Webasto
Marine Comfort

Installation Instructions
Marine Water Heaters

Thermotop C / E - Diesel 12v - English

Webasto Marine Comfort

Thank you for choosing Webasto Marine Central Heating

We are certain that you will enjoy many years of satisfactory service from your Webasto product. Should you require any assistance Butler Technik are always at your service.

Happy Boating!

Webasto Part Number : 4110310A
Issue No: 02 : 10th November 2010
Matthew Millard

Replacing other heaters

Webasto Marine Comfort

If this heater kit has been purchased to replace an existing installation please see the important points below. Otherwise continue to the next page.

Replacing other heaters

If you are removing an existing heater to fit this new one then you must remove all the associated old parts for that heater even if you are replacing a like for like heater.*

This includes:

- Fuel lines
- Fuel pump
- Exhaust system
- Wiring harness
- Controls / timers
- Heater mountings

The heating circuit can remain intact, i.e. (radiators and blowers etc) as long as they are installed in a correct manner and resemble the installations described on pages 16-22.

When all of the above parts are removed continue with the new installation using the supplied new parts.

*System components wear and performance can decrease with age and should be replaced when fitting a new heater.

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WARRANTY

Webasto Marine Comfort

Your Webasto heater is covered by a full Manufacturer's warranty covering defects caused by faulty manufacture. This warranty period is 24 months from the point of purchase.

Claims cannot be accepted where faulty installation has caused failure.

The warranty does not cover damage through water ingress, external force, incorrect installation or misuse.

Repairs, both during and after the warranty period, should be carried out by an authorised Webasto dealer only. Claims for repairs carried out by other than an authorised Webasto dealer cannot be accepted.

These conditions do not affect your statutory rights.

If you have any doubts as to who is your local dealer, please do not hesitate to call Webasto. We will inform you of your local dealer, who will be pleased to give you any further information with regard to your heater, or carry out any work or repairs you may require.
All warranties are subject to the specific exclusions detailed below:

- Bulbs, line fuses, fuel filters, overheat fuses, drive belts, glass panels, refrigerant, receiver drier and lubricants. (Unless their loss, damage or failure, has been caused by a defect that falls within the scope of the warranty cover as detailed above).

- Glow plugs, burners, gaskets and seals normally replaced during routine servicing, will not be covered by the warranty, either to qualify for, or within the duration, of any specific warranty period.

- Travelling time and mileage incurred in order to affect repairs, (unless the installation of the product is such that it cannot practically be taken to an authorized repair centre).

These exclusions also preclude any claims for labour associated with the diagnosis, or repair, of any defects falling wholly within the scope of the exclusions.

Warranty cover does not apply if the product was not correctly installed (except as detailed above); is used for any purpose other than that for which it was designed; has been subject to misuse or neglect in any way; has been modified without the prior approval of Webasto product UK Ltd; has been fitted with non genuine parts; or has been serviced or repaired other than by a person approved by Webasto Product UK Ltd.

Warranty cover commences upon the date of purchase of the product, or of the equipment into which the product is installed from new. All warranty claims must be presented with proof of purchase of the product.

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SERVICE

Don't guess … seek advice!

Your local authorised Webasto dealer will be pleased to help. Check first to determine whether 'call out' charges may be applicable.

Regularly check your Webasto heating system for the following points:-

- Corrosion on electrical terminals … clean and spray with an inhibitor as necessary
- Clean running at the exhaust … if not, call an authorised Webasto dealer
- Ensure that the exhaust outlet and combustion air intake are 'free' and not blocked or damaged … repair or replace as required.
- Ensure sufficient water is in the header tank if a tank is used, or check the system pressure gauge if a the heater is fitted to a pressurised system. Do not let either type of system run dry.
- Periodically check the water specific gravity and top up as required with a 75% water 25% anti-freeze mix .
- Run your heating system during the summer, if only for a few minutes each month, to check that it is operating satisfactorily and to avoid 'old' diesel collecting in the fuel lines. This avoids acidity which can destroy components.

Every alternate season, it is recommended that an authorised Webasto dealer tests the heater system, and if required, any carbon deposits can be removed from the heat exchanger.

If the heater takes in sea water or water from a hose whilst cleaning the boat, - seek the advice of a Webasto dealer immediately.

