Balancing

Coolant takes the easiest flow path, so coolant loops which are longer or more convoluted will get inadequate flow. Systems use balance valves to limit flow in shorter more direct pipe sections, forcing even coolant distribution.

Thermal Mass and Furnace Cycling

Diesel hydronic furnaces produce heat at set power levels. For example:

- The Eberspacher D5E operates between 1.3 kW and 5 kW with 32 power levels.
- The Eberspacher M12 runs between 1.2 kW and 12 kW with 6 power levels.

Why Thermal Mass Matters

If a system lacks sufficient thermal mass or is unbalanced, the furnace may cycle excessively (turn on and off too frequently).

Example 1: 2 kW Heat Load

Imagine a furnace running at a total heat load of 2 kW (from an air heating fan head and pipe losses).

- **Eberspacher D5E**:
  - Starts on high power.
  - When coolant reaches 80°C, it reduces power to exactly 2 kW and maintains a stable 70°C temperature without cycling.
- **Eberspacher M12**:
  - Starts on high power.
  - When coolant reaches 74°C, it reduces power to 1.5 kW.
  - Since heat output (2 kW) exceeds heat input (1.5 kW), the coolant cools down.
  - The furnace ramps up to the next power level (3.5 kW) to reheat the coolant.
  - This process oscillates between two power levels to maintain system temperature.

This kind of operation is ok as the furnaces are throttling up and down, but are not de-igniting and reigniting.

Example 2: 900W Heat Load (Below Furnace Minimum Power)

If the system's heat demand is less than the furnace's minimum output, the coolant temperature continuously rises because heat in > heat out.

- At ~85°C, the furnace shuts off its flame (de-ignites) but continues circulating coolant.
- When coolant cools to ~65°C, the furnace restarts on high power.
- This cycle repeats continuously, causing cycling.

Why is Excessive Cycling a Problem?

Excessive cycling causes:

- Higher battery consumption (due to glow plug activation at startup and shutdown).
- Slight odor and smoke when the furnace stops and restarts.
- Fluctuating noise levels from the system.
- Faster wear and tear on the furnace.

A well-designed system minimizes cycling or extends cycle times so it's less noticeable.

How to Reduce Cycling

- Ensure the system has adequate thermal mass via a sufficiently large header tank.
- Include the hot water cylinder in the system—it adds significant thermal mass.
- Avoid running the system with minimal or no heat load, as this promotes cycling and excessive furnace idling.

Header Tanks

Hydronic systems operate at atmospheric pressure and require a header tank at the highest point to:

- Allow the system to be filled with coolant.
- Accommodate thermal expansion as the coolant heats.

Choosing the Right Header Tank

- Systems with less than 20L of coolant: Use a 1L tank for expansion.
- Larger systems or those requiring more thermal mass: Use a 6L tank.
- The Ebersacher M12 requires a minimum 6L header tank.

Installation

- The header tank must be at the highest point to allow air to escape from the system.
- Allow space above the header tank to easily complete coolant fill-up and inspect the coolant level.
- Allow space under or beside the header tank for the coolant pump.
- Mount the header tank securely to a bulkhead or bracket which cannot vibrate or shake as this may fatigue the tank seam welds.
- Do not overfill the tank or it will overflow when the coolant expands.

Drain Valves

Larger or more complex hydronic systems (especially in boats) require drain valves to:

- Remove coolant for repairs or servicing.
- Drain the system during commissioning if leaks occur.

Placement Recommendations

- Install drain valves at the lowest point of the system, or in a position to drain the header tank, furnace, coolant pump segment of the system.
- Position them where a bucket can be placed underneath for easy draining.

Positioning the Furnace, Header Tank, Coolant Pump(s) and Manifolds

These components are usually placed together and connected with rubber heater hoses, as explained in the Pipework section. Common installation locations include:

- **Lazarette** – Must be dry; often allows for a transom exhaust, which is a good option.
- **Engine Room** – Works only if the hull is accessible from the engine room to connect the exhaust.
- **Pilot House (above deck level)** – Can be placed under a seat or in a cupboard. This setup helps position the header tank high while allowing the exhaust to exit through the cabin wall rather than the hull, keeping it dry.
- **Catamarans** – Often installed in a bridge between the hulls, under a seat, or in a cupboard. This placement keeps the header tank elevated and allows for vertical exhaust exit between the hulls.

Key Factors in Choosing a Location

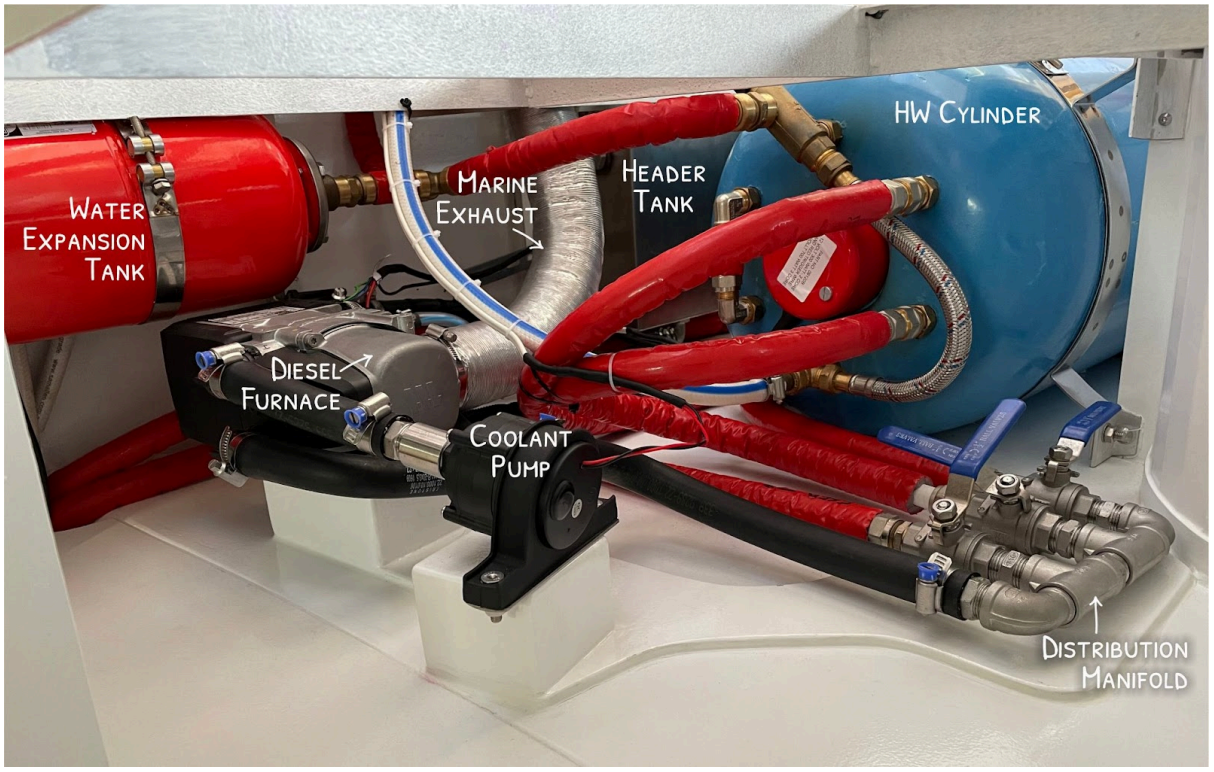
The placement of these components is determined by the following factors, in order of importance:

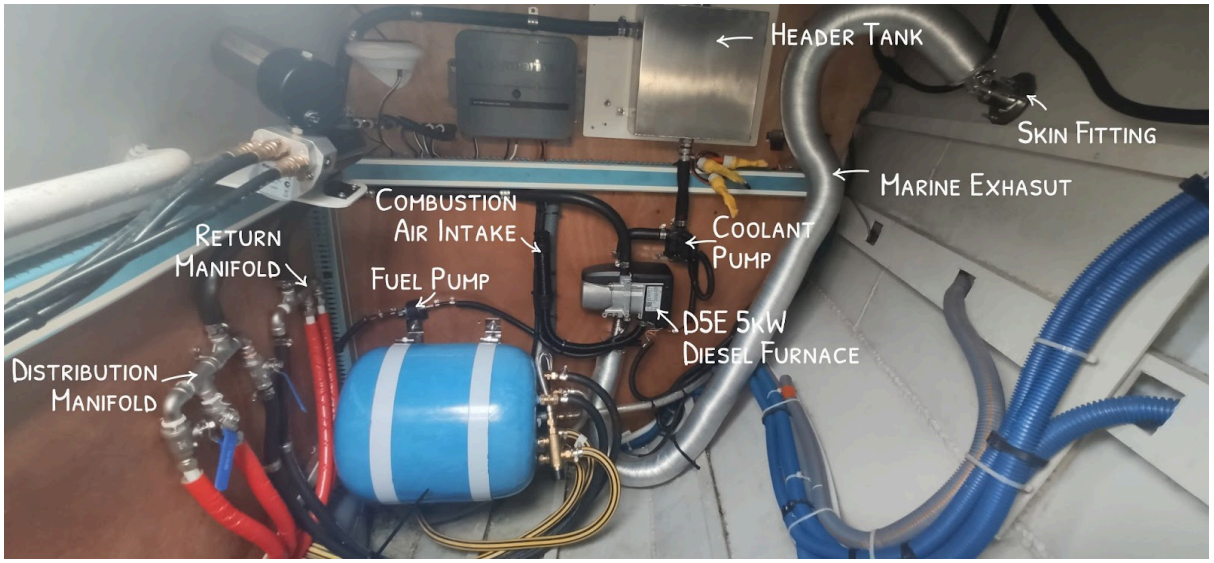
1. **Physical Space** – The furnace, header tank (which must be at the highest point), pump(s), and manifolds need enough room. They do not need to be near the hot water tank or heating areas.
2. **Exhaust Placement** – The exhaust must be **no longer than 2 meters** and positioned to **minimize water ingress**. The furnace's location is often dictated by where the exhaust can safely exit the boat. In general, placing the exhaust higher and further astern is preferable.
3. **Coolant Line Routing** – There must be enough space to install and route the coolant lines. PEX coolant lines have a 25mm outer diameter, which means they can often be routed behind cabinets or under the floor.
4. **Fuel, Power, and Control Wiring** – These are the most flexible components, so they are considered last.

Important Considerations

- Furnaces should **never be placed in damp or exposed areas**, such as sail lockers, bilges, or any location prone to sea spray or moisture.
- Always install the furnace in a location that allows for **easy access and removal for servicing**.

Hydronic System Layouts





System Control

Furnace Control

Eberspacher furnaces can be switched on via a +12v signal to the yellow ignition wire. The can also be controlled via digital controllers which also allow for diagnostics.

Easystart Pro controller for the D5E Furnace

Easystart Select Controller for the M12*

*This controller defaults to 1 hour run time, so it is generally suggested to use an on/off switch and only use the controller for diagnostics.

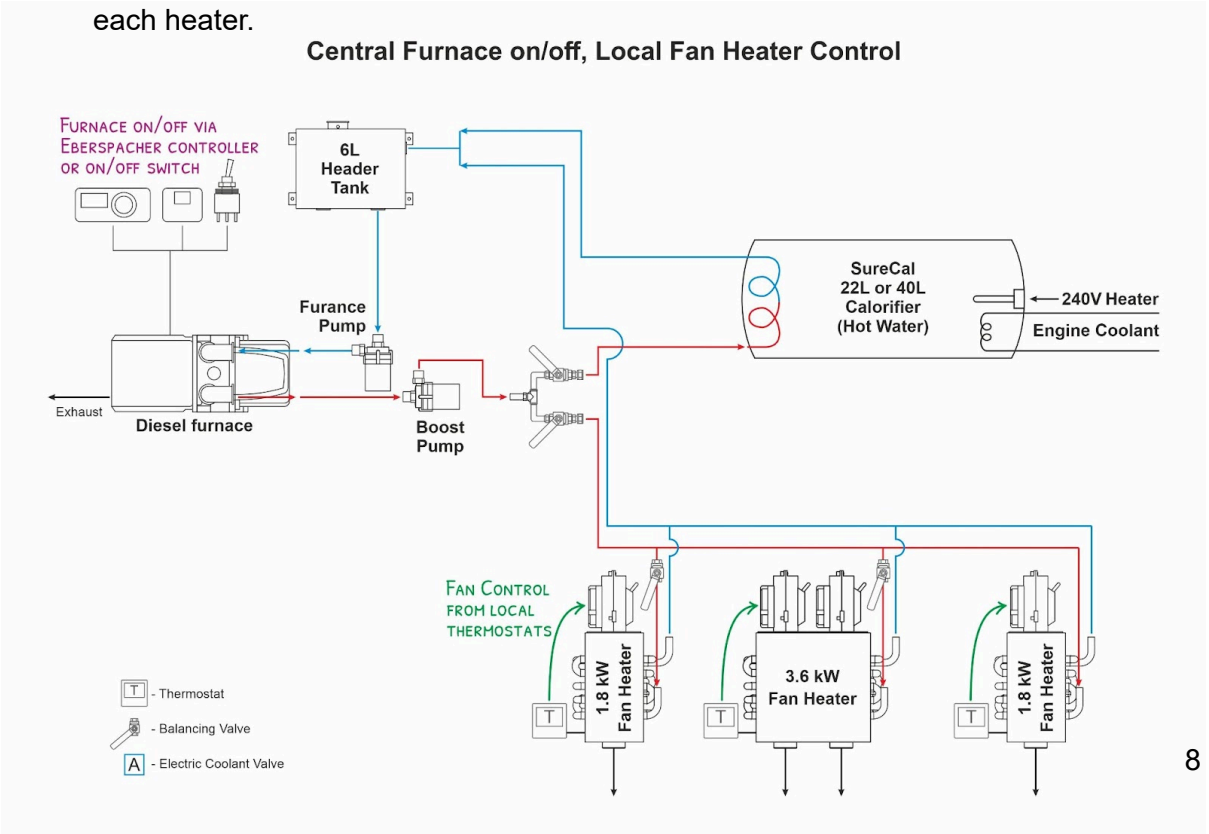
Options for Furnace and Air Heating Control

Option 1: Central furnace on/off; local air heater fan control

This is the simplest setup, where:

- A single switch or an Eberspacher digital controller is used to turn the furnace on or off.
- Each air heater is controlled independently at its installation location.
- A Dieselheat hydronic thermostat manages the fan speed and room temperature for each heater.

