

Marine heater installation guide

Hydronic D4, Hydronic D5



Eberspächer

Eberspächer (UK) Ltd.
Headlands Business Park,
Salisbury Road, Ringwood,
Hants BH24 3PB.

Tel: 01425 480151
Fax: 01425 480152

www.eberspacher.com



1 Introduction

Concept of this manual

This manual aims to provide all the necessary information to assist with the installation of Eberspächer Hydronic D4/D5 coolant heaters into marine craft when used in conjunction with the heater’s technical description manual.

This manual has been divided into chapters for quick and easy reference as listed below.

Please Note!

Additional safety and statutory information is to be found within the technical description and operating instruction manuals that accompany this manual. If you require information specific to your installation, which is not included in our manuals, please contact your nearest dealer.

- 1

Introduction
Provides initial information and advice on using the content of this manual.
- 2

Positioning the heater
Discusses suitable mounting locations and possibilities.
- 3

Water pipework
Information on routing pipework and connecting to a calorifier, etc.
- 4

Exhaust and Combustion air system
Advice on routing the exhaust and combustion air, as well as installing the exhaust hull fitting.

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Fuel system
Connections and limitations of the fuel system.
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Electrical system
Information on connecting the heater electrics and positioning of the operating device.
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Information on using your heating system for the first time.
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Information on the Warranty documentation.
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Notes



1 Introduction

Special text structure, presentation and picture symbols

This manual uses special text structures and picture symbols to emphasise different contents. Please refer to the examples below for the corresponding meanings and associated actions.

Special structure and presentations

A dot (•) indicates a list which is started by a heading. If an indented dash (–) follows a dot, this list is subordinate to the dot.

Picture symbols



Regulation!

This picture symbol with the remark “Regulation” refers to a statutory regulation. Failure to comply with this regulation results in expiry of the type of permit for the heater and preclusion of any Guarantee and liability claims on J. Eberspächer GmbH & Co, KG.



Danger!

This picture symbol with the remark “Danger!” refers to the risk of a fatal danger to life and limb. Failure to comply with these instructions can result in severe injuries under certain circumstances.



Caution!

This picture symbol with the remark “Caution!” refers to a dangerous situation for a person and/or the product. Failure to comply with these instructions can result in injury to people and/or damage to machinery.

Please Note!

These remarks contain application recommendations and useful tips for installation of the heater. **Important information before starting work**

Range of application of the heater

The water heater operating independently of an engine is intended for installation in the following vehicles, depending on its heating output:

- Vehicles of all kinds
- Construction machinery
- Agricultural machinery
- Boats, ships and yachts

Please Note!

Installation of the heater is not permitted in vehicles used for the transport of dangerous goods as per ADR / ADR99.

Purpose of the heater (using the vehicle heat exchanger)

- Pre-heating, de-misting windows
- Heating and keeping the following warm:
 - Driver and working cabs
 - Freight compartments
 - Ship's cabins
 - Passenger and crew compartments
 - Vehicle engines and units

On account of its functional purpose, the heater is not permitted for the following applications:

- Long-term continuous operation, e.g. for preheating and heating of:
 - Residential rooms
 - Garages
 - Work huts, weekend homes and hunting huts
 - Houseboats, etc.



Caution!

Safety instructions for application and proper purpose!

- The heater must only be used and operated for the range of application stated by the manufacturer in compliance with the “Operating instructions” included with every heater.

Statutory regulations

The Federal Vehicle Office has awarded an “EU Type Permit” with an official test symbol for installation of the heater in motorised vehicles, shown on the heater nameplate.

HYDRONIC

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Regulation!

Directive 2001 / 56 / EU of the European Parliament and the Council!

Arrangement of the heater

- Parts of the structure and other components near the heater must be protected from excess heat exposure and possible contamination from fuel or oil.
- The heater must not pose a fire hazard even when it overheats.

This requirement is deemed to be fulfilled when adequate clearance to all parts is observed during installation, sufficient ventilation is provided and fire-proof materials or heat plates are used.

- The heater must not be mounted in the passenger compartment of vehicles in class M₁, M₂, M₃ and N. A unit may however be used in a hermetically sealed housing which also corresponds to the conditions stated above.
- The factory nameplate or duplicate must be affixed so that it can still be easily read when the heater is installed in the vehicle.

1 Introduction

- All appropriate precautions must be taken when arranging the heater to minimise the risk of injuries to persons or damage to other property.
- **Fuel supply**
 - The fuel intake connection must not be located in the passenger compartment and must be sealed with a properly closing lid to prevent any fuel leaks.
 - In heaters for liquid fuel where the heater fuel is separate from the vehicle fuel, the type of fuel and intake connection must be clearly identified.
 - A warning sign is to be fixed to the intake connection indicating that the heater must be switched off before refuelling.
- **Exhaust system**
 - The exhaust outlet must be arranged so as to prevent any penetration of exhaust fumes into the vehicle interior through the ventilation system, warm air intakes or open windows.
- **Combustion air intake**
 - The air for the heater combustion chamber must not be sucked in from the passenger compartment of the vehicle.
 - The air intake must be arranged or protected in such a way that it cannot be blocked by other objects.
- **Operating status display**
 - A clearly visible operating display in the user's field of vision must indicate when the heater is switched on and off.

Statutory regulations

Please Note!

- Compliance with the statutory regulations and safety instructions is prerequisite for guarantee and liability claims.

Failure to comply with the statutory regulations and safety instructions and incorrect repairs even when using original spare parts make the guarantee null and void and preclude any liability for
J. Eberspächer GmbH & Co. KG.
- Subsequent installation of this heater must comply with these installation instructions.
- The statutory regulations are binding and must also be observed in countries which do not have any special regulations.
- When the heater is to be installed in vehicles not subject to the German Ordinance for the Registration of Motor Vehicles (StVZO), for example ships, the specially valid regulations and installation instructions for these special applications must be observed.

- Installation of the heater in special vehicles must comply with the regulations applying to such vehicles.
- Other installation requirements are contained in the corresponding sections of this manual.

Safety instructions for installation and operation



Danger!

Risk of injury, fire and poisoning!

- Disconnect the marine craft battery before commencing any kind of work.
- Before working on the heater, switch the heater off and let all hot parts cool down.
- The heater must not be operated in closed rooms, e.g. in the garage or in a multi-storey car park.



Caution!

Safety instructions for installation and operation!

- The heater must only be installed either by an authorised Eberspächer partner or by an individual who has been authorised by them. Failure on the installers part to follow the installation instructions and any special advice contained therein will lead to all liability being refused by Eberspächer and its associated companies.
- Repairs by non-authorised third-parties or with not original spare parts are dangerous and therefore not allowed. They result in expiry of the type permit of the heater; consequently, when installed in motor vehicles they can cause expiry of the vehicle operating licence.
- The following measures are not allowed:
 - Changes to components relevant to the heater
 - Use of third-party components not approved by Eberspächer
 - Nonconformities in installation or operation from the statutory regulations, safety instructions or specifications relevant to safe operation as stated in the installation instructions and operating instructions. This applies in particular to the electrical wiring, fuel supply, combustion air system and exhaust system.
- Only original accessories and original spare parts must be used during installation or repairs.

Safety instructions for installation and operation



Caution!

Safety instructions for installation and operation!

- Only controls approved by Eberspächer may be used to operate the heater.
The use of other controls can result in malfunctions.



1 Introduction

- Before the heater is installed again in another vehicle, rinse the heater parts carrying water with clear water.
- When carrying out electric welding on the vehicle, the plus pole cable at the battery should be disconnected and placed at ground to protect the controller.
- The heater must not be operated where there is a risk of an accumulation of flammable vapours or dust, for example close to:
 - fuel depot
 - coal depot
 - wood depot
 - grain depots etc.
- The heater must be switched off when refuelling.
- When the heater is mounted in a safety housing etc., the installation compartment of the heater is not a stowage compartment and must be kept clear. In particular fuel canisters, oil cans, spray cans, gas cartridges, fire extinguishers, cleaning rags, items of clothing, paper etc. must not be stored or transported on or next to the heater.
- Defect fuses must only be replaced by fuses with the prescribed rating.
- If fuel leaks from the heater fuel system, arrange for the damage to be repaired immediately by a JE service partner.
- When topping up the coolant, only use the coolant permitted by the vehicle manufacturer, see the vehicle operating manual. Any blending with unpermitted coolant can cause damage to the engine and heater.
- After-running of the heater must not be interrupted prematurely e.g. by pressing the battery disconnecting switch, apart from in the case of an emergency stop.

The fitting of a diesel heater in a petrol engine boat is permitted with the following provisos:

- The heater must not be mounted in the engine compartment.
- RCD 94/25EC or ISO 100088:2001 are followed.
- The combustion air pipe must be taken from a vented to atmosphere area.
- The exhaust system must be routed as recommended in our Marine Installation Manual (Section 5).
- Heating intake air must be taken from a clean dry environment.

Accident prevention

General accident prevention regulations and the corresponding workshop and operation safety instructions are to be observed.

Please read carefully the following instructions, these have been compiled to assist you with every aspect of installing your heater. Special attention is required to the Safety or Caution areas, which are found at the end of each section.

To ensure maximum performance from your heater and for your own safety, please adhere to the following instructions closely, being aware that in the unlikely event of a heater failure during the warranty period, that warranty may be rejected if the heater is not installed in accordance with these instructions.

Additional operational, technical and safety information, specific to the model of heater you are installing, are provided in the heater technical description and operating instructions manuals that are included within the heater packaging. Please ensure you have this for reference before and during your installation.

When installing the heater, for your own safety, please use all necessary personal protection/safety equipment where required.

Before you begin, we advise that you take some time to plan the installation.

Planning your installation

Where and how you install your system will depend on various limitations of both your boat design and construction as well as the technical specification of the heater. Because of this we have endeavoured to give helpful advice within the different sections of this manual, we advise that each section is read fully before commencing the installation.

As a general guide before you begin, be aware of the location of the boat's fuel and water tanks, the batteries and any cold box, fridge or cooker that may prohibit the routing of the water hoses or affect the installation.

Before installing the heater into the boat, ensure that in doing so you are not infringing upon, or contravening any legal requirements of the boats use or construction. For instance, if the boat is to be used for hire purposes, it may require additional systems or warning labels to be installed, which may not be mentioned in this manual. Similarly, advice from the boat manufacturer may be required if you plan to cut through bulkheads that may be structurally important to the boat design.

Regulations that could affect the installation of the heater may be different in each country, so please check.