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TECHNICAL DATA
THERMOTOP C 12v

Webasto Marine Comfort

Heater	Operation	Thermotop C
Type		Water heater with evaporator type burner
Mark of Approval		~S289
Heat Output	Full load Part load	5.2kW 2.5kW
Fuel		Diesel - EN590 Gas Oil - BS2869A2
Fuel Consumption	Fuel load Part load	0.59 l/h 0.30 l/h
Rated Voltage		12 Volt
Operating Voltage Range		9.75…15 Volt
Rated power consumption with circulating pump (without vehicle fan)	Full load Part load	32 W 18 W
Max. permissible ambient temperature: Heater: - operation - storage Metering pump: - operation		 -40º …+60ºC -40º …+120ºC -40º …+20ºC
Max. allowable working pressure (heat carrier)		0.4…2.5 bar
Capacity of heat exchanger		0.15 l
Minimum amount to be maintained in the circuit		4.00 l
Minimum volume flow of heater		250 l/h
CO2 content in exhaust gas (perm. funct. Range)		8…12.0 Vol -%
Dimensions of heater		Length 214 mm Width 106 mm Height 168 mm
Weight		2.9kg

Circulating Pump	4847
Volume flow against 0.14 bar	500 l/h
Rated voltage	12 Volt
Operating voltage range	10.5…15 Volt
Rated power consumption	14 W
Dimensions of circulating pump	Length 95 mm Width 61 mm Height 61 mm
Weight	0.3 kg

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TECHNICAL DATA
THERMOTOP E 12v

Webasto Marine Comfort

Heater	Operation	Thermotop E
Type		Water heater with evaporator type burner
Mark of Approval		~S316
Heat Output	Full load Part load	4.2kW 2.5kW
Fuel		Diesel - EN590 Gas Oil - BS2869A2
Fuel Consumption	Fuel load Part load	0.47 l/h 0.30 l/h
Rated Voltage		12 Volt
Operating Voltage Range		10.5…15 Volt
Rated power consumption with circulating pump (without vehicle fan)	Full load Part load	22 W 18 W
Max. permissible ambient temperature: Heater: - operation - storage Metering pump: - operation		 -40º …+60ºC -40º …+120ºC -40º …+20ºC
Max. allowable working pressure (heat carrier)		0.4…2.5 bar
Capacity of heat exchanger		0.15 l
Minimum amount to be maintained in the circuit		3.00 l
Minimum volume flow of heater		250 l/h
CO2 content in exhaust gas (perm. funct. Range)		8…12.0 Vol -%
Dimensions of heater		Length 214 mm Width 106 mm Height 168 mm
Weight		3.0 kg

Circulating Pump	4847
Volume flow against 0.14 bar	500 l/h
Rated voltage	12 Volt
Operating voltage range	10.5…15 Volt
Rated power consumption	14 W
Dimensions of circulating pump	Length 95 mm Width 61 mm Height 61 mm
Weight	0.3 kg