Central Furnace on/off, Local Fan Heater Control

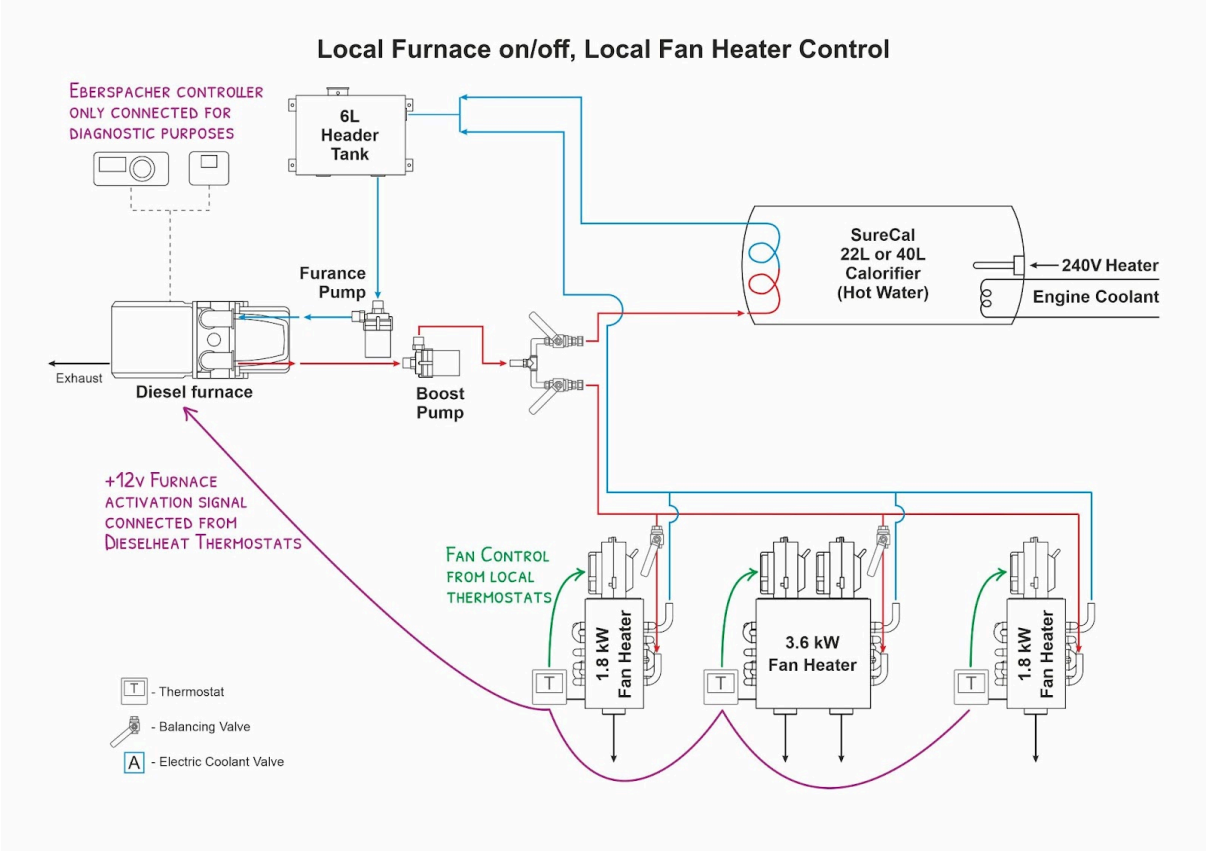


Option 2: Local furnace on/off; local air heater fan control

This setup allows users to turn the furnace on or off from any air heating location using a Dieselheat thermostat. This means If someone is cold at night, they can activate the furnace and air heating without having to get up and find the main switch.

In this setup:

- Thermostats are daisy-chained and connected to the furnace ignition wire.
- This means any user can start the furnace from their location without needing to access a central switch.
- A Dieselheat hydronic thermostat manages the fan speed and room temperature for each heater.



Option 3: Systems using Eberspacher D5E Furnace, Dieselheat Thermostat as master controller using CAN

[COMING SOON]

Options for Coolant Control

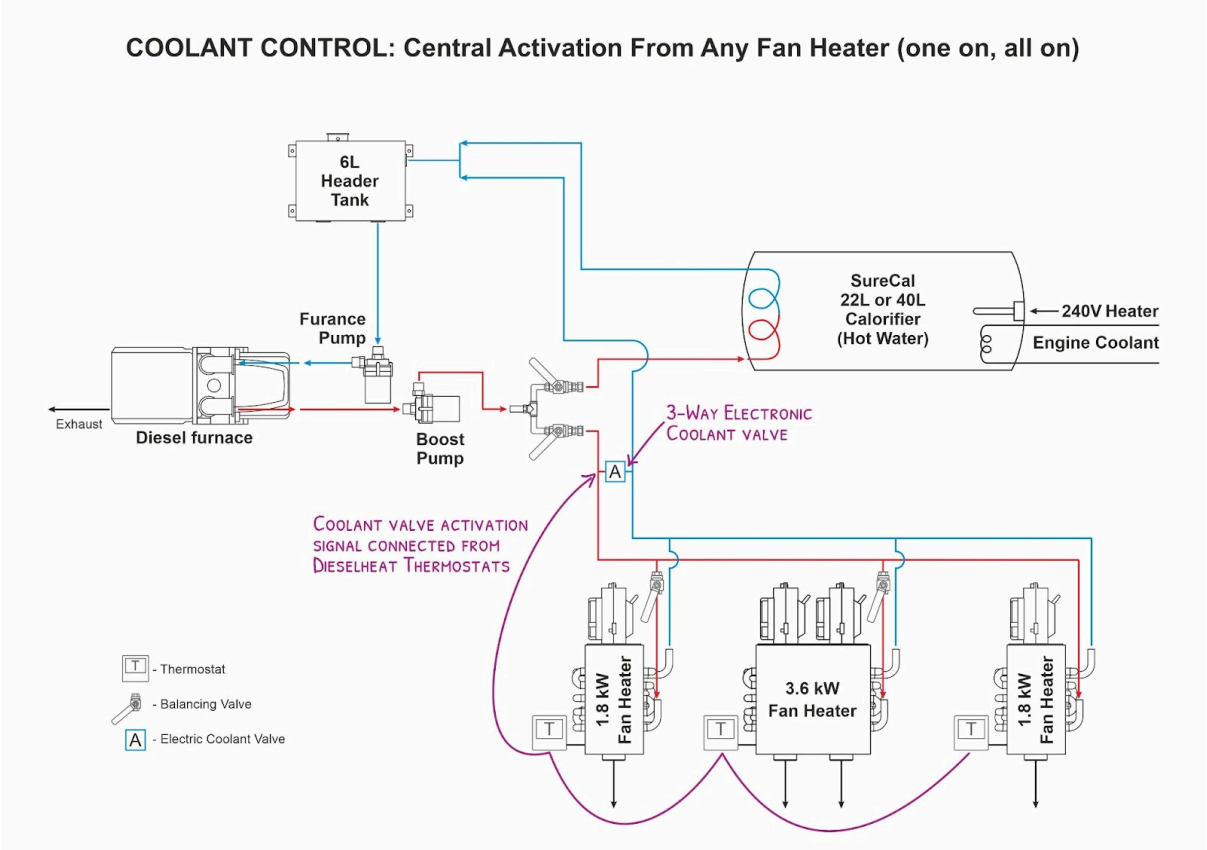
Electrically controlled coolant valves can be used to shut down coolant loops when they are not needed, such as in hot weather.

At least one coolant circuit must always remain open to prevent overheating if the furnace is turned on while the valves are closed.

Central Control of the Coolant

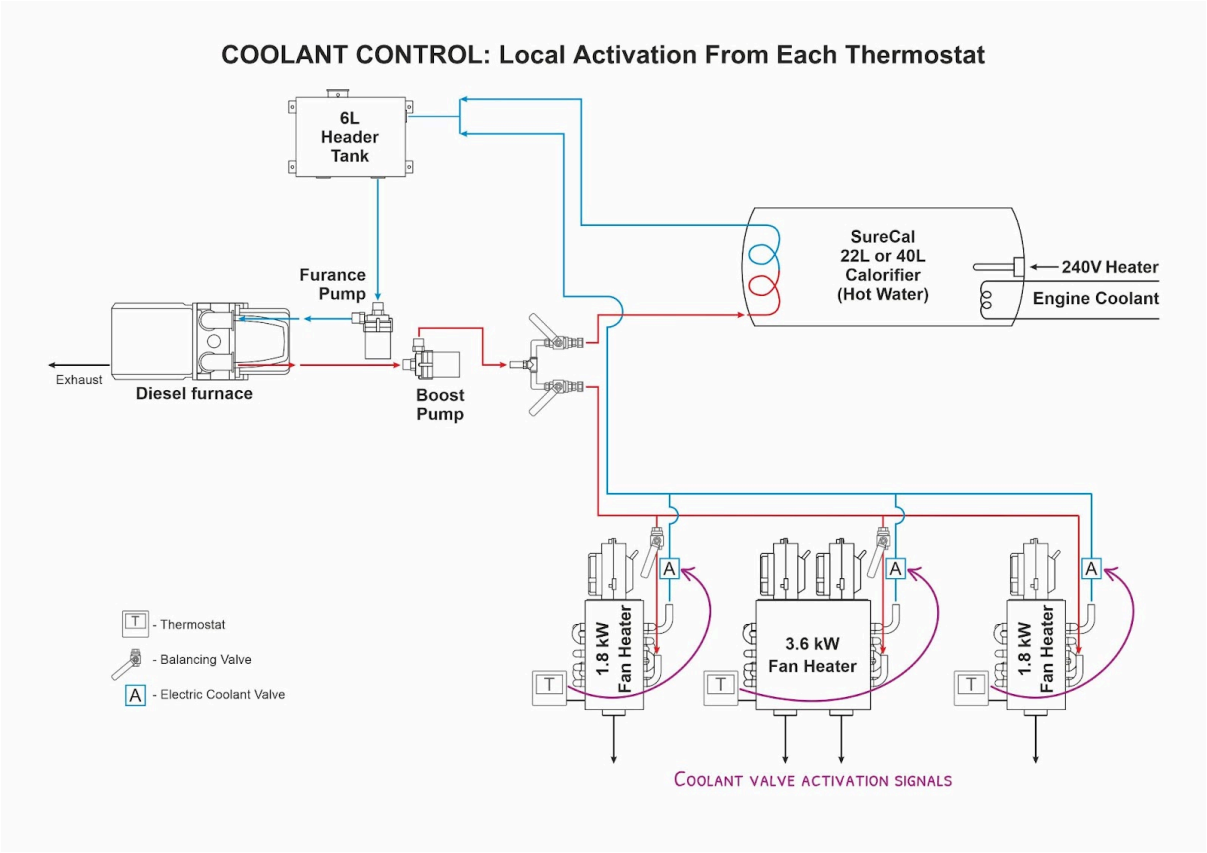
A 3-way valve can be installed to bypass the main piping and fan heads when they are not in use.

- The valve's opening signal can be daisy-chained from Dieselheat thermostats.
- This ensures that if any fan head is turned on, the valve opens automatically.