2 Positioning the heater

The heater should be installed in a dry and protected position and within the permissible mounting planes as shown in Figure 1. Before deciding on the position, be aware that the location of the exhaust hull fitting and length of the exhaust may limit where you position the heater unit. Refer to the exhaust chapter for further information. Also you must consider ventilation for the heater and the relative height of the unit with regard to other water components such as radiators, matrix units and any expansion tank (header tank / pressure vessel) that may be used. Further details are shown in the water pipework chapter of this manual.

Cockpit locker or engine/machinery spaces are ideal installation locations for the heater.

However, the heater must not be installed into any accommodation area.

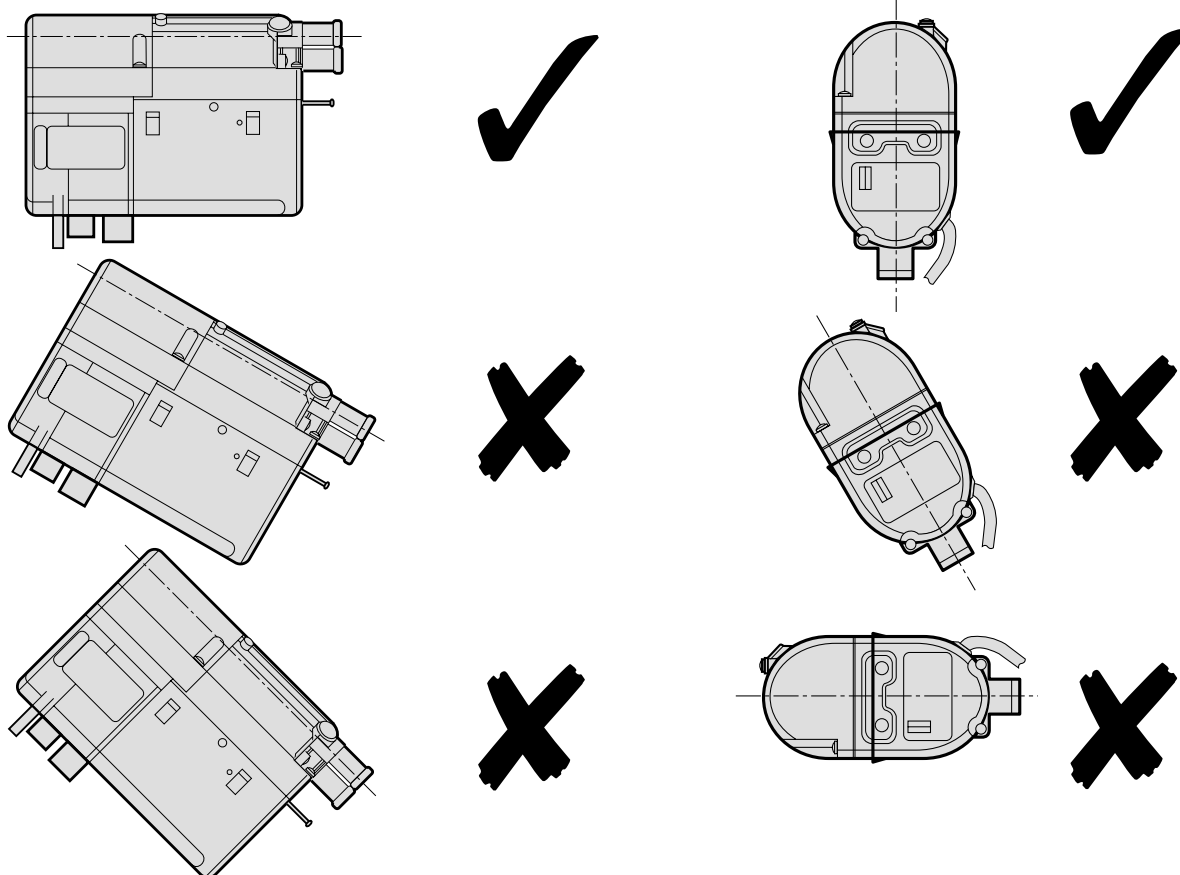
Ideally, the heater is installed with the exhaust and combustion air connections pointing vertically downward. Failure to achieve this could affect the optimum performance of the heater, particularly when sailing at an angle. The heater will operate in conditions of permanent 15° angle and after starting to a maximum angle of up to 30°.

When deciding on the position, consideration should also be given for future servicing and access for removal of the heater.

Please Note!

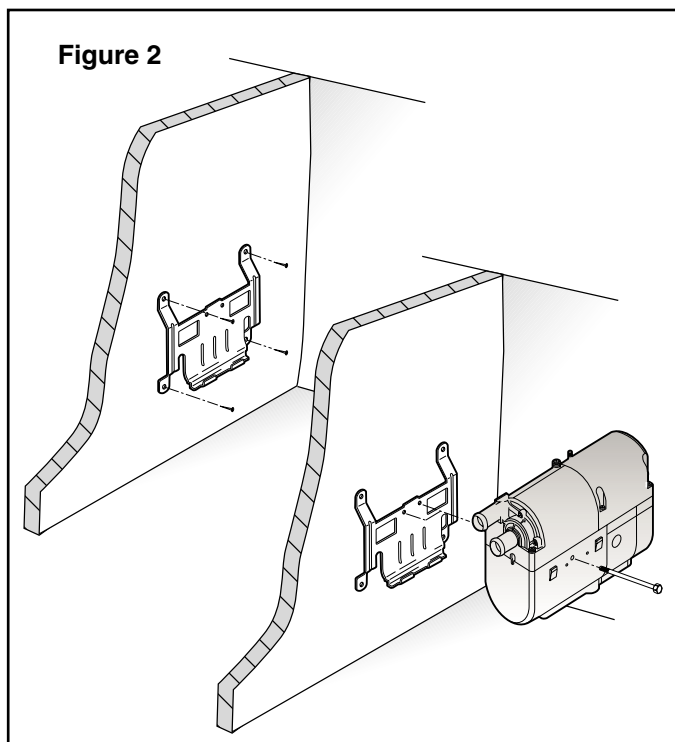
Depending on the installation space available, the heater can be moved sideways in the bracket and screwed in one of the two fastening threads.

Figure 1



2 Positioning the heater

Attach the heater mounting bracket to a suitable strong bulkhead. Thin bulkheads may need additional support to give the heater a secure mounting. Care should be taken to avoid securing directly onto cabin bulkheads where the possibility of noise or vibration could be transmitted.



Caution!

Safety Instructions!

- The heater must be located so that aerosol cans, fuel containers or other flammable/combustible materials cannot be stored on, or close to the heater.
- The heater must not be located in a position where it could be damaged or affected by the stowing of any items, or used as a step.

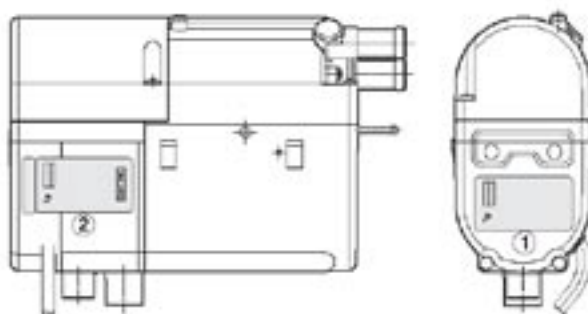
Nameplate

The nameplate is fastened to the front of the heater.

The second nameplate (duplicate) is included in the scope of supply of the heater.

If required, the duplicate nameplate can be adhered in a clearly visible position on the heater or near to the heater.

Figure 3



- 1 Original nameplate.
- 2 2nd nameplate (duplicate).

2 Positioning the heater



Danger!

Risk of injuries and burns!

It is possible for the coolant and components of the coolant circuit to get very hot.

- Parts conveying water must be routed and fastened in such a way that they pose no temperature risk to man, animals or material sensitive to temperature from radiation/direct contact.
- Before working on the coolant circuit, switch the heater off and wait until all components have cooled down completely, if necessary wear safety or heat resistant gloves.

Please Note!

- When installing the heater, please take note of the direction of flow of the coolant circuit. On the Hydronic D4/D5 there is an arrow imprinted on the outlet port.
- Fill the heater and water hoses with coolant before connecting to the coolant circuit.
- Route the water hoses without any kinks, and in a rising position if possible.
- When routing the water pipes, observe a sufficient clearance to hot engine parts.
- Protect all water hoses/water pipes from chafing and from extreme temperatures.
- Secure all hose connections with hose clips.
- After the heater has been operated for 2 hours, tighten the hose clips again.
- The minimum water flow rate is only guaranteed if the temperature difference of the heating medium does not exceed 10°C between water inlet and water outlet during heating.
- Only overpressure valves with an opening pressure of min. 0.4 – max. 2 bar may be used in the coolant circuit.
- The coolant liquid must contain at least 40% antifreeze all year round as corrosion protection antifreeze .
- Before commissioning the heater or after changing the cooling liquid, bleed the whole coolant circuit including heater. A pressure test is recommended.

3 Water pipework

General guidelines

In order to obtain the best performance from the system, restrictions in the water flow should be kept to a minimum. The use of right angle bends and large variations in height should be avoided where possible. Ideally, the Hydronic should be mounted as low as possible in regard to the other water components in the system. This will minimise the possibility of air collecting in the Hydronic heater and assist with initial air purging. The above is especially important when an expansion header tank based system is used.

The use of flexible water pipework such as rubber or polybutylene is recommended, as this is easier to install in the boat and allows for vibration and movement. The preferred pipework circuit configuration is a two pipe, flow and return system as shown in Figure 5. This will ensure equal water flow (regulating valves may be required for selected components) to all the water components resulting in even heat distribution regardless of the distance and order that the matrix or radiator is from the heater.

Single pipe systems (Figure 4), that connect radiators or matrices in a loop, one after another, should be used with caution as they give priority to the first components on the system. As a result the water temperature reduces as it passes and is extracted through each subsequent radiator or matrix. This will therefore make attaining an even temperature throughout the boat difficult to achieve, with the furthest cabin from the heater receiving the least heat, as well as increasing the restriction on the water flow returning to the heater.

However, if the water system contains only a small amount of pipework and one or two components (as

shown in Figure 4), then a single pipe circuit can be adopted as long as the internal diameter of the components used do not restrict the water flow of the heater (18 - 20mm). In addition bypass valves should be fitted to reduce possible restrictions in the water flow as well assisting to a degree in balancing the system. Full heating systems with several matrices or radiators on systems using larger amounts of pipework should not be piped using this type of system.