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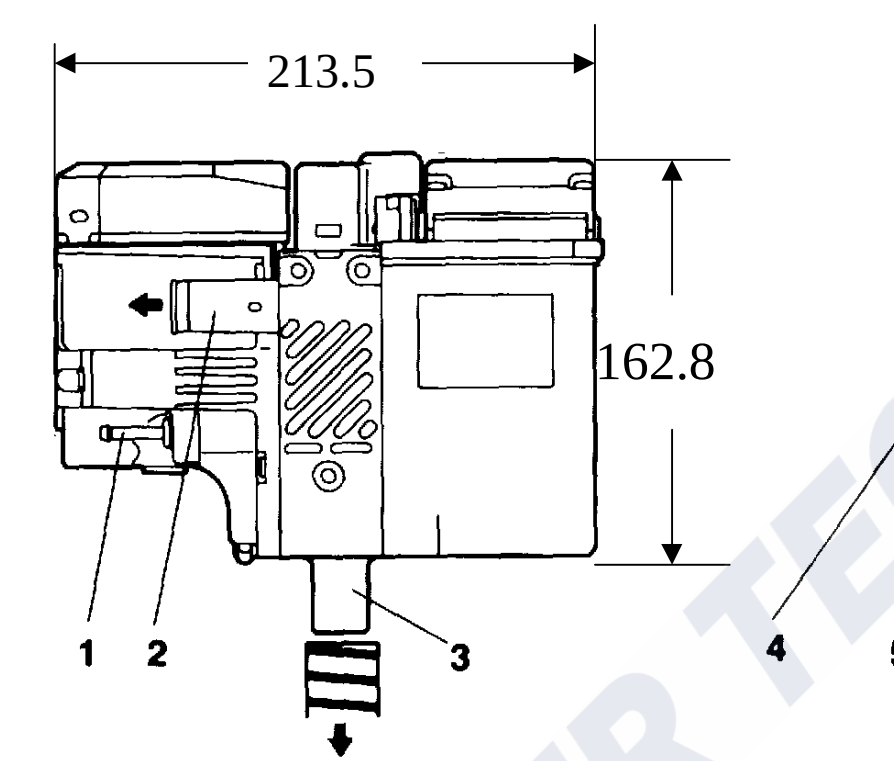
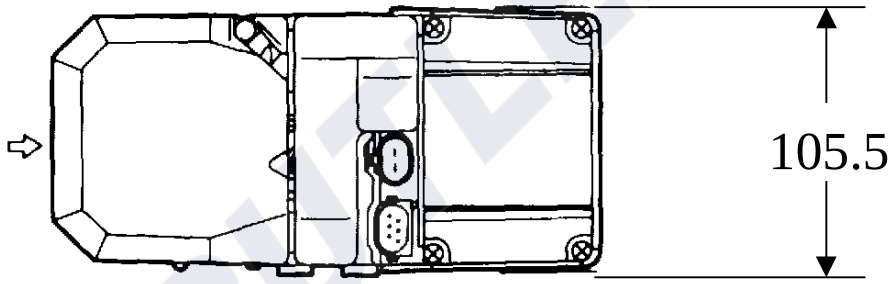
HEATER DIMENSIONS





1	Fuel Inlet
2	Water Outlet
3	Exhaust Gas Outlet
4	Combustion Air Inlet
5	Water Inlet

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THE HEATER

Webasto Marine Comfort

The Thermotop Marine Kit incorporates a diesel powered 5.2kW / 4.2kw water heater, with a capability of a variable heat output, down to a reduced heat level of 2.5kW. Heated water is supplied to the vessel's heating system, consisting of household style radiators and an option of domestic hot water is also possible with the use of a Calorifier.

The heater burns diesel fuel supplied from the vessel's main tank, the correct amount of fuel being measured and drawn by the dosing pump, prior to delivery to the heater's combustion chamber.

On arrival in the combustion chamber, the fuel is vaporised off a unique 'Ferro-Tech' burner, initially being ignited by a glowpin. Following starting the heater, combustion is sustained by the continuous vaporisation of the metered fuel delivery.

Combustion takes place within a sealed heat exchanger, and exhaust gasses are ducted to the vessel's side or transom, via a stainless steel flexible pipe and skin fitting.

Meanwhile the heater's integral water pump circulates cool water from the heating system into the heat exchanger, where it is heated and re-introduced hot into the heating system to heat the radiators etc.