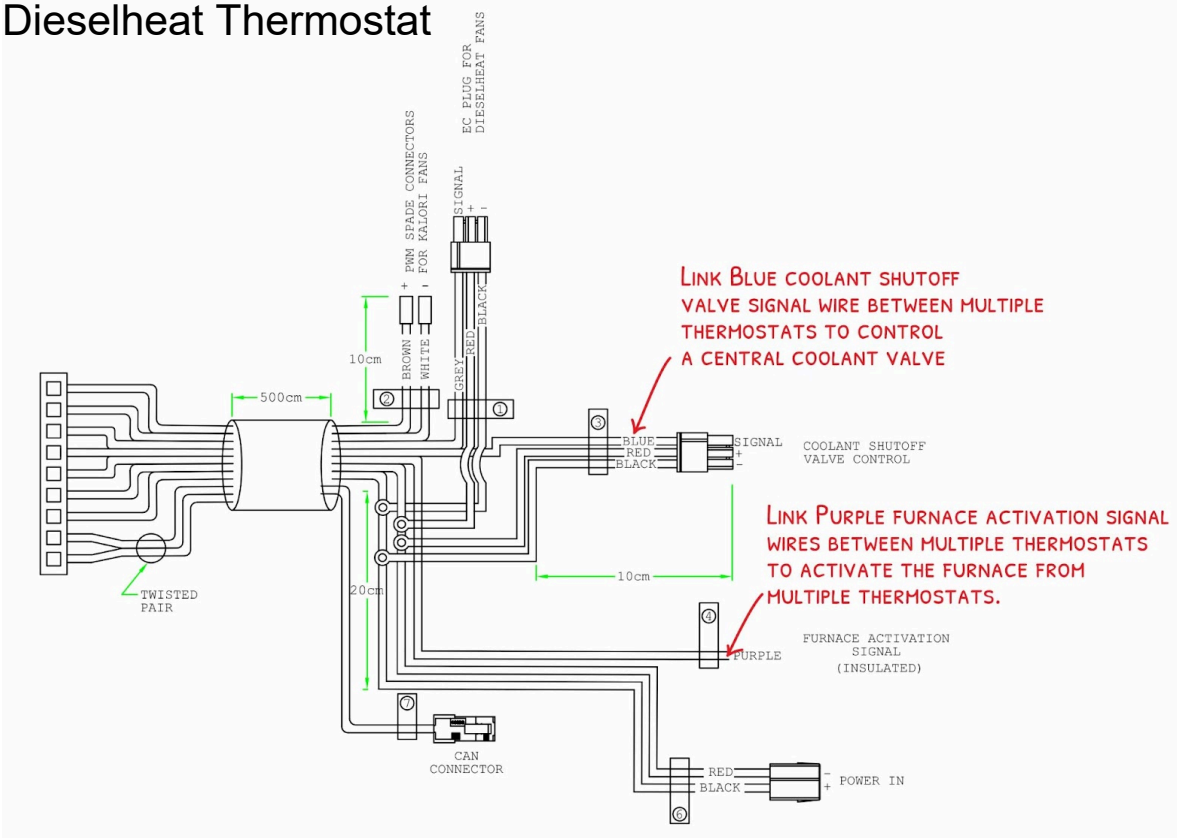


Local Coolant Control at Each Fan Head

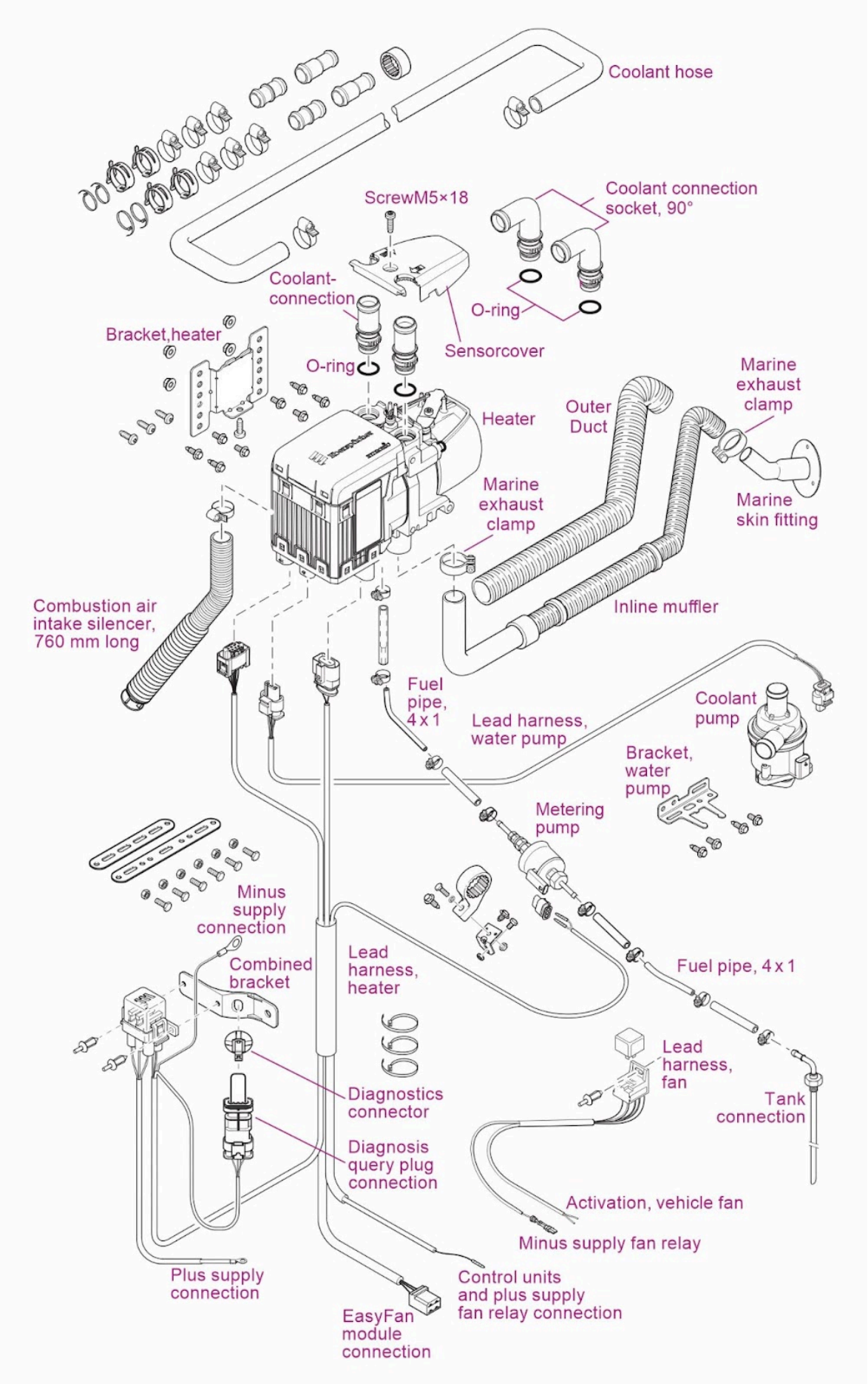
A 2-way valve can be installed at each fan head to keep it cool when not in use. The valve opens when triggered by the fan's Dieselheat thermostat. In this case the coolant pipes stay hot wherever the furnace runs.



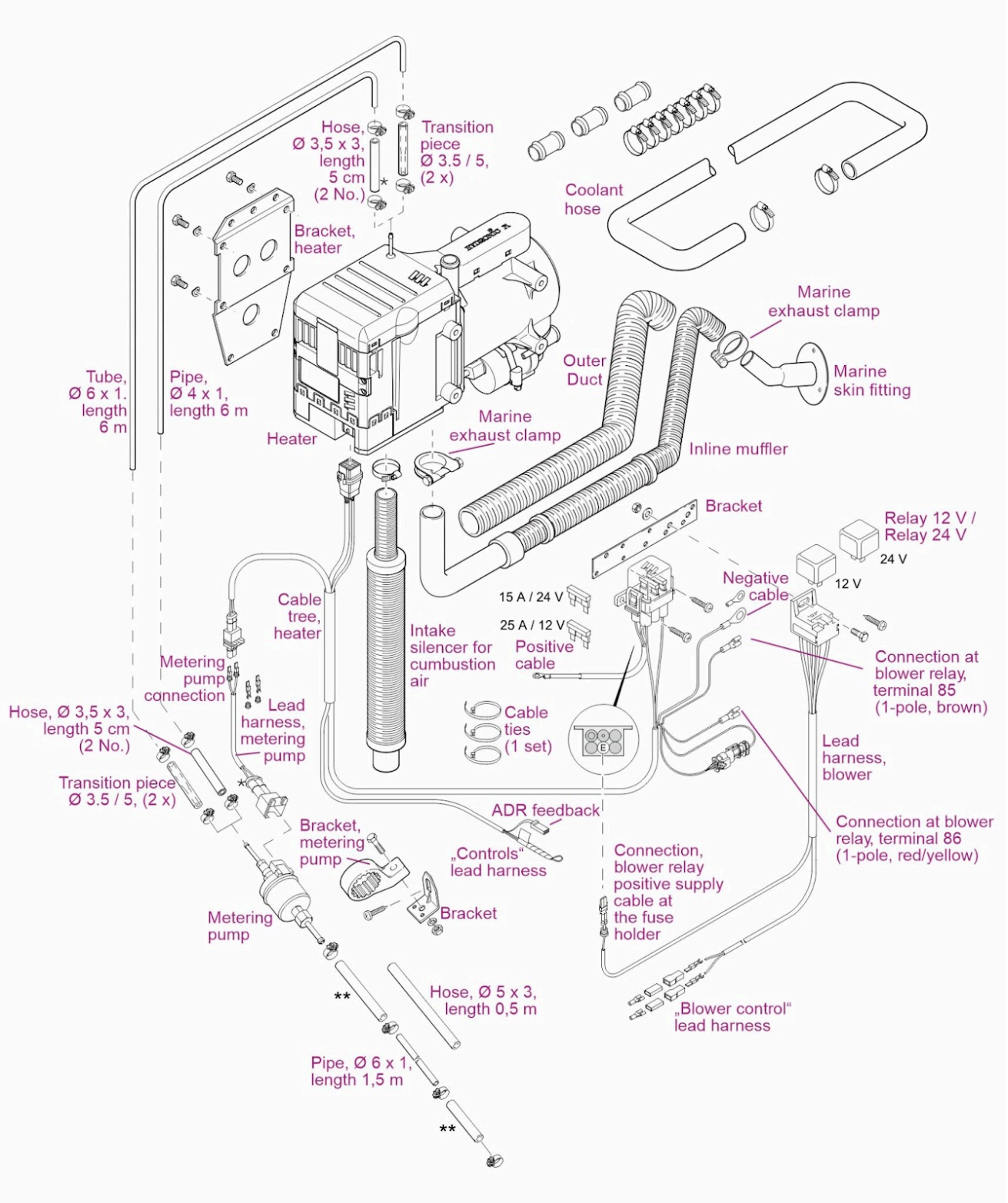
Wiring Local Coolant Valves or Furnace Activation Using the Dieselheat Thermostat



Eberspacher D5E General Arrangement



Eberspacher M12 General Arrangement



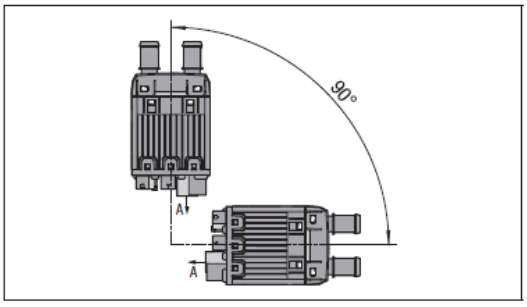
Furnace Mounting

When mounting the furnace consider the following:

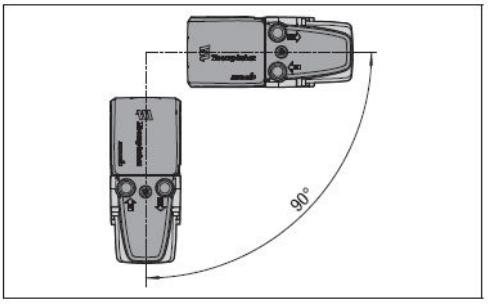
- The furnace can only be oriented in specific ways, check the diagrams below for allowable orientations.
- Mount the furnace below the top of the header tank to ensure it always stays filled with coolant.
- Make sure the furnace is easy to remove if it needs to be uninstalled for service
- Ensure the furnace is mounted in a dry salt water free environment.

D5E Allowable Orientations, Mounting and Coolant Pipes

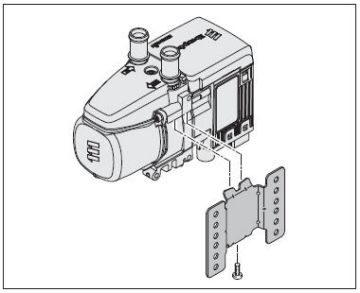
Heater Upright/ On SIde



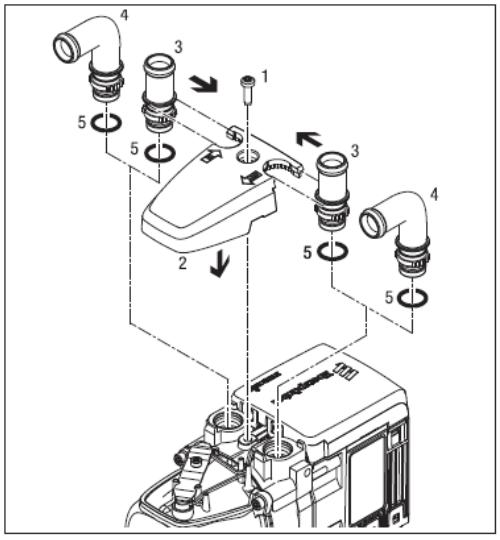
Heater Horizontal / Vertical



Always position Exhaust A at the bottom.



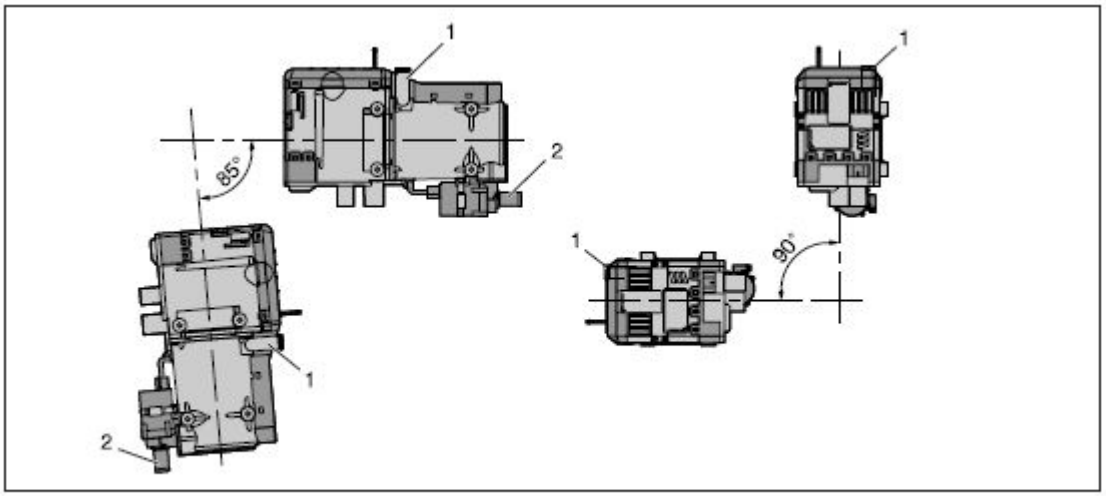
Fix the furnace to the mounting bracket as shown.



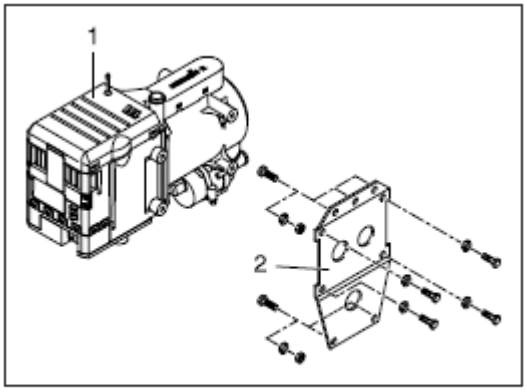
Install the Coolant Pipes as shown, note it is important that the correct screw (1) is used to hold down the cover (2). This screw is M5 x 18mm torx and is in the same bag as the straight coolant connectors and the O'Rings.

The cover (2) locks the elbows into position, so determine where the elbows need to point (if using them), place them in the cover and then push the cover down onto the furnace before installing the screw.
Note: The screw cuts a thread as it is installed, so it must be put in by hand.