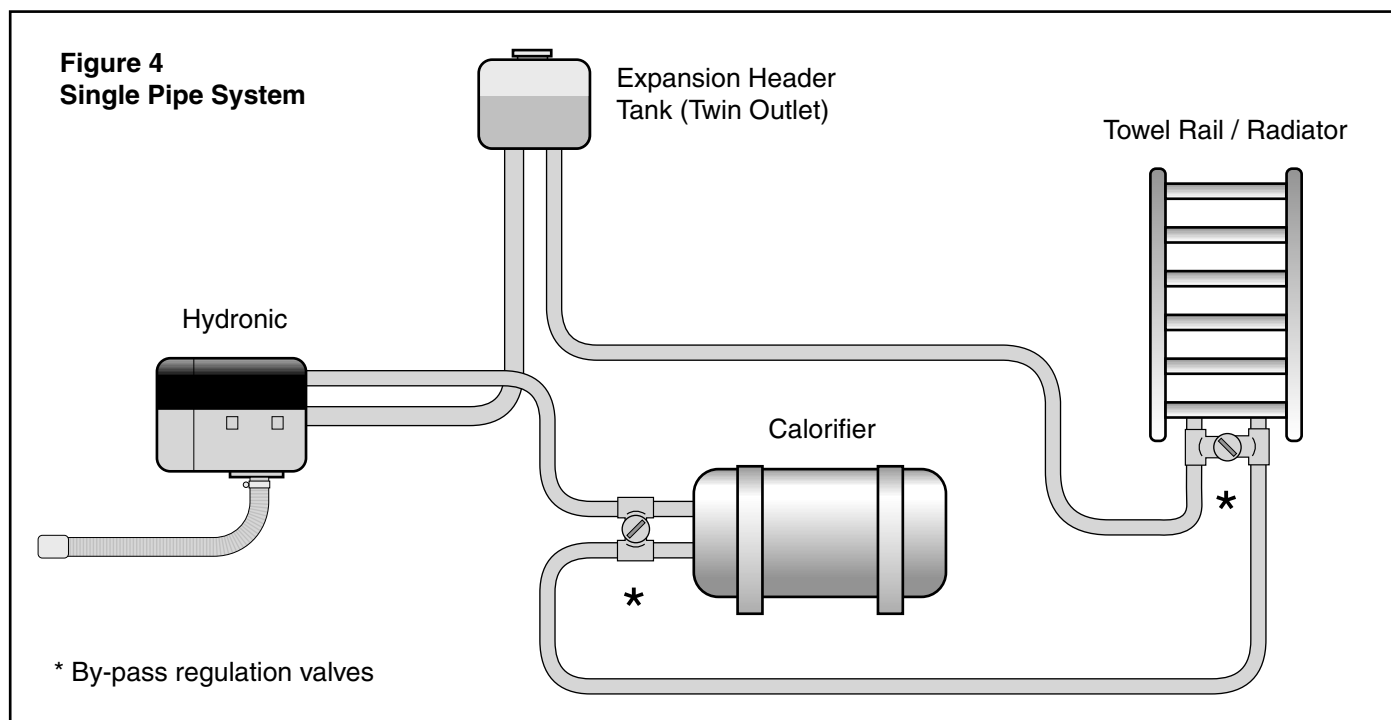
Hydronic D4 / D5 heaters are to be piped using 18mm rubber hose or 22mm polypipe to a length of 20 metres total (supply and return pipe added together), use 15mm pipe to connect to components (maximum 10 metres).

Types of water systems

There are generally two types of water systems that can be used. The most common type is the expansion header tank system as shown in Figure 4/5. This type of system uses an expansion tank situated at the highest part of the system. This ensures the system always has a head of water and allows for the expansion of the water as it rises in temperature.

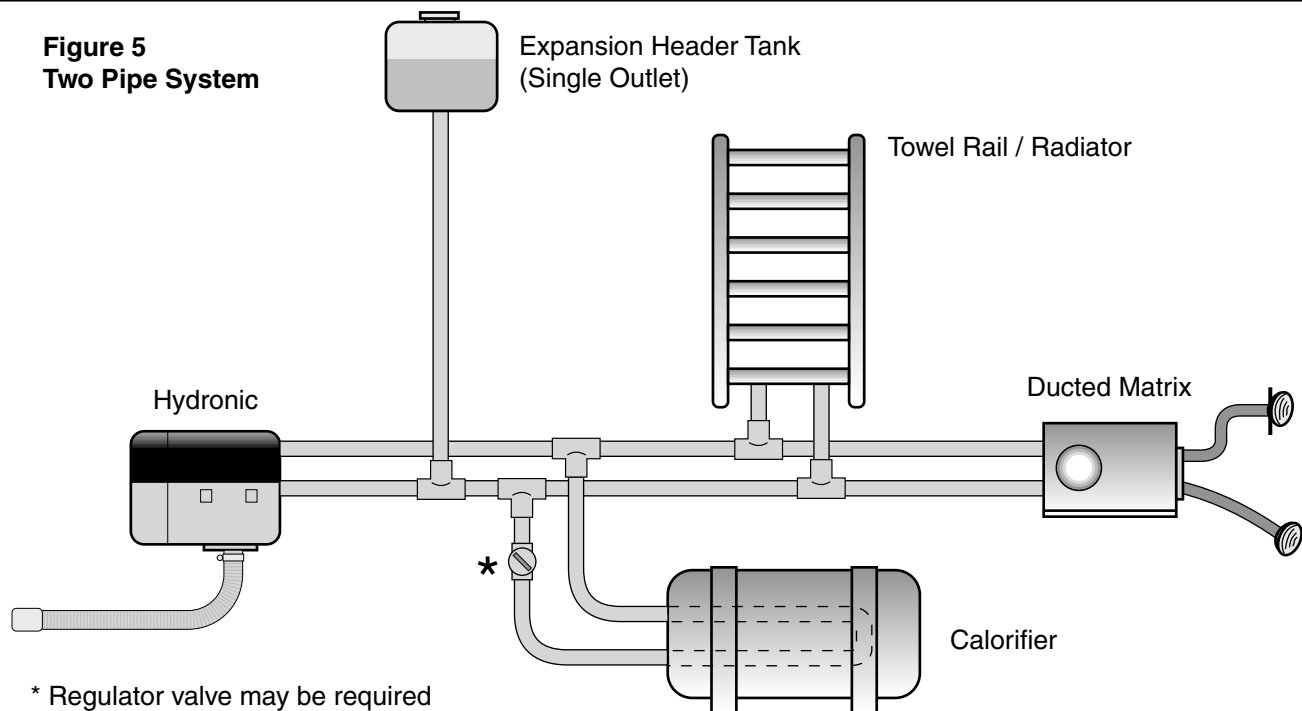
Pressurised or sealed systems use a pressure vessel and gauge as shown in Figure 6, and can be filled and topped up by a filling loop.

For ease of installation and simplicity an expansion header tank system is preferable as long as a suitable high position for the tank can be found. A pressurised/sealed system does not have this problem although it is initially more complex to install. This type of system is less affected by the height variations of the system water components.



3 Water pipework

Figure 5
Two Pipe System



Expansion tank based systems

Positioning the expansion tank

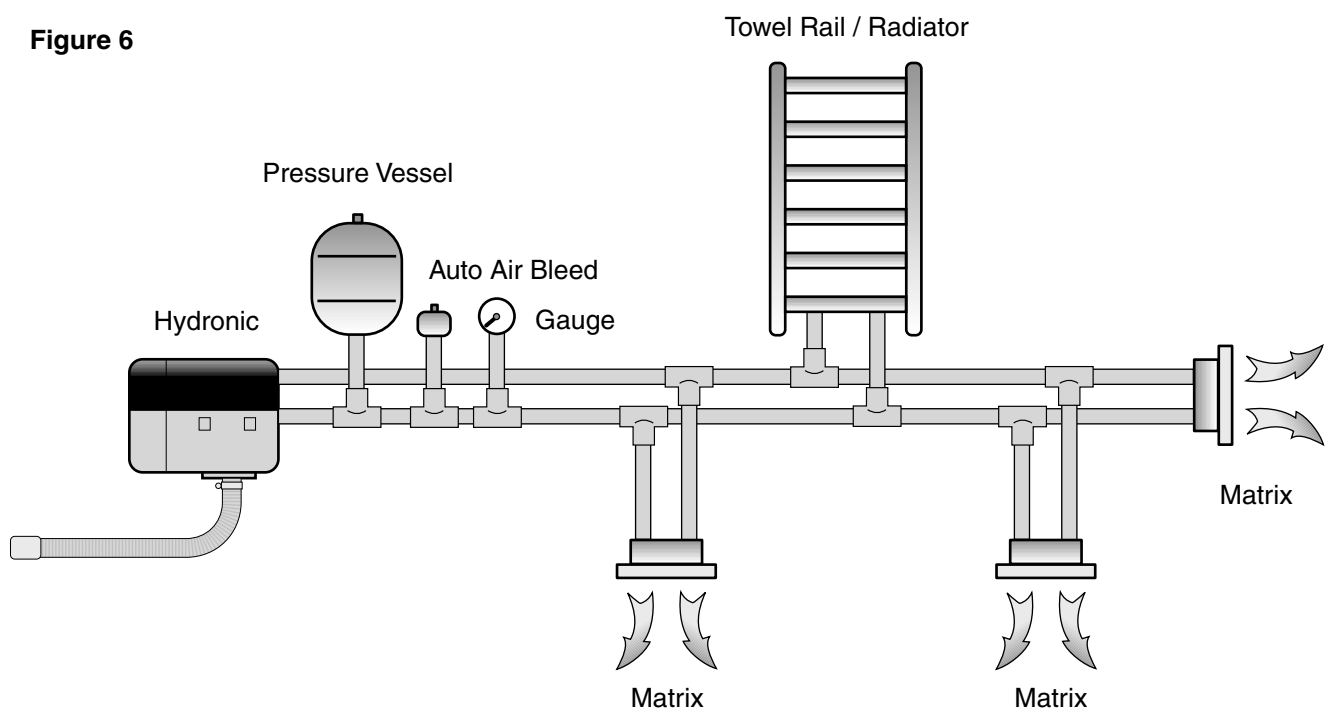
The expansion tank must be positioned above the highest water component in the system and in a location that allows it to be topped up and the level checked periodically. Caution should be taken when considering installing the tank above any accommodation area where people, animals or materials could be affected by potential coolant leak or accidental spillage when filling.