M12 Allowable Orientations, Mounting



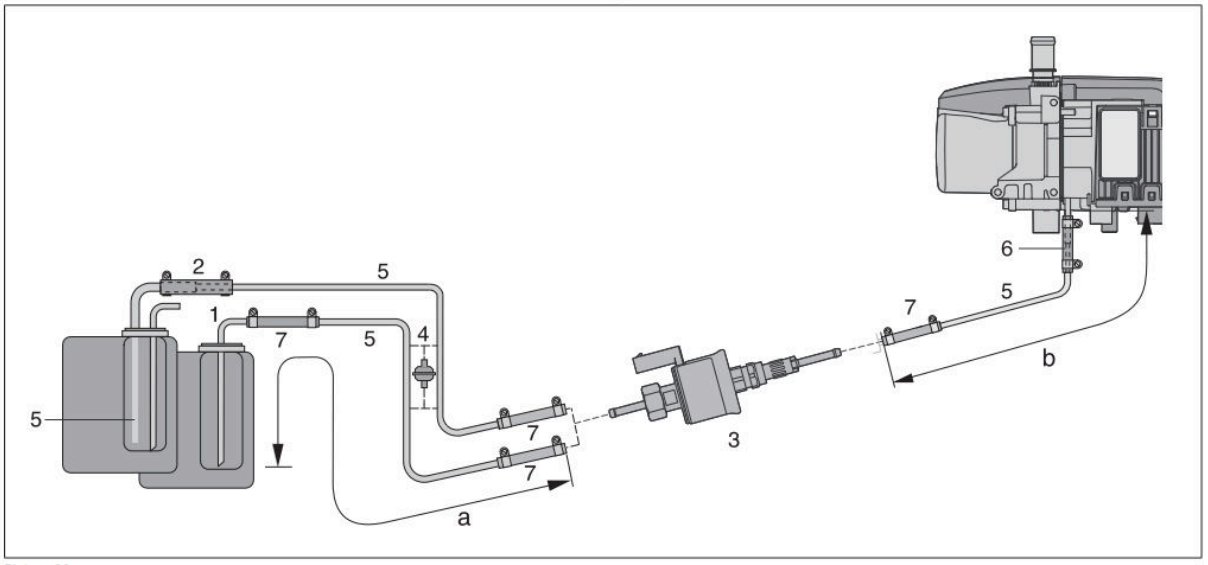
1 Water outlet socket, heater
2 Water inlet socket, water pump



1 Heater
2 Heater bracket

Fuel System

Fuel System Layout - D5E

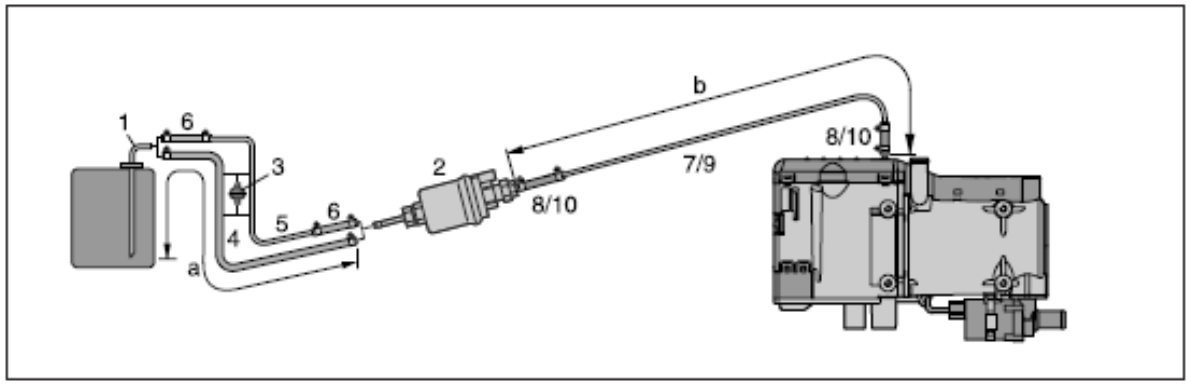


Picture 20

1 Tank connection (di = Ø 2 mm, da = Ø 4 mm) – installed in the vehicle's own tank fitting
2 Adapter (Ø 7.5 / 3.5 mm) – connected to the vehicle's own tank fitting, at a socket Ø 8 mm, used to pass through the intake line (fuel pipe 4 x 1) up to just before the bottom of the tank.
3 Metering pump
4 Fuel filter – only required for contaminated fuel
5 Fuel pipe, 4 x 1 (di Ø 2 mm)
6 Adapter (Ø 4.5 / 3.5 mm)
7 Fuel hose, 3.5 x 3 (di Ø 3.5 mm), approx. 50 mm long

Permissible line lengths: a = max 2m; b = max 6m

Fuel System Layout - M12

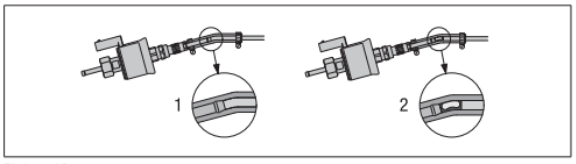


1 Tank connection for metal tank – di = Ø 4 mm, da = Ø 6 mm
2 Metering pump
3 Fuel filter
4 Fuel hose, 5 x 3 (di = Ø5 mm)
5 Fuel pipe, 6 x 1 (di = Ø 4 mm)
6 Fuel hose, 5 x 3 (di = Ø 5 mm), approx. 50 mm long
7 Fuel pipe, 4 x 1 (di = Ø 2 mm)
8 Fuel hose, 3.5 x 3 (di = Ø 3.5 mm), approx. 50 mm long

Permissible line lengths: a = max 2m; b = max 6

Fuel System Installation

- To install the fuel line into the rubber joiners, use a small amount of vaseline or silicon grease prior to inserting into the joiner.
- When cutting the fuel line, use a sharp knife or snips. Do not allow the end of the line to compress or burr.
- If possible, install the fuel line running uphill from the pump to the furnace.
- Protect the fuel line with split corrugated conduit and secure it with cable ties or clamps to avoid mechanical damage or chafing.
- It is especially important to secure the fuel line in the vicinity of the fuel pump or impulses from the pump can cause the fuel lines to rattle.
- When making fuel line connections, always push the fuel line all the way into the rubber joiner to ensure a butt joint and prevent bubbles forming.

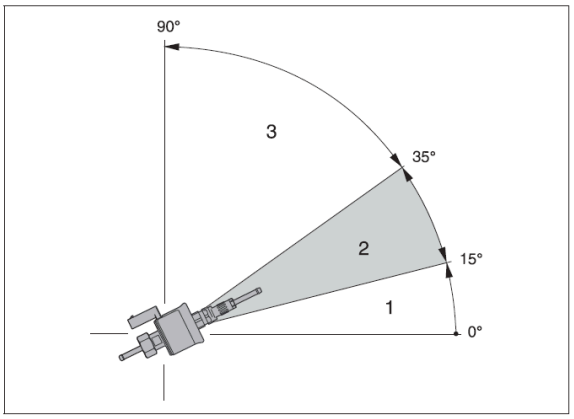


Picture 19

1 correctly laid lines
2 incorrectly laid lines – bubbles form

- Ensure all connections have screw or single use ear clamps installed.
- Ensure the fuel line cannot contact anything hot like the furnace exhaust or a boat exhaust.

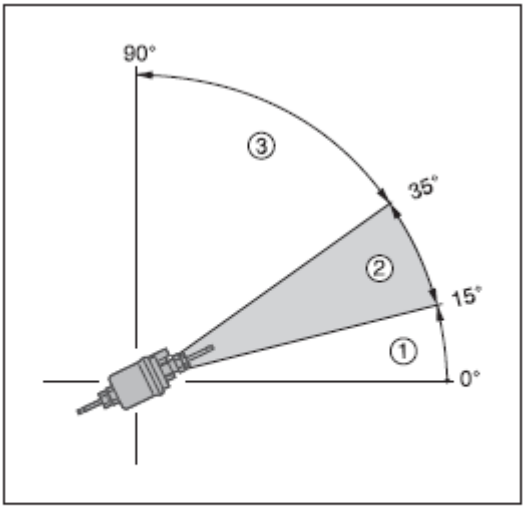
Pump Orientation - D5E
Ensure the pump is installed with the correct orientation. The outlet is on the opposite side to the power cable and the pump must be angled upwards at an angle of 15-35 degrees.



Picture 23

1 Installation position between 0° – 15° is not allowed
2 Preferred installation position within the range 15° – 35°
3 Installation position within the range 35° to 90° is allowed

Pump Orientation - M12
Ensure the pump is installed with the correct orientation. The outlet is on the same side to the power cable and the pump must be angled upwards at an angle of 15-35 degrees.



1 Installation position between 0° and 15° is not allowed.
2 Preferred installation position in range 15° to 35°.
3 Installation position in range 35° to 90° is allowed.

It is advisable to install the pump as close as possible to the fuel source so that it pushes the fuel instead of sucking it.

The Eberspacher D5E fuel pump is very quiet so noise does not need to be a major consideration when selecting a location. The

M12 pump does emit a low ticking sound so it is advisable to install it in the engine room or away from sleeping areas.

Note: The pump contains a small filter behind the nut on the inlet side.

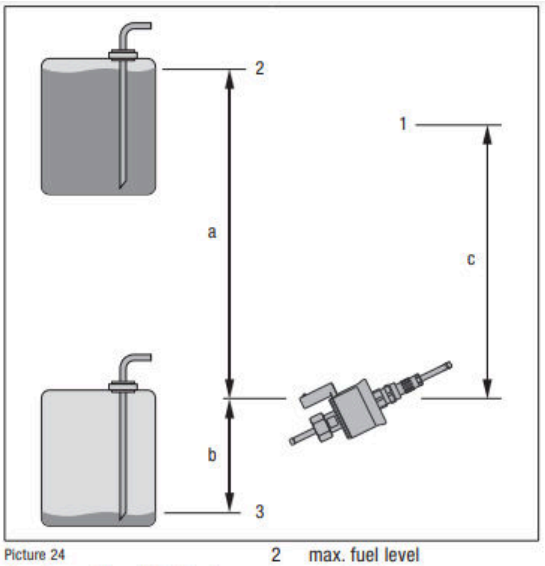
A small inline pre-filter is available as an option to prevent the fuel pump filter clogging if the fuel is dirty.

Fuel Source

The furnace can be connected to an auxiliary fuel tank, to a day tank or to a connection point on the main fuel system or generator fuel system.

When connecting to main fuel systems in boats it is important to ensure that the fuel take off point is not pressurised (downstream of any feed pumps) and that there are no opportunities for air to enter the fuel lines.

Allowable Suction Head - D5E



Picture 24

1 Connection at the heater
2 max. fuel level
3 min. fuel level

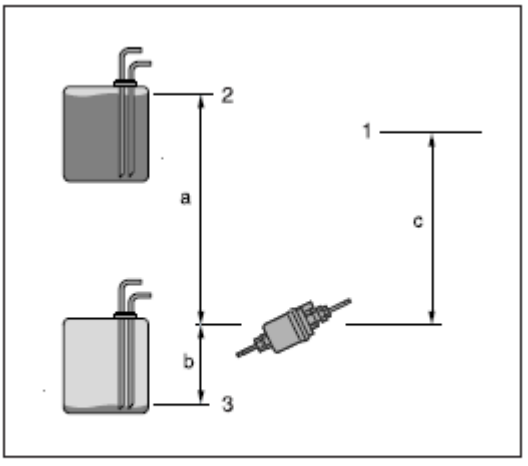
Pressure head from vehicle tank to metering pump:
a = max. 3000 mm

Suction head in pressure-less vehicle tank:
b = max. 500 mm for petrol
b = max. 1000 mm for diesel

Suction head in a vehicle tank in which negative pressure occurs during extraction (valve with 0.03 bar in the tank cap):
b = max. 150 mm for petrol
b = max. 400 mm for diesel

Pressure head from the metering pump to the heater:
c = max. 2000 mm

Allowable Suction Head - M12



1 Connection to heater
2 Max. fuel level
3 Min. fuel level

Pressure height from vehicle tank to metering pump:
a = max. 1000 mm

Intake height for non-pressurised vehicle tank:
b = max. 750 mm

Intake height for a vehicle tank with withdrawal by negative pressure (valve with 0.03 bar in the tank lid):
b = max. 400 mm

Pressure height from the metering pump to the heater:
c = max. 2000 mm

Marine Exhaust

Always use high-quality marine stainless steel exhaust systems and clamps to ensure no exhaust gasses are vented inside the boat.

The total maximum length of the marine exhaust is 2m. Always install the exhaust with a gooseneck on the inside of a hull fitting to prevent water washing back into the exhaust system.

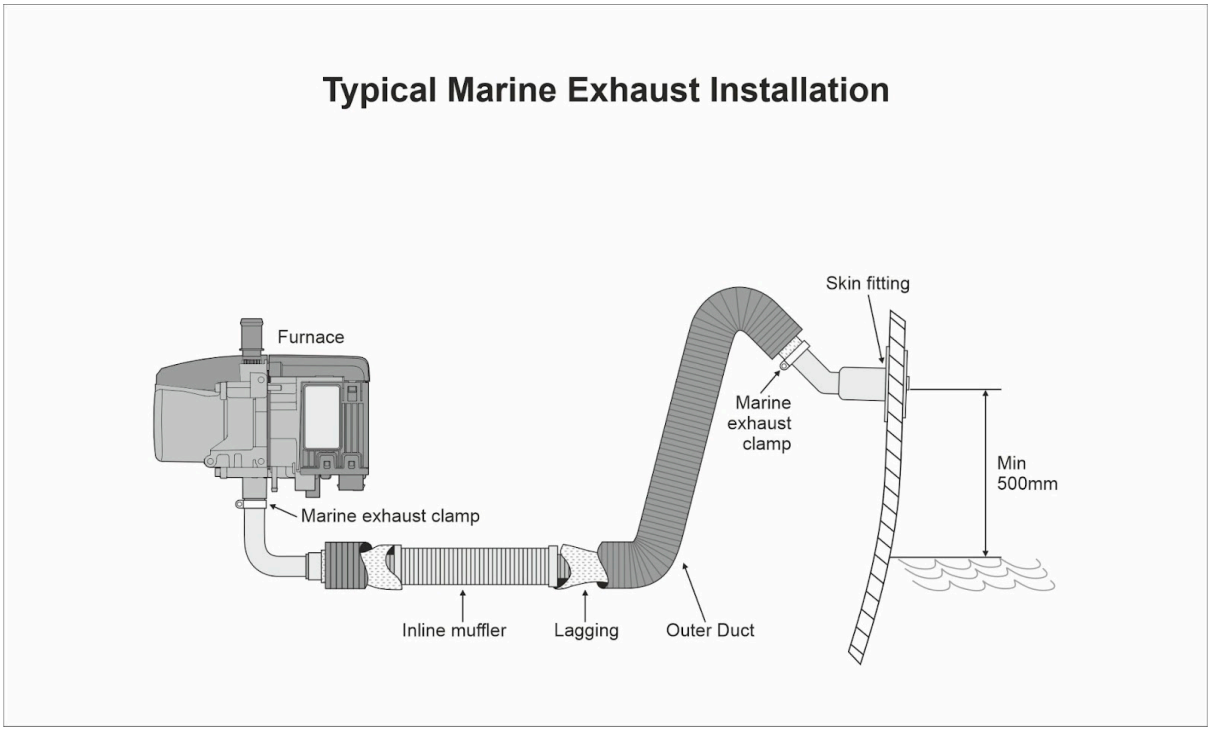
Note: The exhaust system reaches temperatures of up to 300°C. Always lag the exhaust and ensure that the exhaust is not in contact with any materials that could be damaged or set alight by this heat.