Pressure based systems

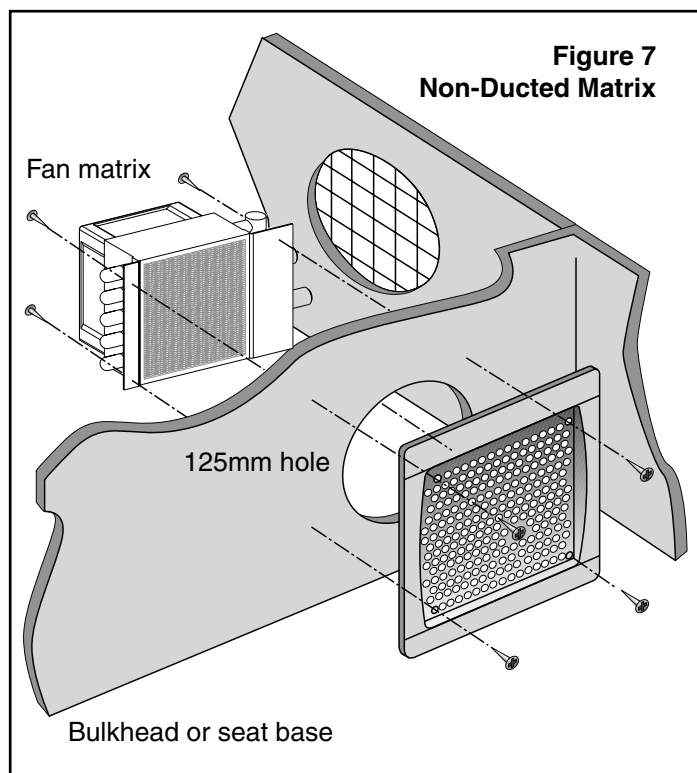
If a pressure-based system is to be used, it must not be pressurised so that it exceeds the maximum permitted pressure of 2 bar at maximum operating temperature (85° C).

Additionally, if the coolant system is to be filled or topped up from a feed connected to the boat's domestic water supply, a suitable non-return device must be fitted to prevent the heater's anti-freeze coolant mixture and the boat's domestic water supply cross contaminating.

Figure 6



3 Water pipework



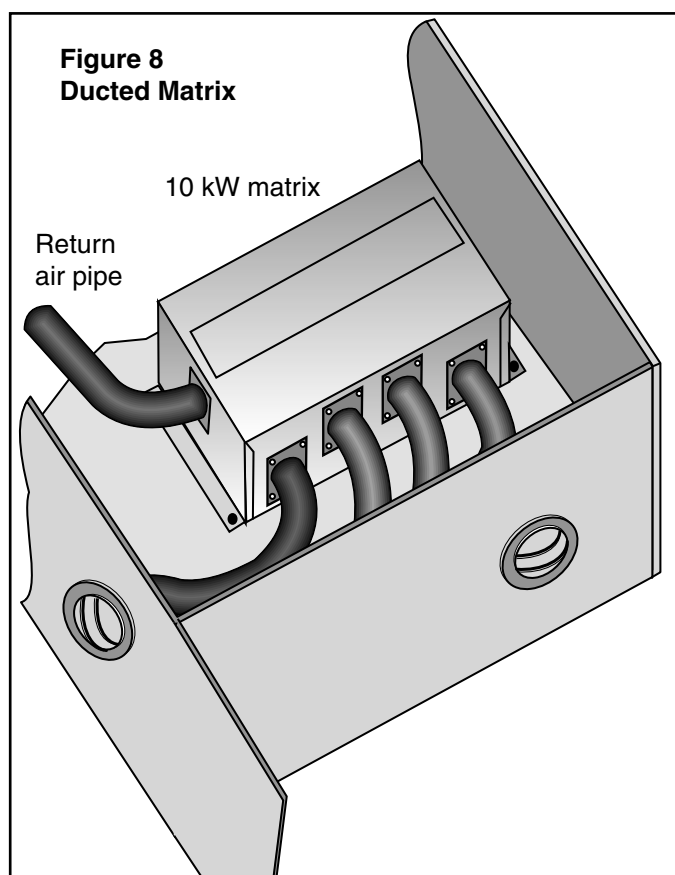
Installing fan matrix units

Eberspächer fan matrix units are available in both non-ducted and ducted versions.

Our non-ducted units feature very low power consumption fans that gives their maximum performance when able to allow air to flow with minimal restriction. Therefore, matrices should be mounted as close to the area that requires heating as possible. The areas that the matrices are located must be well ventilated otherwise the matrix performance will be reduced resulting in poor airflow and heat output.

Ideal mounting locations are directly behind cabin seat bases and bunks or the base of hanging lockers. The chosen location must be dry and free from possible unpleasant odours that could be distributed by the matrices into the accommodation.

Ducted units can be mounted remote from the area to be heated but it is advisable to keep the duct lengths to the outlets as short as possible to ensure the minimum heat loss. Again where they are located must be dry and odour free as well as adequately vented, otherwise airflow and heat output will be affected.



Controlling the matrices

Matrix units can either be wired or controlled directly from the Hydronic, or switched individually. Individual control of each matrix is recommended, as this enables a greater level of controllability for guests and/or each area of the boat.

Each individual matrix must be fuse or circuit breaker protected to the correct rating (which will be dependant on the model of matrix used).

Connecting to a calorifier

General guide

There are several methods of connecting the Hydronic into a calorifier and the way this is carried out will depend on various factors.

- How any existing calorifier is connected.
- Is the calorifier single or twin coil?

3 Water pipework

The majority of boats will probably have a calorifier already installed, which is usually connected to the engine and/or a mains AC supply.

If the existing single coil calorifier is used with the Hydronic heater, it is strongly recommended that the engine is disconnected from the calorifier. Suitable blanking fittings will be required - contact engine manufacturer.

The use of a twin coil calorifier will allow the engine and Hydronic heater to independently heat the domestic hot water.



Danger!

Risk of burning and injuries!

- The calorifier must be fitted with a device such as a blender/thermostatic valve to limit the temperature of the water that can be used for washing, bathing, etc. to a safe temperature.

Connecting into and engine circuit

It is not generally considered advisable to maintain a static engine at its operating temperature for long periods of time. This is because lubricating oils can drain from the upper parts of the engine, causing increased friction and therefore increased mechanical wear upon starting.

In connecting the heating system to the engine, it will increase the water content of the coolant system which increases the volume of water that expands as the coolant rises in temperature. The expansion/header tank fitted to the engine may not be able to accommodate such expansion.

Additionally, the engine expansion/header tank may need re-siting to ensure it is the highest component of the combined circuit.

For this reason, caution is advised if considering incorporating the boat engine into the heating/hot water circuit and advice should be taken from the engine/boat manufacturer before commencing. The terms of your boat /engine warranties may also be affected by such modifications.



Danger!

Risk of burning and injuries!

- The water pipework must be routed and fastened in such a way that there is no risk to people, animals or materials that are sensitive to temperature from radiation or contact or blown hot air from matrix units.
- If necessary cover or protect exposed pipe work or deflect hot air from any matrix that poses a potential risk.
- High temperatures occur during and after heater operation. Avoid working in the heater vicinity while it is in operation. Switch the heater off and allow it to cool before commencing work. Wear safety gloves if necessary.
- The heater system pipework must not be connected to the engine circuit in any way that would allow coolant from the heating system to be released when the engine coolant pressure cap is removed. i.e. All the heater system water components must be installed below the level of the engine coolant pressure cap.



Caution!

- The heater air intake must not be positioned in such a way that any exhaust gases can be drawn directly into the heater under normal circumstances.
- Fan matrix units must not be located in areas that can allow fumes, gases etc to be drawn into the accommodation area.
- In the event of overheating, the heater or exposed pipework surface temperatures can reach 100°C. Only use the temperature resistant water hoses of the correct specification.



4 Exhaust and Combustion air system

Exhaust

The exhaust system included in the kit comprises of an exhaust hull fitting, a flexible insulated exhaust with silencer, securing clamps and exhaust support brackets.

Installing the hull fitting

The position of the exhaust hull fitting will depend on several factors, where you have located the heater, whether your boat is sail or power, and the suitable surfaces available.

On a sailboat, the preferred location is on the transom, as it is normally the area least likely to be affected by seawater when sailing and it is also close to the heater (if the heater is located in a cockpit locker), see Figure 9.

On a motorboat, the transom or side of the hull are suitable locations. However, when locating the hull fitting on the transom of a motorboat, the fitting should be positioned a minimum of 300mm above the waterline to avoid any following seas covering the fitting when the boat slows suddenly.

Attaching the exhaust

To avoid water ingress, the exhaust should be installed and routed as illustrated in Figure 9.

Use the exhaust support brackets provided to secure the exhaust and keep it away from heat sensitive materials.



Caution!

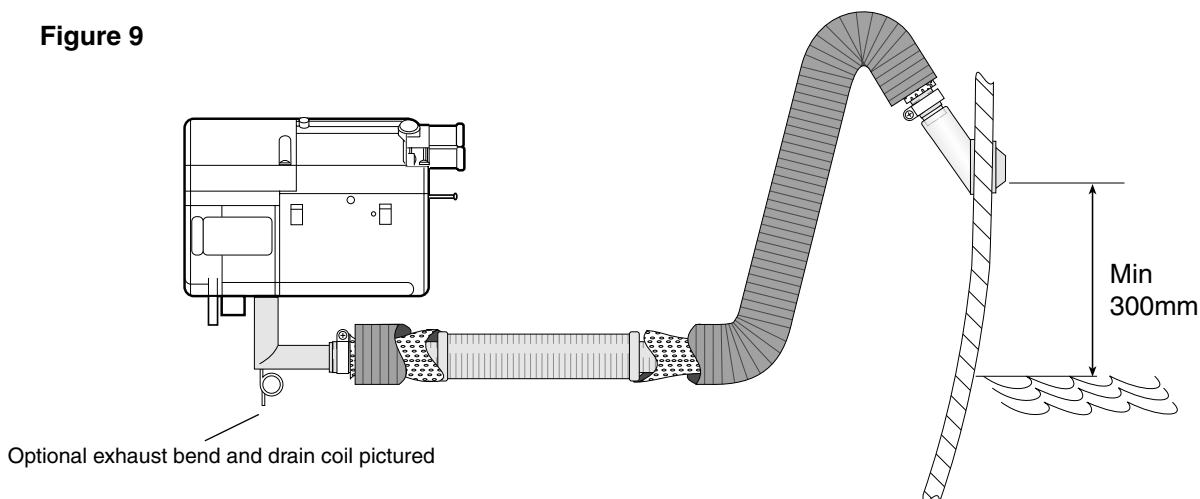
Safety instructions!