Installing the hull/deck fitting
The position of the exhaust hull fitting will depend on several factors, including where you have located the furnace, whether your vessel is a sailboat or a motorboat, and the suitable surfaces available.

On a sailboat, the preferred location is on the transom, cabin wall or rear of the hull as this is normally the area least likely to be affected by seawater when sailing. On a motorboat, the transom or side of the hull are suitable locations.

The hull fitting should be positioned to avoid water ingress:

- Locate as high as possible and ideally a minimum of 500mm above the waterline.
- Maximise the height of the goosneck on the inside, aiming for at least 200mm height.



To avoid potential safety issues, the exhaust system must be installed according to the following instructions:

- Under no circumstances connect the heater exhaust to an engine exhaust or any other exhaust system.
- The exhaust outlet must vent directly to the atmosphere.
- Adequate clearance must be maintained around the exhaust system to prevent interference with important functional parts of the boat, such as steering or throttle cables.
- Route the flexible exhaust giving clearance and consideration to heat sensitive components such as fuel lines and electrical cables.
- Ensure the support brackets are used to secure the exhaust in order to avoid damage from vibration.
- Position the hull fitting so that other inlets (hatches, windows) cannot draw in exhaust fumes.
- Ensure the hull/deck fitting is positioned to allow fumes to exit freely so as not to affect nearby surfaces, such as fenders, ropes or moldings.
- The exhaust must not be routed through the living area.

Furnace Combustion Air

Eberspacher furnaces ship with the furnace combustion air inlet pipe or combustion silencer.

For marine applications it is acceptable to install the combustion air inlet inside the engine room or locker where the furnace is installed.

Ensure the combustion inlet silencer is securely mounted and cannot come into contact with the exhaust system.

Electrical Wiring

All wires should be routed in split corrugated conduit and secured via cable ties or clamps to protect them from damage or chafing.

With the exception of the fuel pump cable, do not cut or shorten supplied looms. Spare cable should be bundled up neatly and tied out of the way.

Never cut or shorten controller or diagnostic looms.

Pay special attention to wires in the vicinity of the exhaust system and where they connect to the furnace to ensure they cannot be damaged by the hot exhaust.

The furnace is switched on and off via a simple switch, the Dieselheat thermostat or Eberspacher controller. The wiring loom for the on/off switch can be extended if necessary.

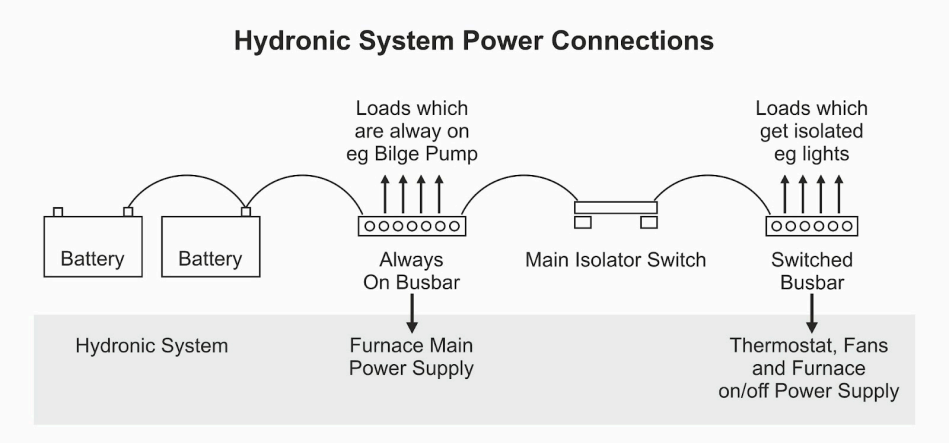
The furnace requires 12V and uses approximately 10A to start. The operating current is approximately 2 - 4A once the starting sequence has completed. The furnace should be connected directly to the house batteries. **Use 6mm2 cable if extending the power loom.**

If connecting via an isolation switch or switchboard, it is important that the switchboard has ample power supply from the batteries to prevent voltage drop making the unit hard to start. Small caravan-style fuse boxes are not recommended for this reason. Only commercial quality marine switchboards with DC bus bars should be used.

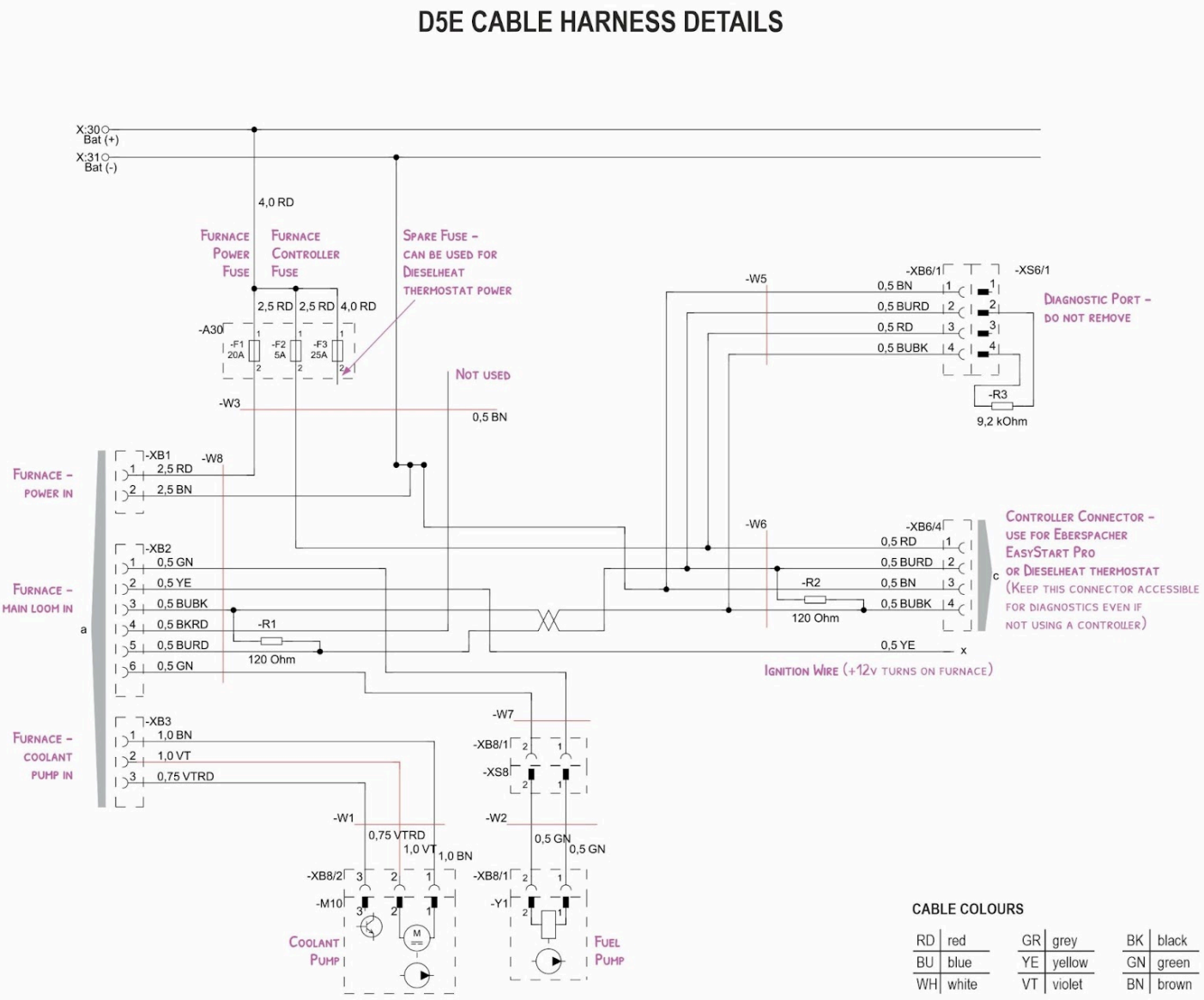
Note: Except in an emergency, never switch the diesel furnace off at the main power supply. The furnace must go through a cool down sequence prior to stopping, which is triggered by switching the furnace off at its on/off switch or via the optional Eberspacher controller. For this reason, switches on the main power supply are not recommended.

Power Supply

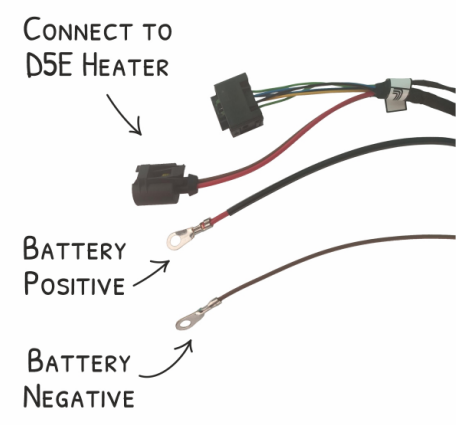
- Connect the main furnace power wires to an always on bus bar or directly to the batties.
- Connect the fan heads, thermostats and furnace controllers, booster pumps or activation circuits to a bus bar which can be isolated when the boat is not in use.



Eberspacher D5E Wiring



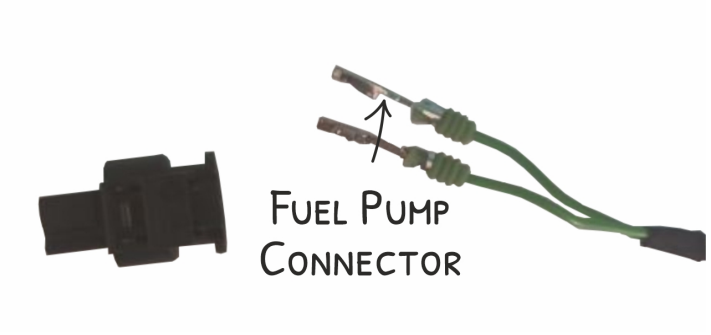
Main Loom Connections



Connect the wires shown below from the loom directly to the battery and heater. Red with black sheath is positive, brown is negative. If you need to extend the power wires, use 6mm2 cable. The fuse box should be in close proximity to the battery.

Fuel Pump

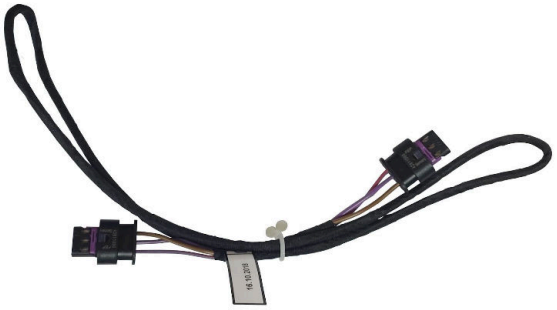
The fuel pump wires are not polarised. The cable bush has a small locking tab to lock the wires in place. Insert the fuel pump wires into the supplied cable plug. (Note that they can only be inserted one way. The side indicated by the arrow below faces the locking tab). Ensure the wires are all the way in (the green rubber should not protrude out the back of the plug). Ensure the plug clips in place until it clicks when installing on the fuel pump.



Coolant Pump

Connect each end of the coolant pump cable to the heater and coolant pump.

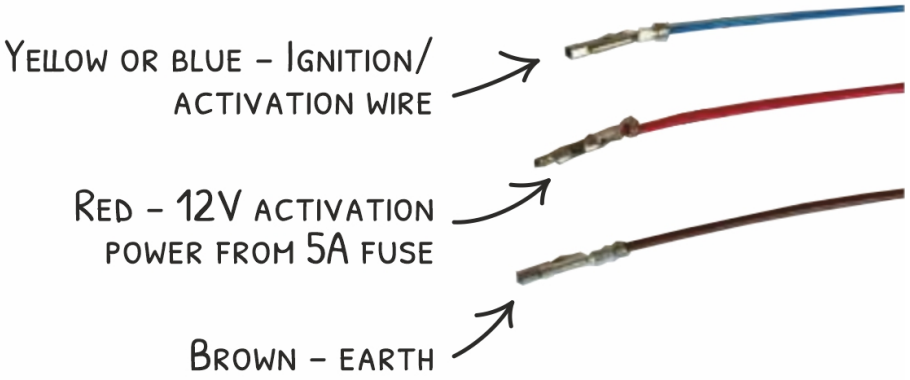
Do not attempt to run any other auxiliary coolant pumps off the furnace coolant pump power supply.



Manual Control Wires

The furnace works with an ignition/activation wire.. Applying 12V to this wire will signal the furnace to turn on. Removing the 12V signals the furnace to shut down. A switch between the red and yellow (or sometimes blue) wire will work to turn the furnace on/off.

Always tape off and insulate these wires if not using them to start the furnace.

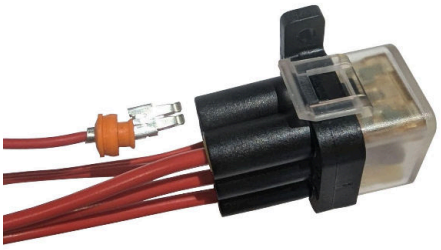


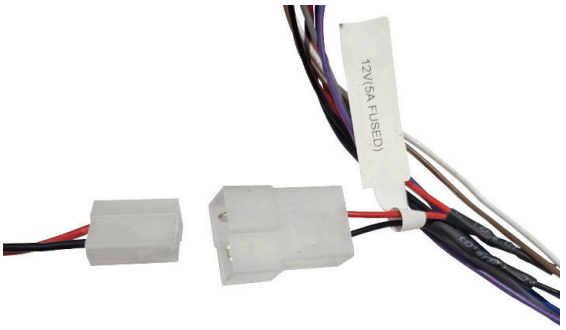
Using the Ebersapcher Fuse Box to Supply Power for the Dieselheat Thermostat.

This will only be relevant in smaller systems where the fan heater is located close to the furnace.

For Dieselheast thermostats, a power loom for the Thermostat is supplied. This loom utilises the spare fuse socket in the Eberspaocher loom to supply power to the thermostat and ducted fan.

Insert the fuse connector into the spare socket in the Eberspacher loom. A 5A fuse is already supplied. Connect the other end to the thermostat loom.

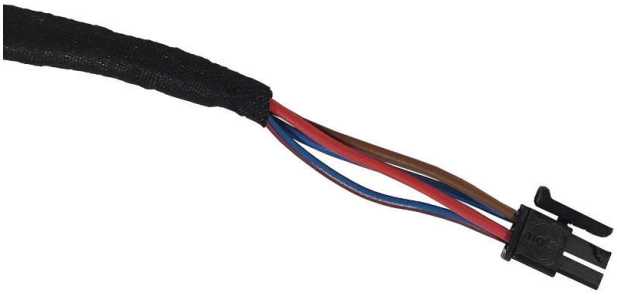




Surplus Wires to Remove

The loom also includes white/red and brown/black wires which are pre-taped off. These are not used.

EasyStart Pro Controller Connector - DO NOT HIDE THIS

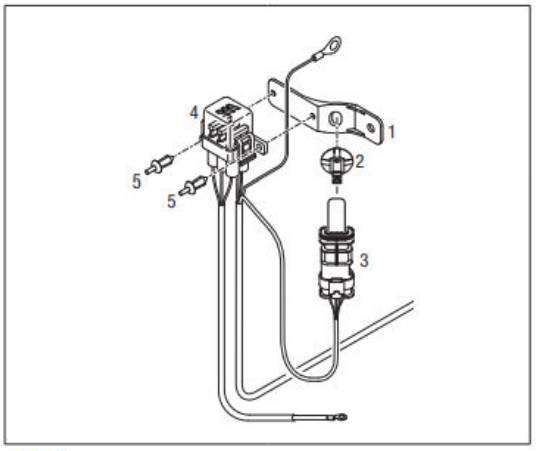


This is an optional controller.
This cable should not be cut or modified.

Either plug this into the EasyStart Pro controller or bundle this cable and strap it in the vicinity of the furnace in a position where it can be found and accessed if an EasyStart Pro controller is needed for diagnostic purposes in the future.

Diagnostic Port

Diagnostic port with end cap. This must be left as is and should be installed in an accessible position next to the fuse box on the supplied mounting tab for future diagnostic purposes (see diagram below).

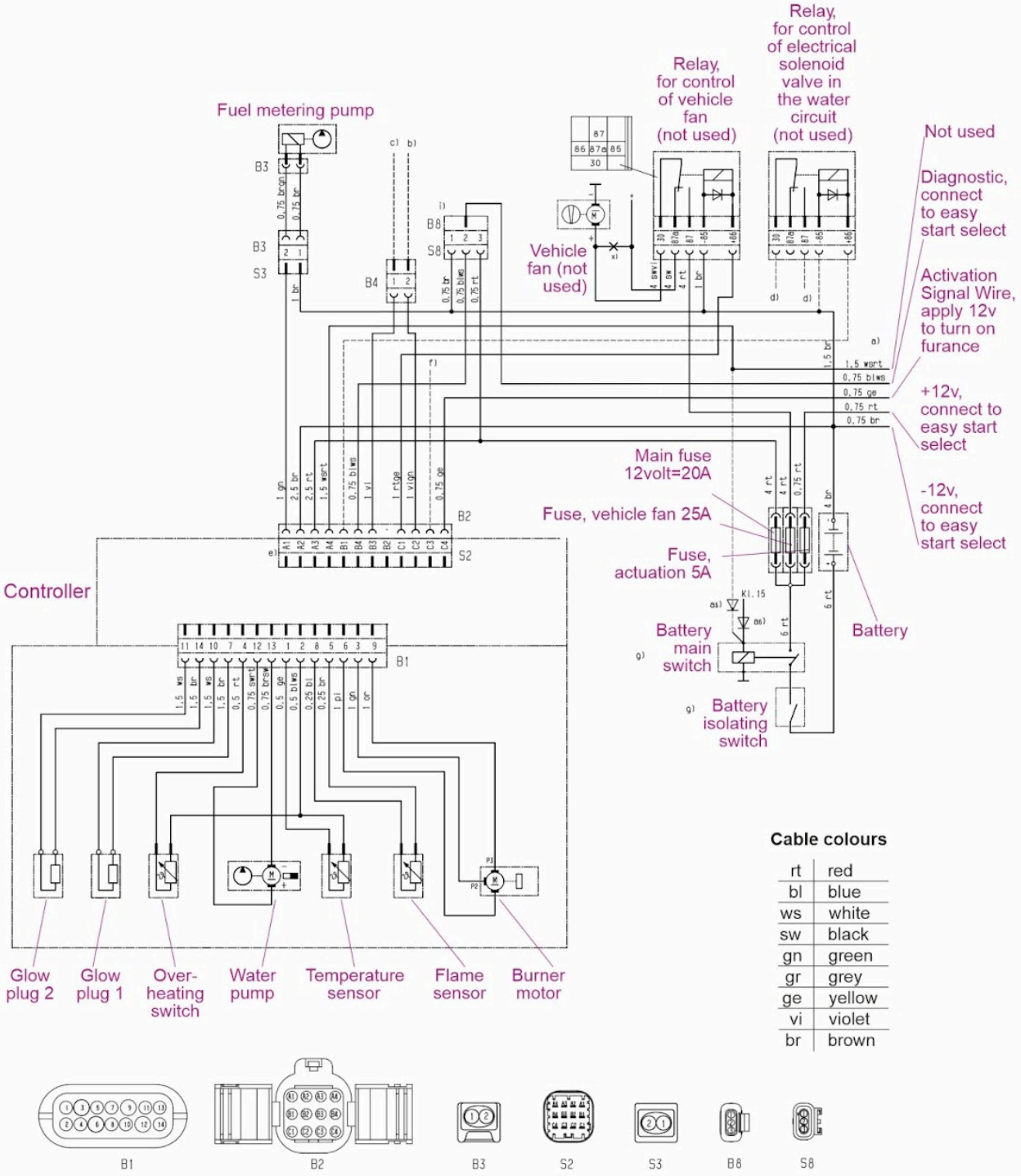


Picture 7

1	Combined bracket	4	Fuse bracket
2	Retainer clip	5	Split rivet
3	Diagnostics connector		

Eberspacher M12 Wiring

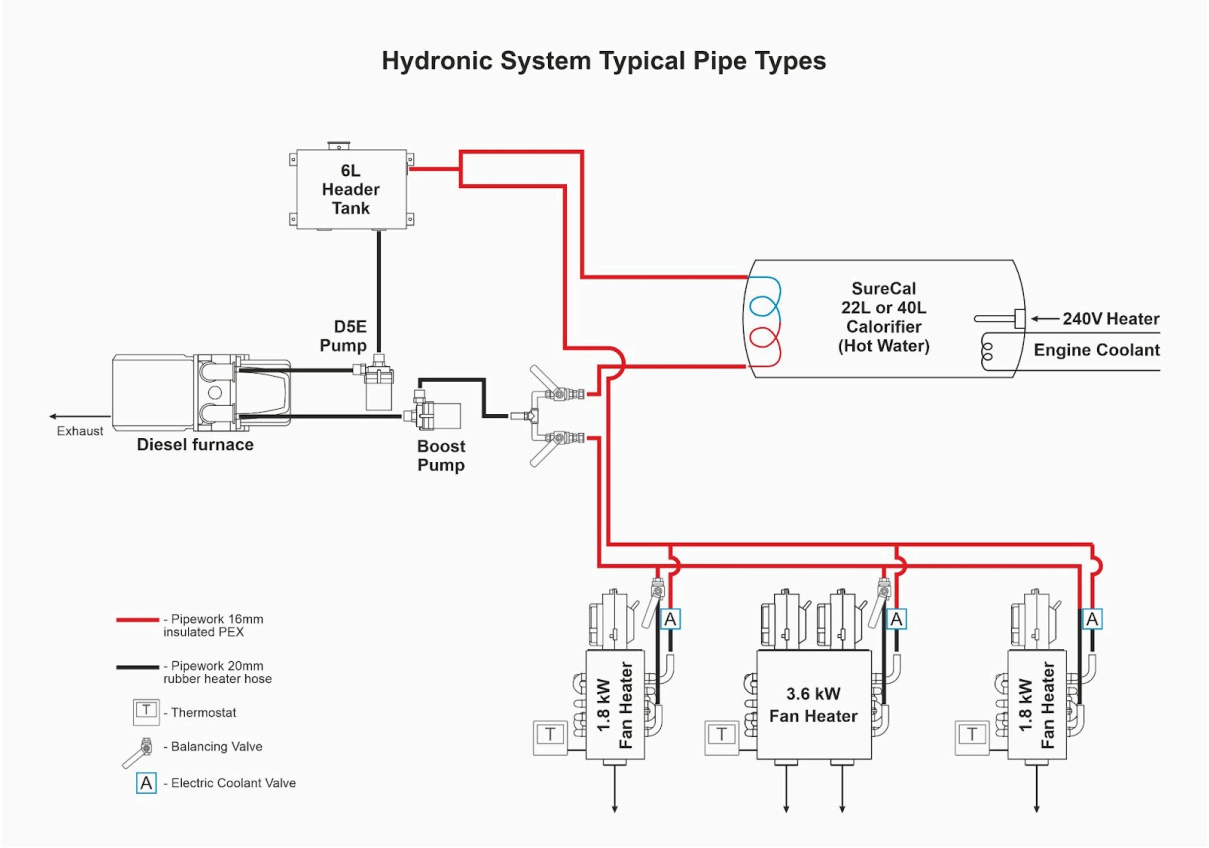
Circuit diagram Hydronic M-II, 12 Volt / 24 Volt, normal and ADR version



Cable colours

rt	red
bl	blue
ws	white
sw	black
gn	green
gr	grey
ge	yellow
vi	violet
br	brown

System Pipework and Fittings



Rubber Pipework for Header Tank, Furnace, Pumps and Manifolds.

Eberspacher D5E and M12 kits include 20mm rubber heater hose, used to connect the header tank, coolant pump(s), furnace, and distribution manifolds. Since these components are typically placed close together, they can be easily connected using flexible rubber hose.

- Ensure that bend radiuses are large enough to prevent kinks in the rubber hose.
- Use the hose clamps provided in the Eberspacher kit to secure all connections.
- If additional hose or pre-formed bends are needed, contact Dieselheat.

PEX Pipework for Fan Heads and Hot Water Tanks

Dieselheat hydronic kits use 16mm pre-insulated PEX pipe for all connections between the distribution manifolds, fan heads, and hot water tanks. This PEX system features spanner-tightened olive-style fittings, which do not require any special tools.

- Use sharp snips or pipe cutters to ensure clean cuts.
- If the pipe end becomes deformed during cutting, reshape it to a round form before installing the olive PEX fittings.
- PEX pipe holds its shape after bending. Bend radiuses should be at least 100mm to avoid kinks.

- Minimize the use of elbows and tee pieces to improve coolant flow. Whenever possible, bend the pipe around corners instead.
- Tighten PEX olive connections firmly with a spanner, but avoid overtightening.
- Do not use any pipe that is kinked or damaged.

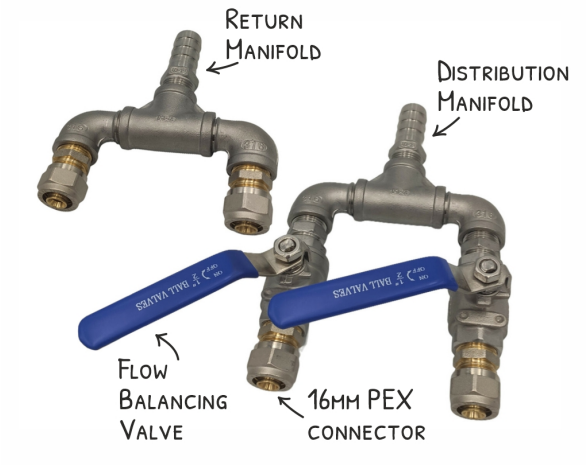
Sealing Threaded Joints

- Joints which are not expected to be undone should be sealed with Loctite 577 or Loxeal 58-11
- Joints which may need to be undone should be sealed with thread tape
- Do not use any sealant or thread tape on the PEX olive joints

Distribution Manifolds (2 way)

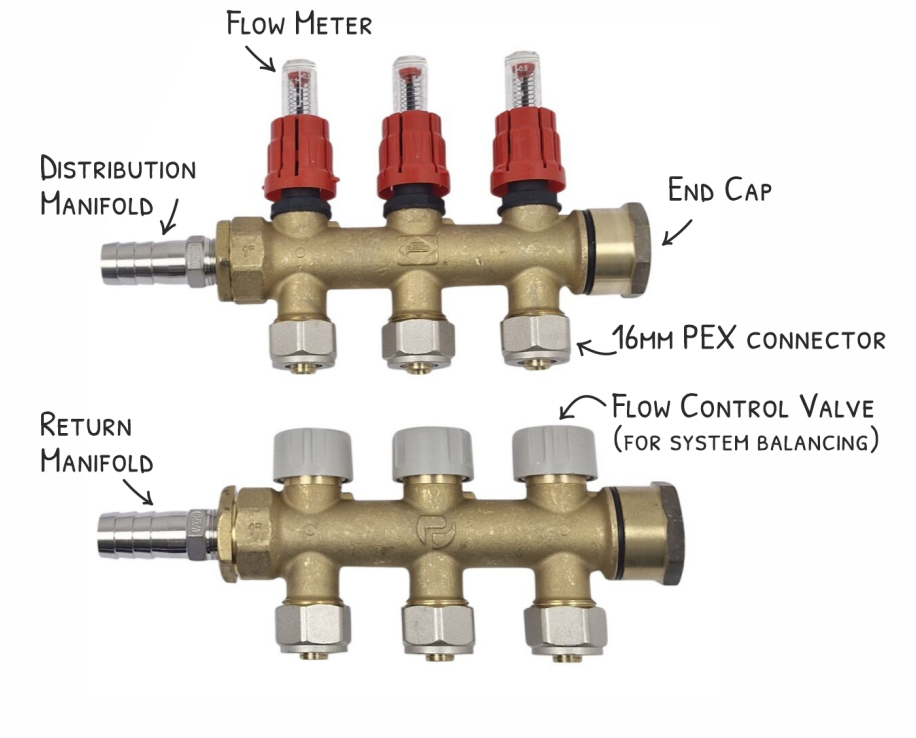
For smaller systems we make distribution and return manifolds using pipe fittings.

- Seal threaded joints using recommended thread sealant (not thread tape).
- Mount using pipe saddles (not supplied by Dieselheat).
- 2 way manifolds are assembled as per the pictures below.



Distribution Manifolds (3 and 4 circuit)

For 3 and 4 circuit systems we use commercial hydronic manifolds which have flow meters and flow control valves.