Although the supplied exhaust is insulated, it will get hot during and immediately after heater operation. To

avoid potential safety issues the exhaust system must be installed according to these instructions.

- The exhaust hull fitting must not be fitted to a deck or horizontal surface.
- Under no circumstances connect the heater exhaust to an engine exhaust or any other exhaust system.
- The exhaust outlet must vent directly to atmosphere.
- Adequate clearance must be kept around the exhaust system to prevent interference with important functional parts of the boat, e.g. steering or throttle cables.
- Route the flexible exhaust giving clearance and consideration to heat sensitive components such as fuel lines, electrical cables, etc.
- Ensure the support brackets supplied are used to secure the exhaust and avoid damage by vibration.
- Position the hull fitting so that either the heater combustion air or other inlets cannot draw in exhaust fumes.
- Ensure that the position of the hull fitting allows fumes to exit freely and not affect nearby surfaces, e.g. fenders, ropes or mouldings.
- To avoid water ingress, the hull fitting must be at least 300mm above the waterline and a suitable bend formed in the exhaust to prevent water collecting in the exhaust.
- The exhaust must not be routed through the living area.

Figure 9



4 Exhaust and Combustion air system



Danger!

Risk of injury and burns!

All combustion processes produce high temperature and toxic exhaust fumes. This is the reason why the exhaust system must be installed to these instructions.

- Do not perform any work on the exhaust system while the heater is in operation.
- Before working on the exhaust system, first switch off the heater and wait until all parts have cooled completely. If necessary, wear suitable gloves.
- Do not inhale exhaust fumes.
- Do not operate the heater in enclosed spaces such as a boat shed or when the boat may have a cover fitted in winter, etc.

Combustion air

The combustion air components are supplied in the installation kit. A silencer, extension tube and a combustion air hull fitting are available as optional parts.

The combustion air silencer and tube should be installed as shown in Figure 10.

If combustion air is to be taken from an engine/machinery space, please ensure it is adequately vented and that the area will not be pressurised or under partial vacuum when the engine is in use or ventilation fans are running.

If it is to be taken directly to an external hull fitting ensure that it is positioned with regard to the same conditions as required for the exhaust hull fitting.



Caution!

Safety instructions for the combustion air system

- The position of the combustion air must not allow exhaust fumes or flammable vapour to be drawn in.
- If a combustion air hull fitting is used ensure water ingress is not possible at any time.
- The combustion air inlet must not be restricted or blocked at any time.
- The combustion air must not be drawn from any of the accommodation areas.
- The combustion air inlet must be drawn from a neutral pressure area.

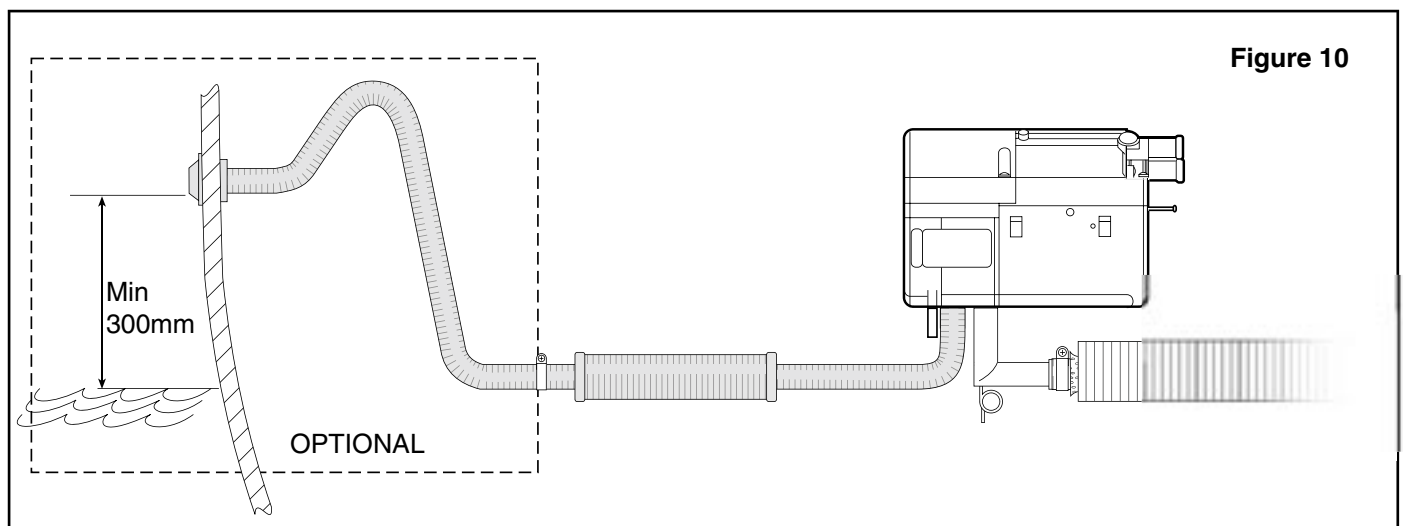


Figure 10



5 Fuel system

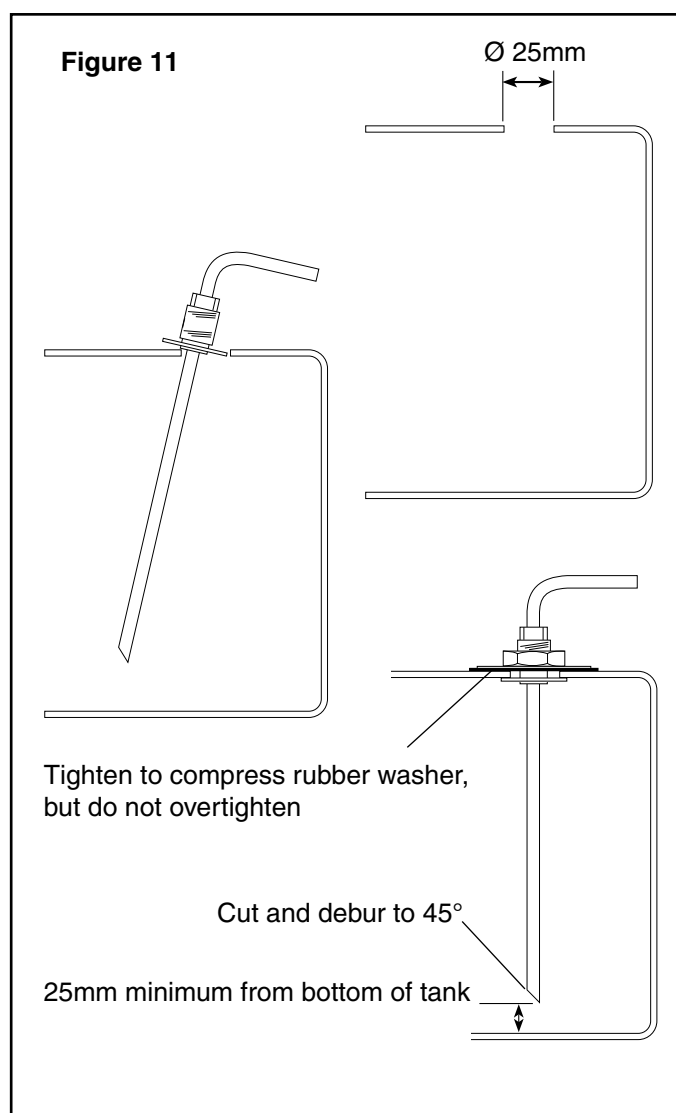
The fuel system supplied comprises of a fuel standpipe, shut off valve, a quantity of fuel line, connectors and a fuel-metering pump (integral on the Hydronic D4 / D5 SC heater models).

Figure 11 illustrates a typical installation using a fuel standpipe, which is the preferred method for the fuel take off. This minimises any problems caused by over pressuring, fuel starvation and air leaks that can occur if connected to an engine fuel line.

Installing the standpipe

The fuel standpipe supplied must only be fitted to the top of the fuel tank and on an even surface. **It must not be fitted to the side or bottom of the tank.**

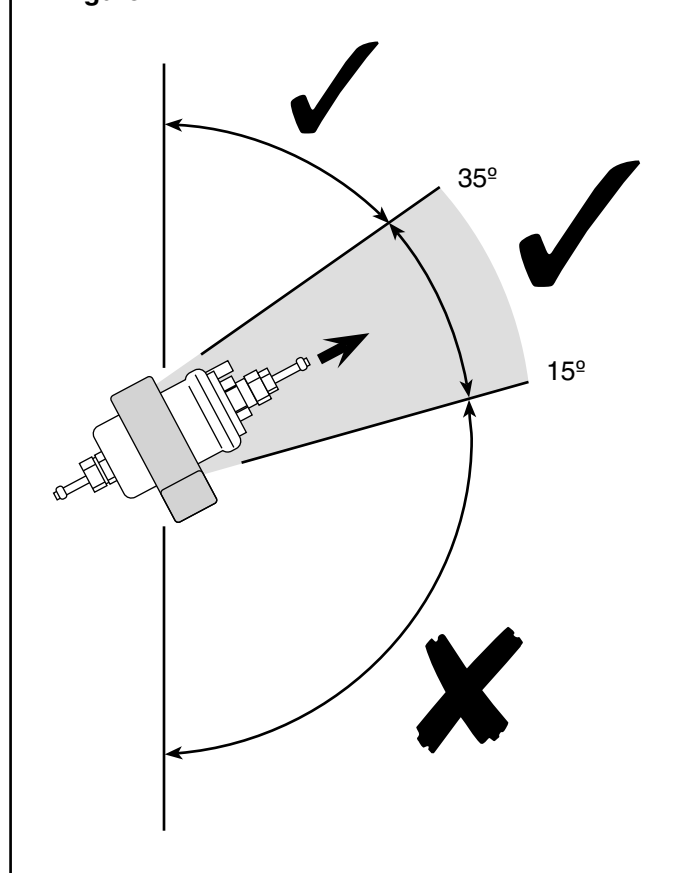
Install the standpipe as shown in Figure 11.



Positioning the fuel-metering pump (if applicable) 24 volt Hydronic D4 / D5 only

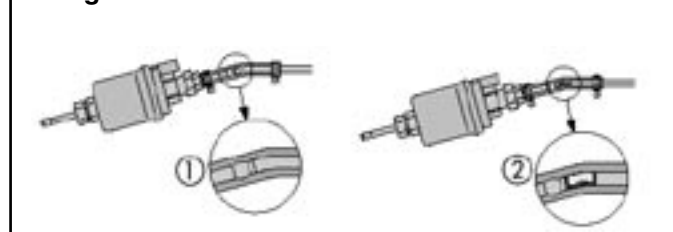
When installing the fuel-metering pump, take into consideration that it may be audible when in operation, so it should be installed into an area or onto surfaces that will not transmit the sound into the accommodation. The chosen area should also be free from excessive moisture and the fuel-metering pump must be mounted with the electrical connections/pressure side uppermost within the permissible angles shown.

Figure 12



When connecting fuel pipes with a fuel hose (ISO 7840) always mount the fuel pipes in a butt joint to prevent any bubbles from forming.

Figure 13



- 1 Correct connection.
- 2 Incorrect connection - bubble formation.

5 Fuel system



Caution!

Safety instructions for installing the fuel pipes!

- Only use a sharp blade to cut the plastic/rubber fuel hoses and pipes. Metal fuel pipes should be cut using an appropriate pipe cutter.
- Ensure all cuts are free from burrs and the fuel lines are not crushed or restricted.
- The fuel line from the fuel metering pump to the heater should be run to give a continuous rise.
- Fuel lines must be secured every 50cm to avoid noise and/or damage by vibration.
- Fuel lines must be protected from any mechanical damage.
- Avoid running the fuel lines where their condition and longevity may be affected by movement, vibration or heat.
- Do not secure the fuel lines to any exhaust system.
- Do not position any fuel connection where it could leak onto electrical connections or hot surfaces.
- Approval must be sought from any engine manufacturer or the boat manufacturer, before sharing an existing fuel feed.
- The fuel must not be conveyed by gravity or overpressure in the fuel tank.
- Withdrawal of fuel after the boat engine fuel pump is not allowed.

Please Note!

Check tank venting.



Caution!

Safety instructions for installing the dosing pump!

- Always mount the dosing pipe with the pressure side rising upwards - minimum incline 15°, maximum 35°.
- Protect the dosing pump and filter from intolerable heat, do not mount near to the silencers and exhaust pipes.



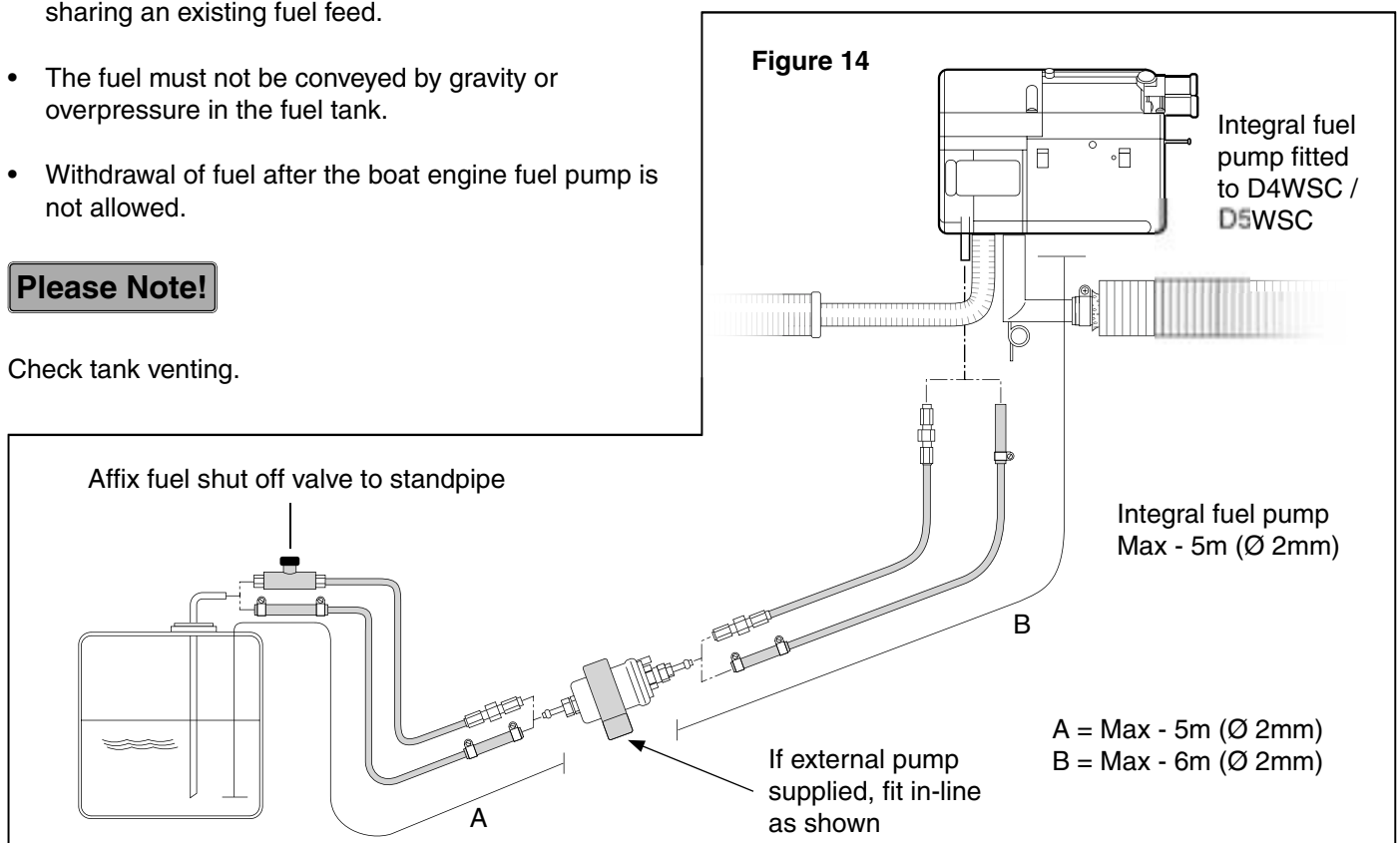
Danger!

Risk of fire, explosion, poisoning and injuries!

Caution when handling fuel, remember to:

- Switch off engine/heater before refuelling or working on the fuel supply.
- No naked flames when handling fuel.
- Do not smoke.
- Do not inhale fumes.
- Avoid contact with skin.

Figure 14





5 Fuel system

Fuel supply

Fuel quality for diesel heaters

The heater can run on commercially available diesel fuel to DIN EN 590 specification.

Fuel for special cases

In special cases (above 0°C), the heater can also run on fuel oil EL or paraffin.

Fuel for low temperatures

Refineries and fuel service stations automatically adjust the fuel to normal winter temperatures (winter diesel). This means that difficulties are only to be expected for extreme drops in temperature, as also apply to the engine. Please also refer to the boat manual.

If the heater is run from a separate tank, please comply with the following rules:

For temperatures above 0°C, any kind of diesel fuel as per DIN EN 590 can be used.

If no special diesel fuel is available for low temperatures, then paraffin or petrol should be mixed with the fuel according to the following table:

Temperature	Winter diesel	Addition
0°C to -25°C	100%	—
-25°C to -40°C	50%*	50% paraffin or petrol

* or 100% special cold diesel fuel (Arctic diesel)

Please Note!

- Mixtures with used oil are not allowed.
- After refuelling with winter or cold diesel or the listed blends, the fuel pipes and the dosing pump must be filled with the new fuel by letting the heater run for 15 mins.

Operation with biodiesel (PME)

The heater is **not** certified for operation with biodiesel (EN 14214).

6 Electrical System

The electrical system comprises of a heater cable harness and individual looms for the power supply, operating device and the fuel-metering pump (where necessary). Also a fuse box assembly and the operating device you have selected are included.

The individual looms can be routed as one or in separate directions as required (depending on the layout of the boat, the location of the batteries and fuel-metering pump, etc.).

Positioning and connecting the operating device

The operating device should be located inside the boat in an area where it is easily visible and accessible. This is especially important if a timer, or where any other device with a programmable display, has been specified.

Operating devices with integral temperature sensors and temperature sensor units should not be located where they can be adversely affected by direct sunlight or drafts. Additionally, locating the units near to boat fixtures such as cookers, or lighting that can emit heat, should be avoided.

A common position for the operating device is to locate it nearby to other instrumentation on the boat, in an area such as the chart table/instrument panel. Additional information regarding fastening and operating instructions is supplied with the operating device.

Connecting to the power supply

The preferred point of connection is the boat's main battery isolator, using the fuse assembly supplied. It should be connected so that when the isolator is switched off, the heater cannot be used.

However, if a remote operating device such as a timer or Calltronic is to be used, then the heater will need to be wired to the battery (permanently live) side of the isolator so that when the isolator is switched off, the heater can still be operated.



Caution!

Connecting to a permanent supply!

- If a permanent supply is required, an additional isolator or circuit breaker may be required, dependant on the legislation of the country.
- Check with the boat marina and your marine insurance policy to see if the heater can be operated when the boat is unattended.
- Ensure only the specified fuse ratings are used.

Heater wiring



Caution!

Safety instructions for wiring the heater!

The heater is to be connected up electrically according to the EMC directives.

EMC can be affected if the heater is not connected up correctly. For this reason, comply with the following instructions:

- Ensure that the insulation of electrical cables is not damaged. Avoid: chafing, kinking, jamming or exposure to heat.
- In waterproof connectors, seal any connector chambers not in use with filler plugs to ensure they are dirt-proof and water-proof.
- Electrical connections and ground connections must be free of corrosion and firmly connected.
- Lubricate connections and ground connections outside the heater interior with contact grease.

Please Note!

Comply with the following when wiring the heater and the control element:

- Electrical leads, switchgear and controllers must be arranged in the boat so that they can function perfectly under normal operating conditions (e.g. heat exposure, moisture etc.).
- The following cable cross sections are to be used between the battery and heater. This ensures that the max. tolerable voltage loss in the cables does not exceed 0.5 V for 12 V or 1 V for 24 V rated voltage.