Coolant Pumps

Furnace Coolant Pumps

All systems will have at least 1 coolant pump which is linked to and controlled by the furnace. The furnace will not start if the coolant pump is not connected. When installing the coolant pump (for the D5E, note the M12 pump is fixed to the furnace) follow these directions:

- The furnace coolant pump is always positioned on the inlet side of the furnace.
- Mount the pump below or beside the header tank at the bottom level of the tank.
- Ensure the coolant pump is securely mounted, do not hang from the pipes with no other securing.
- Minimise the length of the inlet pipe to the pump (header tank outlet to pump inlet).
- If possible mount the pump with the outlet facing up to prevent a trapped air pocket making it hard to prime.
- Do not alter the loom connecting the coolant pump to the furnace
- Do not use the coolant pump power feed to run any other pumps or devices

Booster Pumps

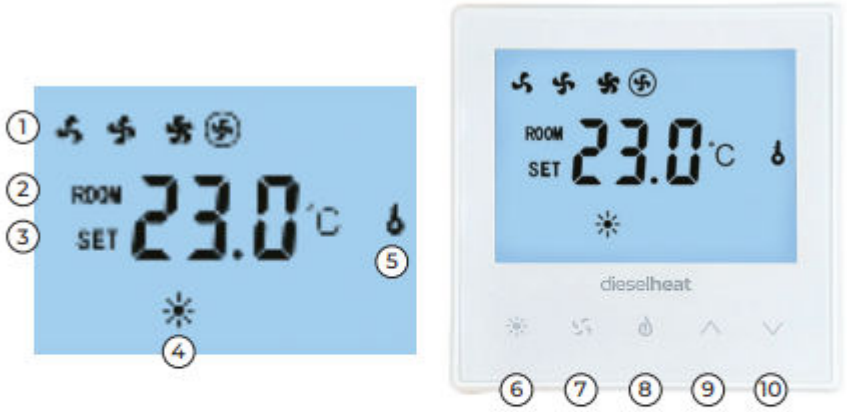
Larger systems with a coolant pipe length exceeding 20m will use a booster pump. When installing a booster pump:

- Generally it goes on the outlet side of the furnace and before the distribution manifold.
- Should be securely mounted.
- Should be switched with the furnace, using a relay triggered by the furnace on signal.
- Always make sure the furnace cannot be started without the booster pump starting as an inoperative booster pump will inhibit coolant flow in the system.

Dieselheat Hydronic Thermostat

The Dieselheat hydronic thermostat is designed specifically for hydronic system control. The thermostat:

- Provides 3 manual and also automatic fan speed control for Dieselheat ducted fans and also Kalori fans
- Provides an ignition signal for Eberspacher D5E and M12 furnaces
- Provides a signal to open a coolant valve when a fan head fan is on.
- Provides digital CAN control of the Eberapcher D5E furnace including fault code reading. [FUTURE FUNCTION]



Display

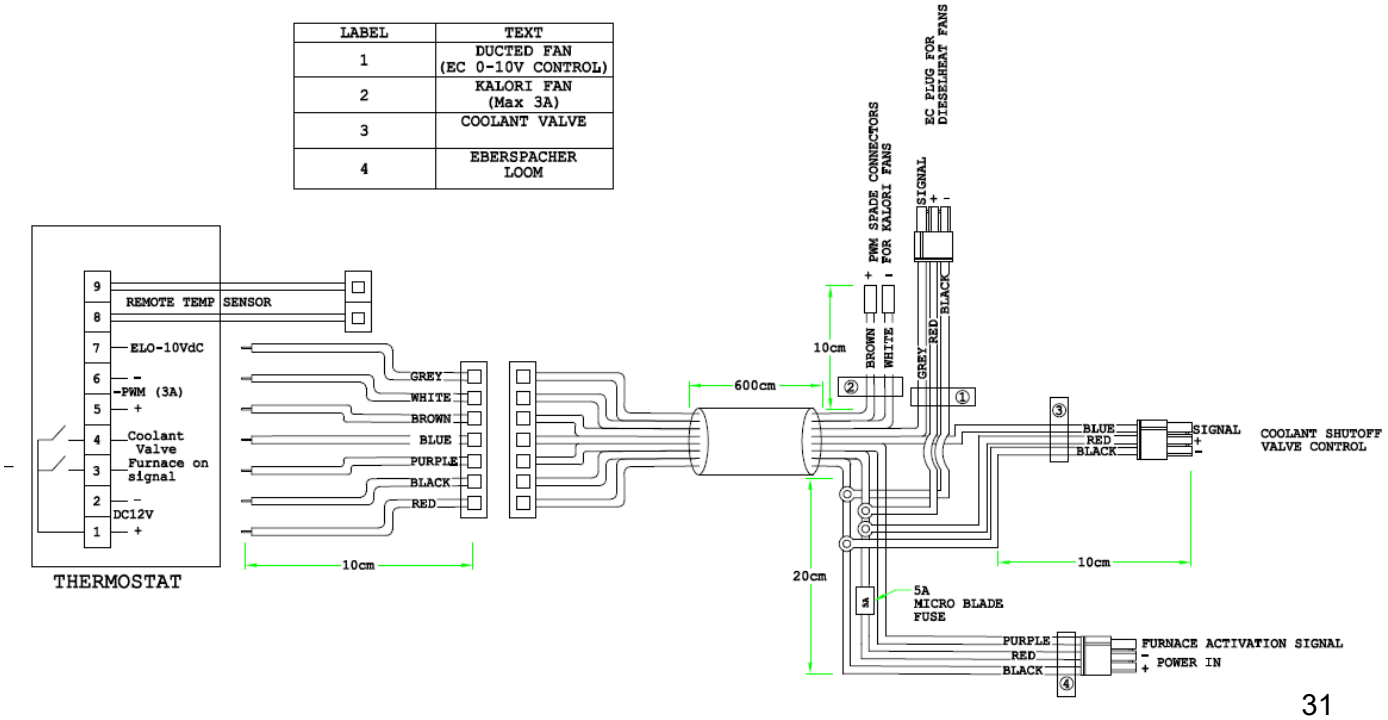
1. Fan speed: Low, Med, High and Off
2. Room temp display
3. Set temp display
4. Hot water furnace is ON (if connected)
5. Keypad is locked

Buttons

6. Hot Water Furnace: On/Off
7. Fan speeds: Low, Med, High and Auto (only available when the furnace and fan mode is selected)
8. Power on/off
9. Temp up
10. Temp down

Thermostat Wiring Diagram

LABEL	TEXT
1	DUCTED FAN (EC 0-10V CONTROL)
2	KALORI FAN (Max 3A)
3	COOLANT VALVE
4	EBERSPACHER LOOM



Hydronic Air Heating Heads

Dieselheat works with our own and Kalori hydronic air heating heads.

Dieselheat Ducted Fan

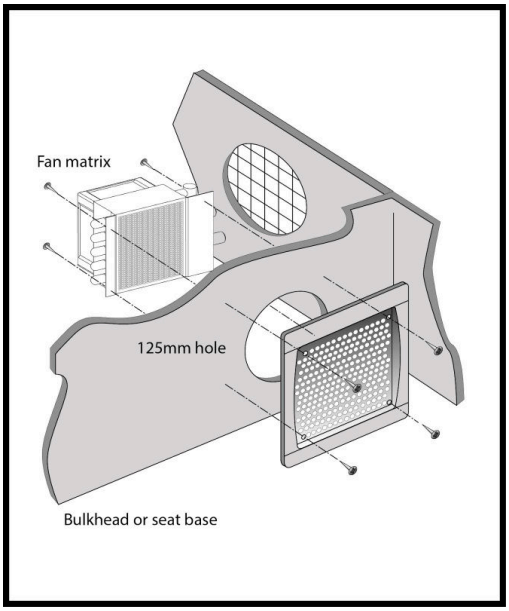
Kalori Fan Heads

Fan Head Installation

- Fan heads should be mounted as close to the area that requires heating as possible.
- Fan heads can be mounted in any orientation.
- Coolant flow direction is only important in Dieselheat fan heads
- Drill two suitably sized holes through the flooring or walls to let the coolant pipe through.
- Take appropriate precautions to stop external pipe damage when hoses pass through walls or bulkheads.

Piping to Fan Heads

Unless they are very close to the furnace, piping to fan heads is done with insulated PEX piping.
Fan heads use 16mm hose tails, so it is necessary to adapt the 16mm PEX to 16mm rubber heater hose.
Always run the PEX into the compartment with the fan head and then use a short section of the more flexible rubber pipe to make the final connection to the fan head.



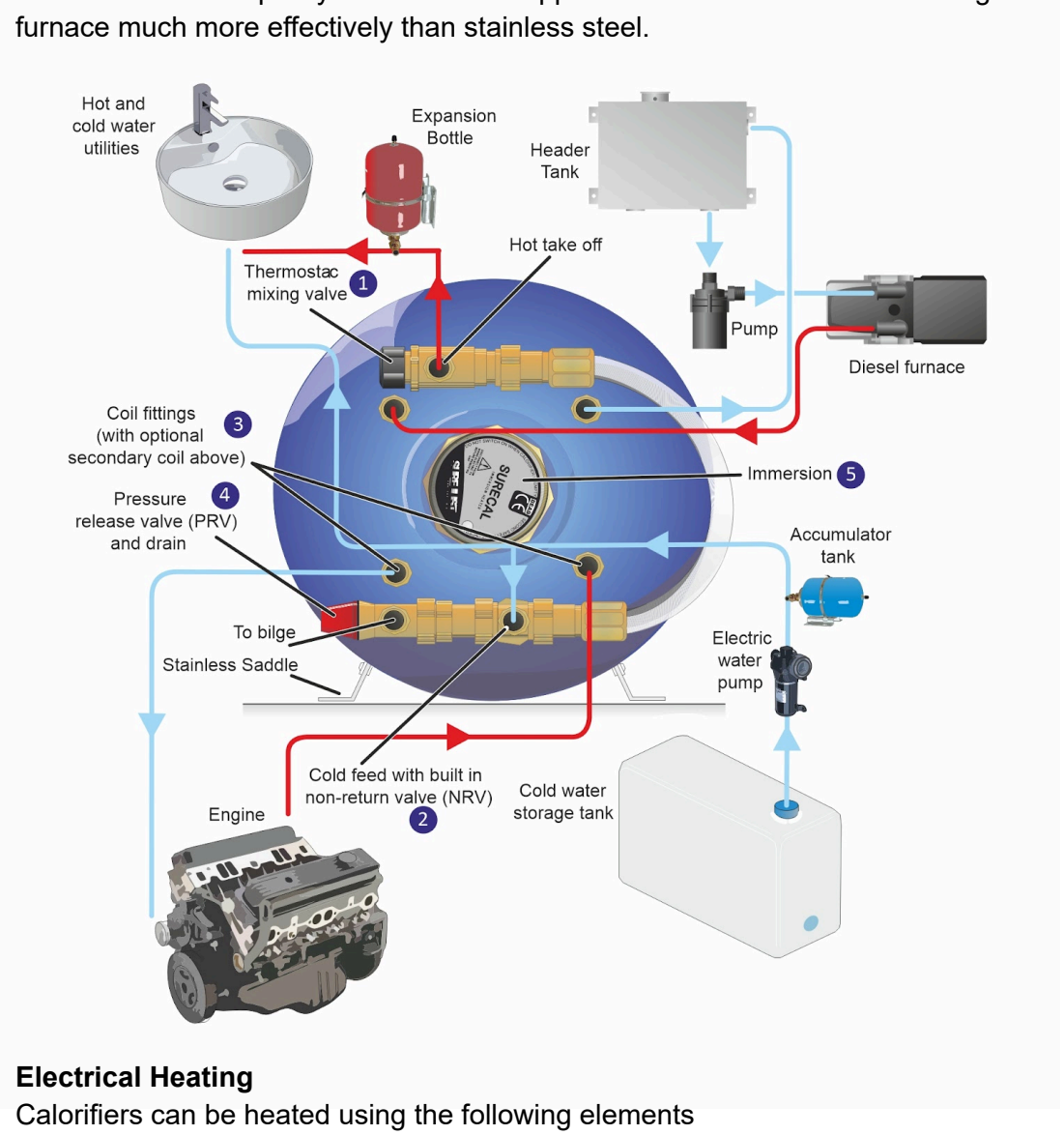
Always make sure there is adequate return air ventilation to ensure the fan head works effectively.

Fan head should have the equivalent of a 90mm open round inlet hole per fan to allow for adequate return air.

Be aware of punched metal louvres - they often constrict airflow and are not suitable as return air inlets.

Surecal Calorifiers

Dieselheat uses Surecal calorifiers which are made from copper in the UK. We use these calorifiers for their quality and because copper transfers the heat from the engine and diesel furnace much more effectively than stainless steel.



Electrical Heating

Calorifiers can be heated using the following elements

- 240V 1kW
- 12V 300W with 240V 700W(combined)
- 24V 600W

Systems with 12V house batteries are recommended to heat using 240V (shore power) or 12V battery power. Systems with 24V or 48V house batteries are recommended to heat using 1kW 240V elements via an inverter. All heating from battery/solar/wind systems should use a solar diverter, do not use batteries as a main source of power to heat water.

Expansion Tanks

It is recommended to use an expansion tank on the hot water pipe.

- 15L and 22L tanks use a 2L expansion tank
- 40L tanks use a 5L expansion tank

The expansion tank allows the water in the hot water tank to expand as it heats without dripping out the PRV. Systems without an expansion tank will drip from the PRV and PRV life is shortened.

Solar Diverters

A solar diverter will turn on an electrical element using a relay when batteries are fully charged and turn it off once the batteries drop slightly - like to say 98%. The theory is that excess solar or wind power being created can be diverted into the hot water cylinder once the batteries are changed, but if the battery state starts to discharge the element turns off.

Surecal Immersion Installation and Replacement - All Immersions

Thermostat Information

The immersion heater is supplied with a RTS/RTS PLUS thermostat, approximately factory set to 80°C, with adjustable temperature.
To maintain safety and operation, any replacement thermostat must be of the same type.

Electrical Information

1.This unit should be connected by a suitably qualified electrician in accordance with the latest I.E.E. regulations.
2. Ensure the electrical supply is switched off before making any connection to the unit.
3. The immersion heater must be wired through a double pole isolating switch with contact separation of at least 3mm in both poles.
4. The immersion heater must be wired with a heat resistant flexible cord with a minimum T rating of "T-80" and with a minimum cross-section area of 1.5mm2.
5. Ensure that the terminal screws are not over tightened as this could result in the terminations being broken off.

⚠ **This device must be earthed**

Wiring

1. Earth connection (green & yellow) should be made firmly to the earth post (marked "E") using the terminals attachments provided.
2. The Live Supply (brown) from the mains supply cable to the thermostat terminal marked "L".
3.The neutral connection(blue)from the mains supply to the thermostat terminal marked "N".

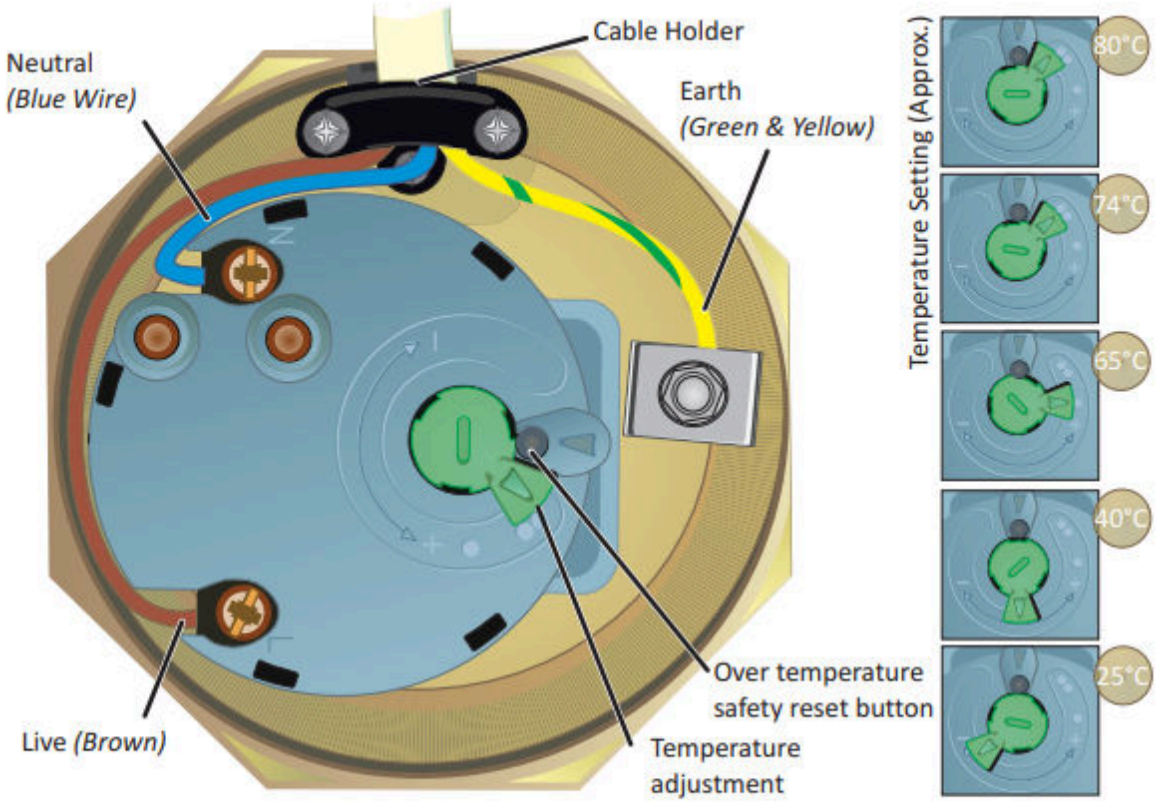
Immersion Replacement Information

1. Check your mains power voltage matches the voltage rating indicated on the label of the plastic terminal cover.
2. The immersion heater screws into a **(2¼" BSP)** thread boss.
3. The immersion heater must be fixed to the cylinder using the O ring provided. Please ensure that the unit is not over tightened into the tank boss.
If the heater is switched on when the water level is not fully covering the heating element there may be serious damage incurred to the heater, property or persons.
The appliance is not to be used by children or persons with reduced capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

⚠ **The immersion must not be switched on without water within the calorifier Due to the possibility of buring out the elements and fire.**

⚠ **Do not remove this cover whilst connected to 220-240 volt hook up or generator that is switched on.**

240V Immersion Wiring Diagram and Instructions



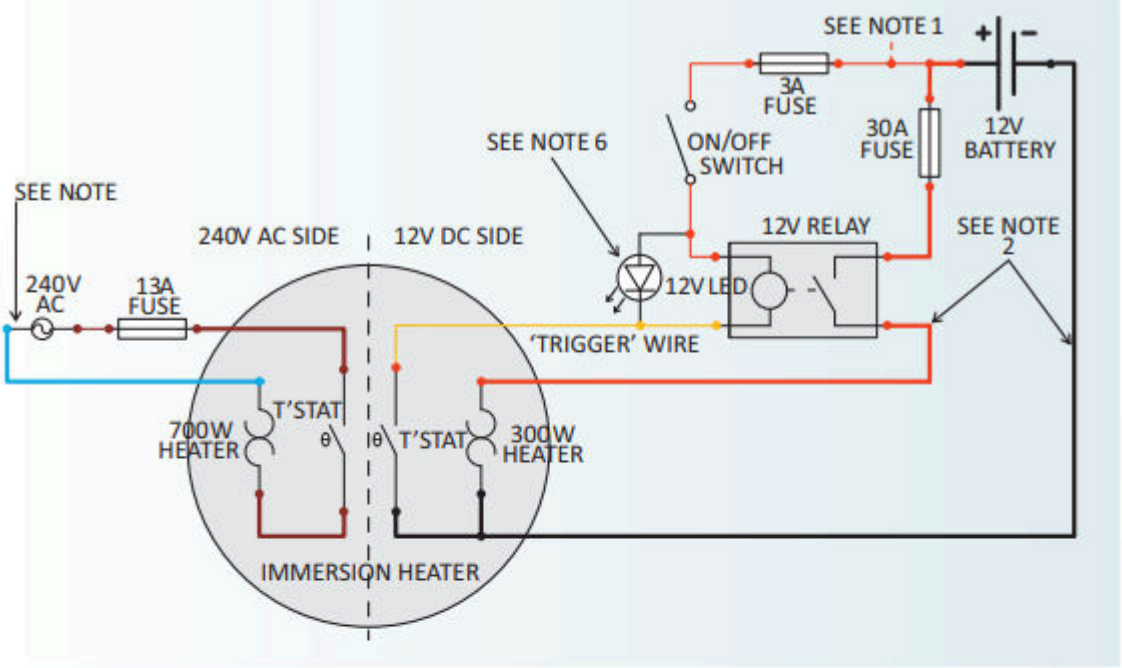
The thermostat has a safety resettable cut out mechanism which prevents excessive temperatures. The unit is able to disconnect both supply conductors (live and neutral) by a single initiating action. In case the normal sensing device fails the over temperature safety device will act to limit the water over temperature.
To reset the thermostat after an intervention of the safety device:

1. Switch off the heater by isolating the power supply
2. Allow the water in the cylinder to cool down sufficiently
3. Remove the cover and press the button on the top of the thermostat.

NB: This cut out is a safety device, if this is found to be operating frequently then we recommend to consult a qualified electrician to investigate the nature of the problem as the thermostat may need to be replaced. It may be helpful to lower the thermostat setting to avoid unnecessary cut offs.

12V/240V Immersion Wiring Diagram and Instructions

As per the wiring diagram below, it is important to install a relay to switch any low voltage element because the thermostat cannot handle the current (Amps) required to drive these thermostats. Connecting a low voltage element directly to the thermostat will destroy it.



NOTES:

1. THIS 12V FEED CAN EITHER BE TAKEN DIRECTLY TO THE BATTERY '+' (AS SHOWN HERE) OR CAN BE TAKEN TO THE VEHICLES ALTERNATOR 'TRIGGER WIRE'. IF POWERED FROM THE ALTERNATOR TRIGGER WIRE, THE HEATER WILL ONLY OPPERATE WHEN THE ENGINE IS RUNNING. IF TAKEN DIRECTLY TO THE BATTERY THEN THE HEATER CAN BE OPPERATED WITH THE ENGINE OFF.

2. ENSURE THE CORRECT GAUGE WIRE IS USED AND DE-RATED ACCORDINGLY. A 300W HEATER AT 12V WILL DRAW ~25A; THEREFORE A 30A FUSE IS REQUIRED. THE WIRING NEEDS TO BE RATED HIGHER THAN THE FUSE RATING ONCE DE-RATED. 11 AWG (4 mm^2) WIRE IS RECOMMENDED.

3. THIS END WOULD BE IN THE FORM OF A NORMAL 3-PIN MAINS PLUG FITTED WITH A 13A FUSE.

4. THE 240V AC THERMOSTAT IS WIRED DIFFERENTLY TO THE 1 2V THERMOSTAT. THIS IS BECAUSE BOTH THERMOSTATS ARE RATED FOR 20A MAX. - AT 240V THE CURRENT REQUIRED FOR THE 700W HEATER IS ~3A; THEREFORE THE THERMOSTAT CAN SAFELY BE WIRED IN SERIES WITH THE HEATER AS SHOWN.- AT 12V THE CURRENT REQUIRED FOR THE 300W HEATER IS ~25A; THERFORE THE THERMOSTAT CANNOT BE WIRED IN SERIES AND A RELAY IS NEEDED AS SHOWN.

5. THE THERMOSTA**MUST BE USED FOR SAFETY** .

6. MAKE SURE A 12V LED/INDICATOR IS USED. THESE HAVE RESISTORS BUILT IN AND DO NOT REQUIRE AN EXTERNAL RESISTOR.

7. WHEN SELECTING THE CORRECT RELAY, A 12V COIL IS NEEDED AND THE CONTACTS MUST HAVE A HIGHER RATING THAN THE FUSE THAT IS PROTECTING IT (GREATER THAN 30A).

Commissioning

After the installation is completed we suggest thoroughly checking the following as part of a final inspection:

- Check all screw together joints are tight
- All PEX connectors are tight
- All hose clamps are present and tight
- All balance valves on distribution manifolds are open.
- Exhaust clamps are tight and the exhaust is installed as per our instructions.
- All fuel line clamps are tight and that there is no air in the fuel source (ie in the top of Racor filters etc.)
- The fuel pump is installed in the correct orientation.

Prior to starting the system

- Insert the fuses into the Ebersapcher furnace
- Fill the system with water keeping track of the volume put into the system

Once this is done, turn on the system and allow the coolant pump(s) to push all the air out of the coolant lines. Keep topping up the header tank until the level stops dropping.

Initial Startup

Once the coolant pump is primed, leave the switch on and the furnace will attempt to start. The furnace will not start until the fuel pump and fuel line have primed with fuel.

A furnace start process involves 2 separate start attempts and takes approximately 6 minutes. During each start attempt, the coolant pump runs, the combustion fan revs up and down and the fuel pump attempts to pump fuel.

At the end of a start process (after 2 attempts), the furnace will shut down and wait. A new start process can be triggered by turning the furnace off and turning the furnace on again. This process can take quite a few start attempts, particularly if the fuel line is long.

During this process observe the coolant level and top up if necessary.

Note: The Ebersapcher furnace will lock out after approximately 10 failed start processes. Always double check the fuel line, pump orientation and fuel source before commencing startup. An EasyStart Pro controller is required to unlock a locked out furnace.

As the system is starting, conduct a detailed inspection of all pipes, joints and components to check for leaks. Fix any leaks before proceeding to run the system.

Post Initial Startup

As the furnace begins to heat the coolant, all the hoses and header tank will start to get warm.

Balancing The System

Coolant will follow the closest or easiest flow path. Partially shut the valves on the shorter/closer loops to force coolant to circulate into the further/longer loops.

When balancing the system - priority can be given to heating hot water or to air heating by prioritising coolant flow to different areas of the system. This is a personal preference and may be refined as the system becomes more familiar.

Adjust balance valves in the system to make sure all coolant loops are getting warm and are reaching a similar temperature. This can be done by feeling the coolant temperature by hand on the pipes at the extremities of the coolant loops, or by using a simple infrared temperature probe.

For systems with flow meters on the manifolds - adjust using the flow meters.

Adding Coolant

Once the system is running with water and has been thoroughly leak checked then replace the water with coolant.

The system needs a good quality automotive/marine coolant. This is to control corrosion and prevent feezing if relevant. No particular kind is specified - however it is often sensible to use the same coolant as used in the boat engine in a form designed to be mixed 50/50 with water.

Drain out 50% of the water added to the system and replace with a coolant concentrate designed to be mixed 50/50 with water. This is easier than trying to drain the whole system to install pre-mixed coolant.

Run the system again and let it get fully hot (until the furnace throttles down). Check the coolant level is close to the top of the header tank, but do not fully fill - around 2-3cm from the top is a good guide.

Final Checks

- Re-check the system for leaks a few days after finishing the install.
- Note the expected lifespan of the coolant so it can be renewed when needed.

Commissioning Troubleshooting

Problem	Things to Check
On initial switch on, furnace does nothing.	• Check fuel pump connection wires are properly inserted into connector and connector is properly plugged into the pump. • Check coolant pump wires are properly connected. • Check power supply and fuses. • Check furnace is wired directly to batteries. • Check power wiring polarity - red (inside black sleeve) is positive, brown is negative.
Furnace tries to start but doesn't start.	• Check fuel pump is orientated correctly. • Check fuel flow in fuel line by shining a torch on the fuel line and looking for bubbles or advancing fuel front. • If installed, check the fuel filter has filled with fuel. • The fuel pump will tick more loudly until filled with fuel. Check fuel pump noise when pump is pumping. • Check all fuel line connectors are tight and air cannot enter the fuel line. • Check battery voltage is above 12.5V. • Check furnace is wired directly to batteries as per install instructions.
Eberspacher D5E Only: furnace has tried to start multiple times and is now 'dead'.	• The furnace has locked out due to excessive start attempts and will need to be unlocked using an EasyStart Pro controller.
Furnace starts and runs for approx. 1 minute, then shuts down very quickly.	• Check coolant circulation.
System works but the air heating fan head is not hot.	• Check all shutoff valves. • Review plumbing and use of bypass valves as per the suggested system schematics. • On larger systems (boats), review the use of booster pumps.
System runs but there is no hot water.	• Check the system plumbing and ensure that hot coolant is passing through the hot water tank (calorifier). • Check the hot water tempering valve is set properly. • Check hot and cold water pipework for misconnections.
System heats up but fan heads do not get hot.	• Check fan head shutoff valves are open. • If using a valved bypass valve, ensure the bypass valve is partially closed. • Check any automatic valves are opening when needed.
Fan heads get hot but do not blow hot air.	• Check fans are wired with correct polarity. • Check fan head has adequate return air as per instructions.

Operation Tips

- Do not run the furnace all the time, this is unnecessary and will result in the furnace spending a lot of time idling which will shorten service intervals. Turn the system on when needed.
- Most furnaces have a limited run time, 12 to 24h so it will be necessary to turn the furnace back on in some instances when using it for extended periods for air heating.
- If a situation ever arises where the exhaust may have taken in water (such as extreme weather) the furnace should be removed and inspected immediately to minimsie damage.