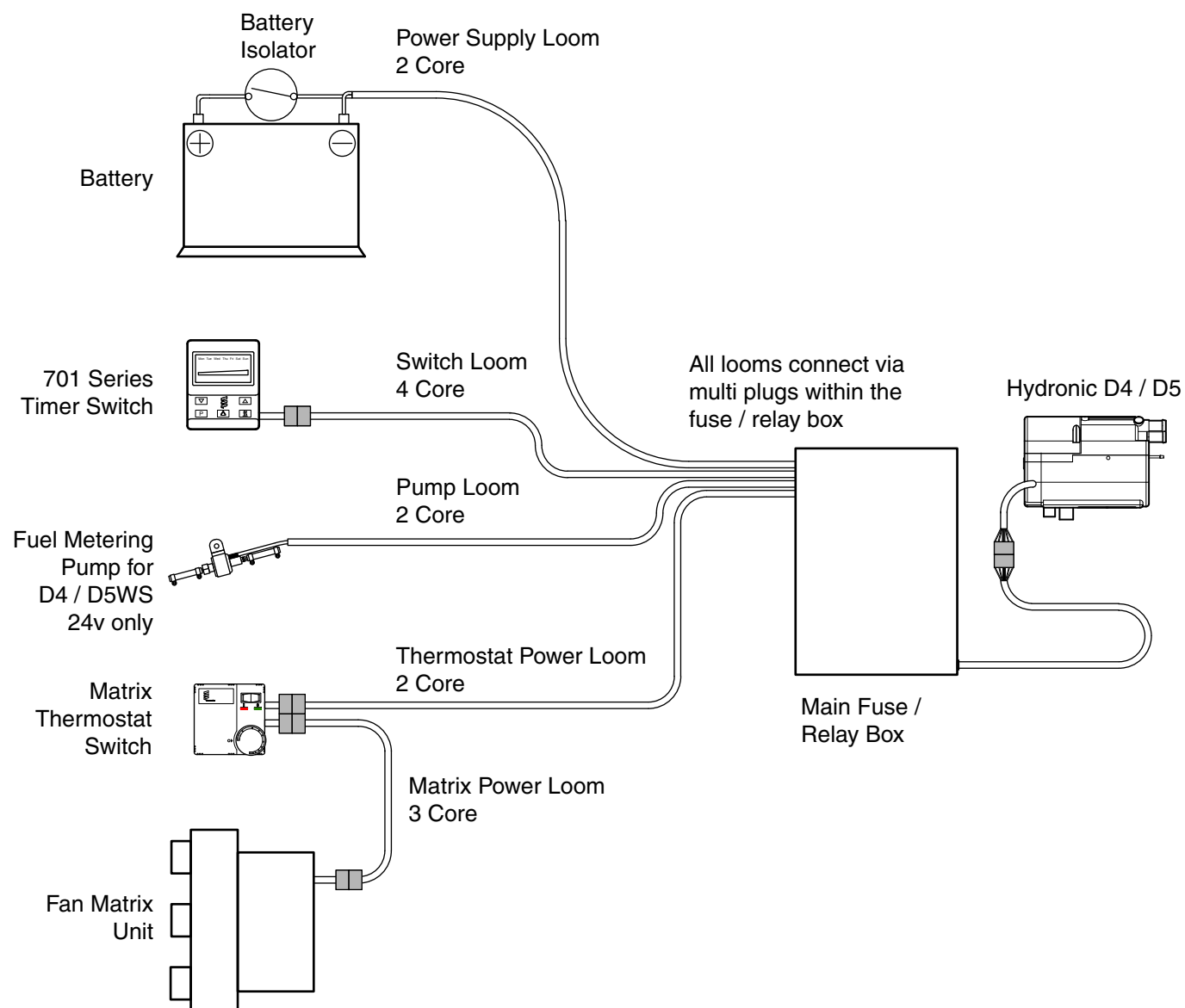
Cable cross sections for a cable length of:

- up to 5 m (plus cable + minus cable) = cable cross section 4 mm²
- from 5 to 8 m (plus cable + minus cable) = cable cross section 6 mm²
- If the plus cable is to be connected to the fuse box, the boat cable from the battery to the fuse box must be included in rating the overall cable length and possibly re-dimensioned if necessary.
- Insulate unused cable ends.



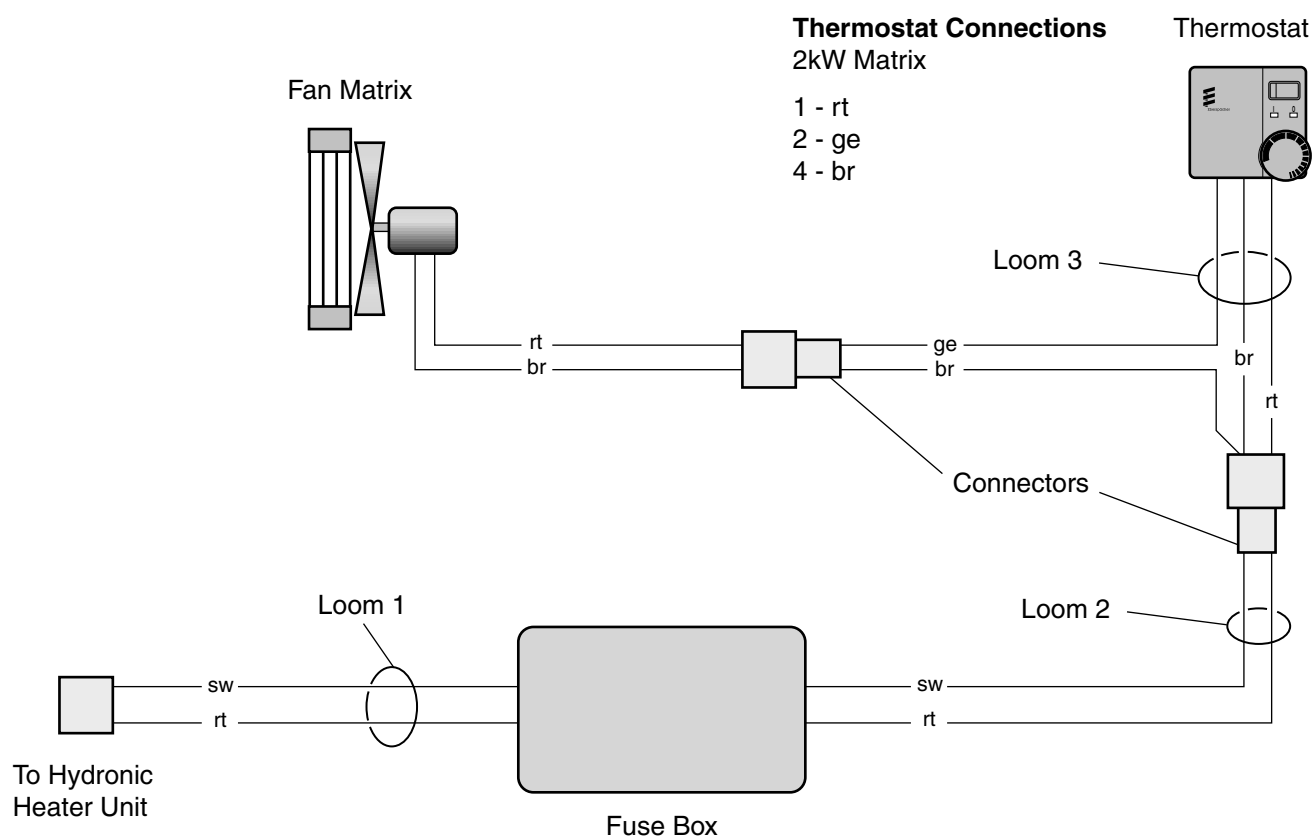
6 Electrical System

Figure 15



6 Electrical System

Figure 16
MWH 2kW Model Fan Matrix Control Wiring Diagram



Note:
This fuse box and Loom No. 1 are optional extras. They are only necessary when 2 or more Fan Matrix are used.

Cable Colours

rt - red
ge - yellow
br - brown
sw - black

6 Electrical System

Electrical Wiring of Fan Matrix 3.7kW (Optional Extra)

Locate the matrix thermostat in a convenient area within the accommodation away from direct sunlight, draughts, cooking equipment or components radiating heat.

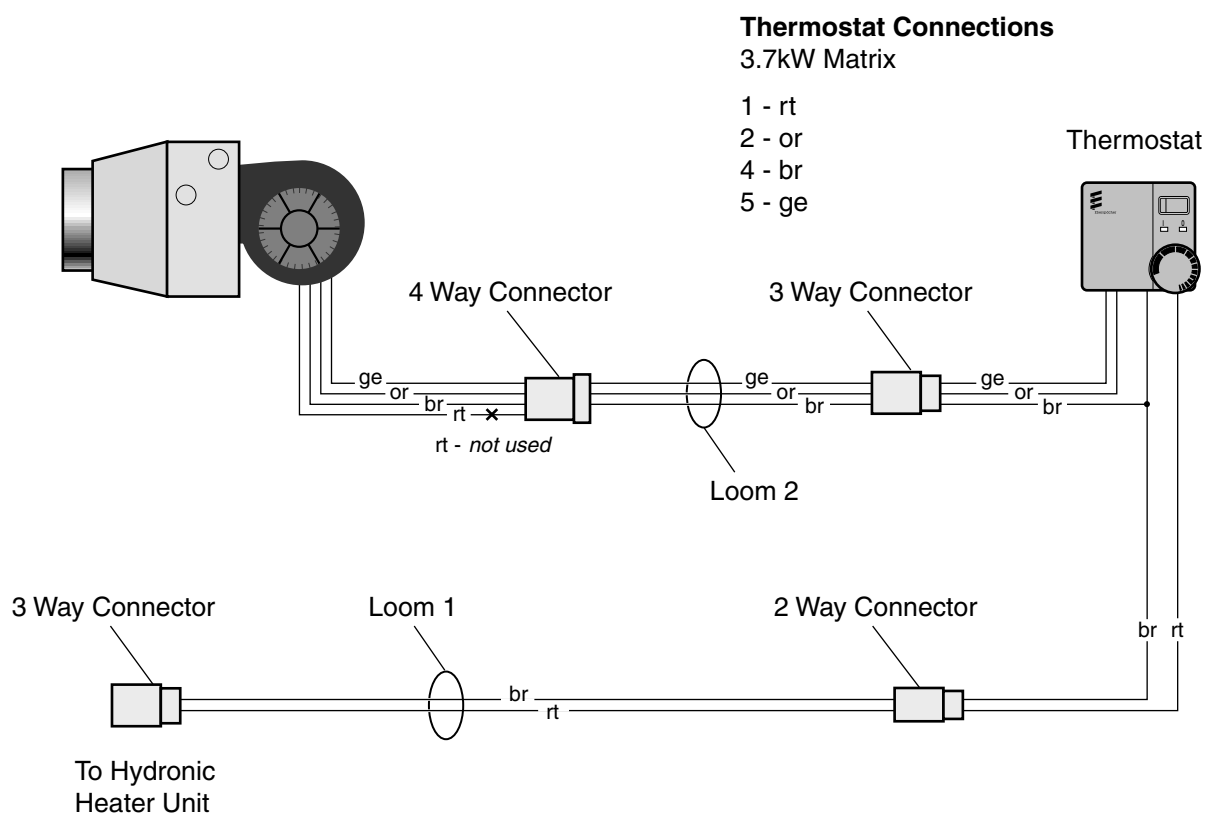
Route wiring Loom No. 2 between the thermostat and the fan matrix. Interconnect as Figure 17.

Route wiring Loom No. 1 between the fan matrix fuse box and the Hydronic heater assembly. Interconnect as Figure 17.

Note:

If it is necessary to shorten the wiring or remove any of the connectors, please ensure that they are properly made to their original standard. Smear all exposed electrical connections with silicone grease or similar.

Figure 17
MWH 3.7kW Model Fan Matrix Control Wiring Diagram

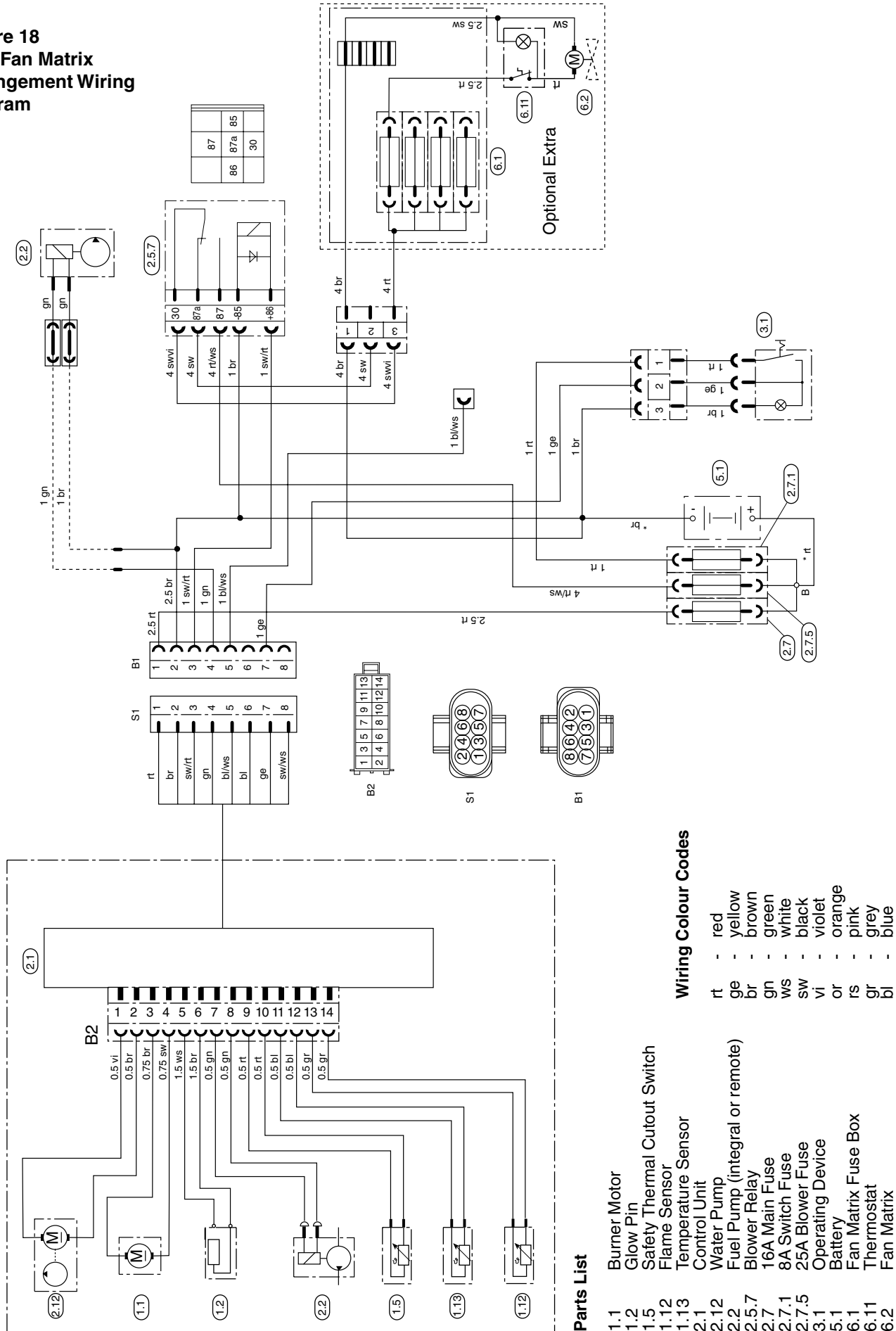


Cable Colours

rt - red
ge - yellow
br - brown
sw - black
or - orange

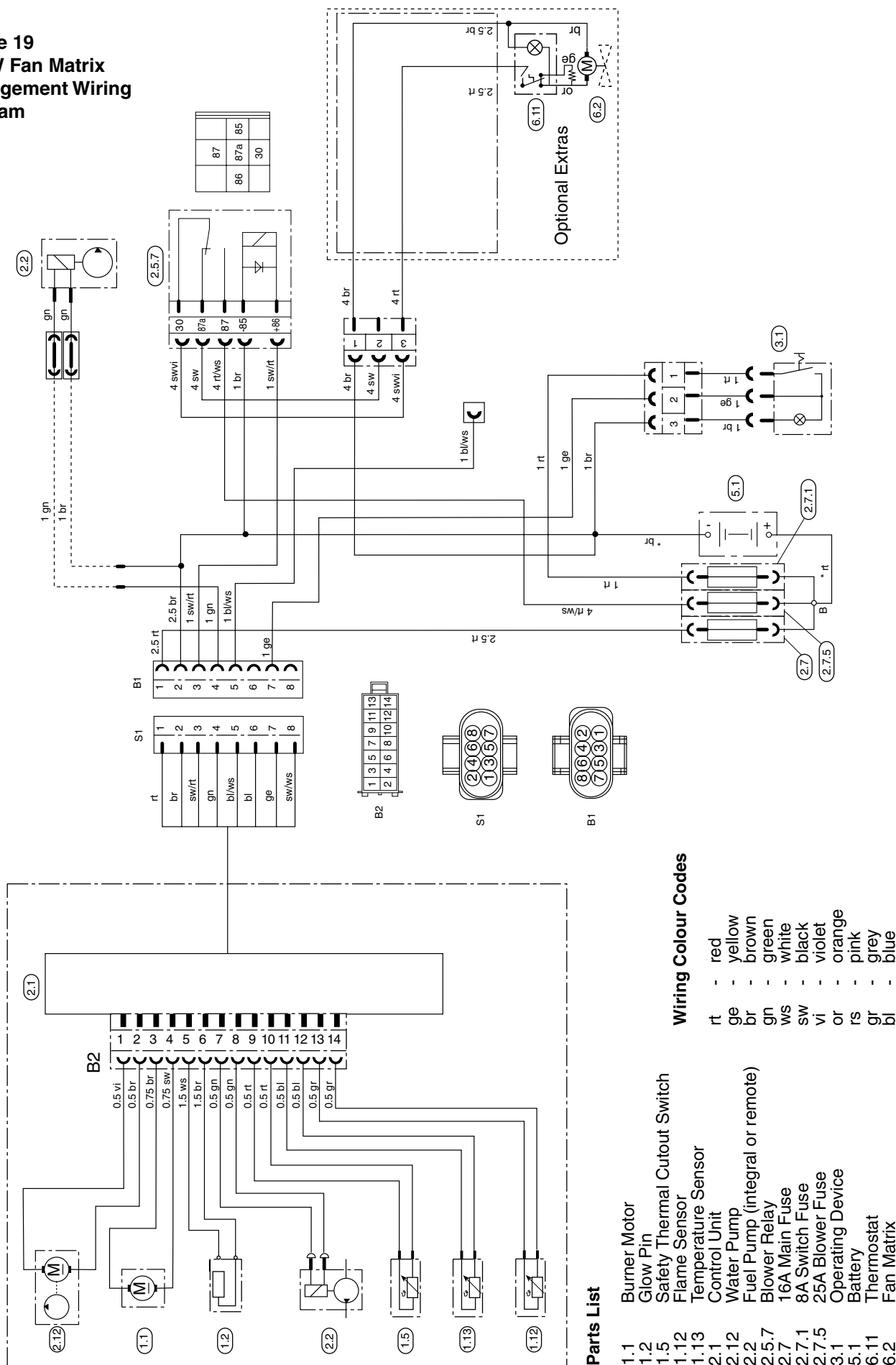
6 Electrical System

Figure 18
2kW Fan Matrix
Arrangement Wiring
Diagram



6 Electrical System

Figure 19
3.7kW Fan Matrix
Arrangement Wiring
Diagram



7 Commissioning the system

Filling the coolant system

Before filling the coolant system ensure that all pipe and hose connections are secure.

Fill the system with an anti-freeze mixture of at least 40% to prevent corrosion and coolant freezing. The anti-freeze mixture concentration will vary and is dependant upon climatic conditions where the heater is to be operated and must be altered to suit accordingly.

Before running the heating system, pressure test to 1 bar / 14.5 psi using an appropriate pressure tester, to check for leaks.

In the event of coolant becoming frozen or lost, the heater must not be operated.

Purging air from the system

Before operating the heater, as much air as possible should be vented from the system. This is best achieved by systematically venting each matrix/radiator in turn, starting with the lowest level vent first.

Once this has been achieved the heater can be started after checking the following.

- Ensure all water connections are secure and leak free.
- Check that the batteries are fully charged.
- Check there is sufficient fuel in the fuel tank.
- Check the power supply for correct polarity.
- Now switch on your heater.



Danger!

Risk of injury and burns!

- Potential scalding or burns can result from venting air from the system if the Hydronic is running and the water is hot.

Please Note!

Combustion may not be established when the heater is first operated. Several attempts may be required to start the heater. This is due to air being present in the heater fuel lines that needs to be purged by the fuel-metering pump. Please also be aware that any air present in the system when the heater is in operation may cause the heater to shutdown prematurely. Always allow the system to cool down before commencing further venting. In some cases leaving the system to vent naturally through the expansion tank overnight is the best option.



8 Warranty information

Separate documents concerning warranty accompany the heater.



Eberspächer