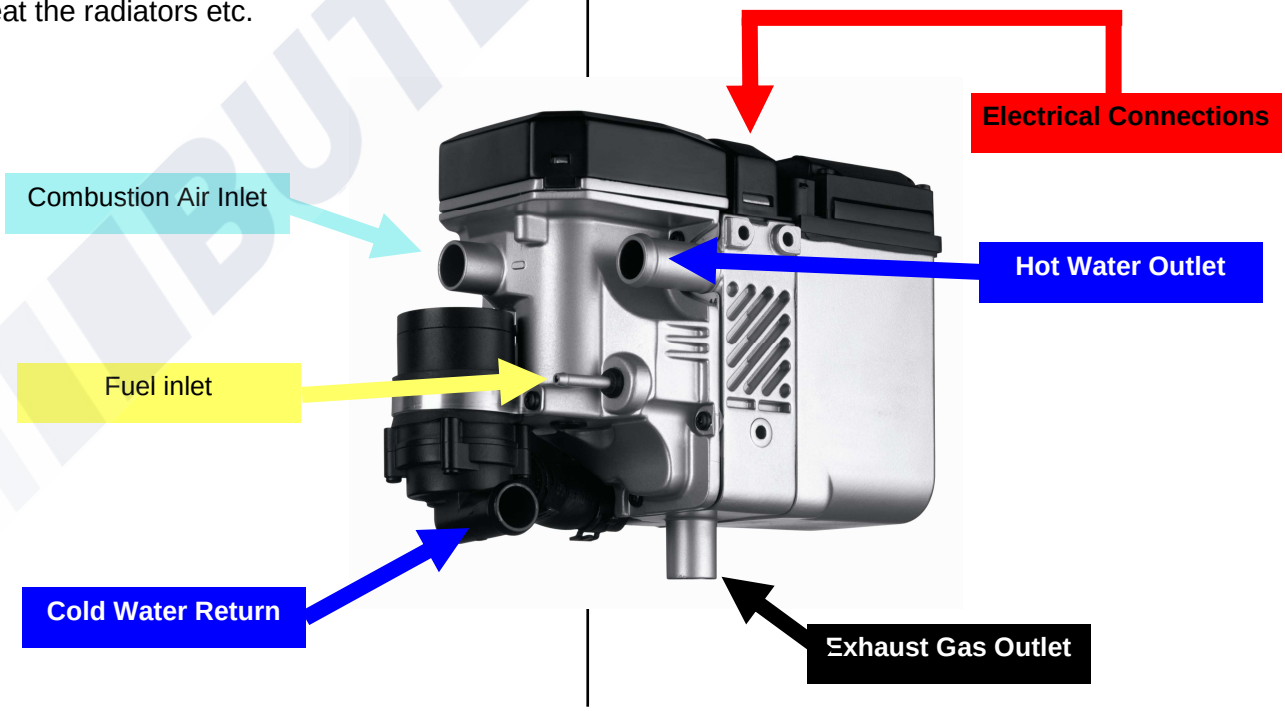
Operation of the heater is via a 3 event digital timer, which can be sited in the main cabin area. The timer also has an "instant heat" facility.

If blower boxes are used, an optional thermostat control system is available to regulate the cabin temperature.

For maximum safety, the heater has various sensors which will shut down the heater should they be activated.

These heaters are not solely used in boats; but are supported by a pedigree of military, truck, car, luxury coach and a variety of other applications.

The Thermotop C / E marine kit is designed specifically for marine users, incorporating the high technical specification required for The Inland Waterways



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POSITIONING OF THE HEATER

Webasto Marine Comfort

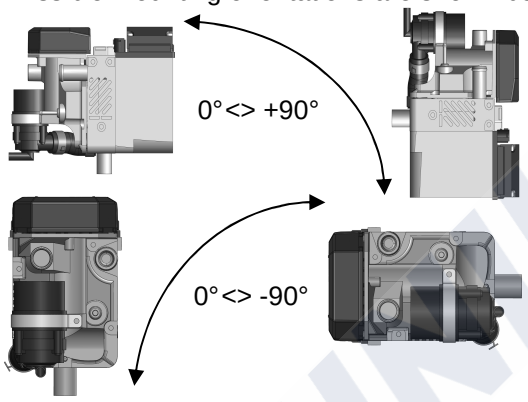
The heater requires a dry, protected area, which will not be adversely affected by seawater, excessive vibration or fumes.

The location of the heater must be well clear of any gas storage or delivery lines. When choosing the position, bear in mind stowage, conduits and service access points, steering gear linkages etc. It is also important to consider the required installation features for the Thermotop C / E heater.

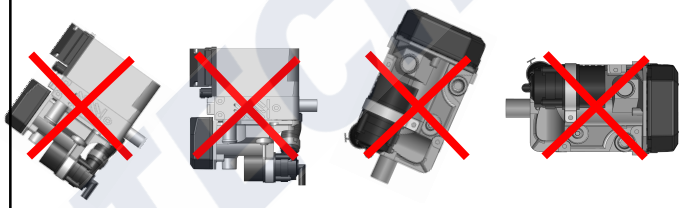
1. Exhaust maximum length
2. Exhaust outlet point
3. Combustion air maximum length
4. Combustion air inlet point
5. Access for heater pipes
6. Fuel pick-up point
7. Electrical supply

The engine room is a favoured position, where fuel, combustion air and access to the hull for the exhaust are all at hand. As an alternative, fit the heater in a cupboard in the galley, ducting the combustion air inlet to a point within the vessel not usually occupied by passengers. Avoid impinging upon stowage space or placing the heater where sails may rest on the hot exhaust system. Mount the heater level so as to avoid forming air pockets inside the heat exchanger.

Permissible mounting orientations are shown below



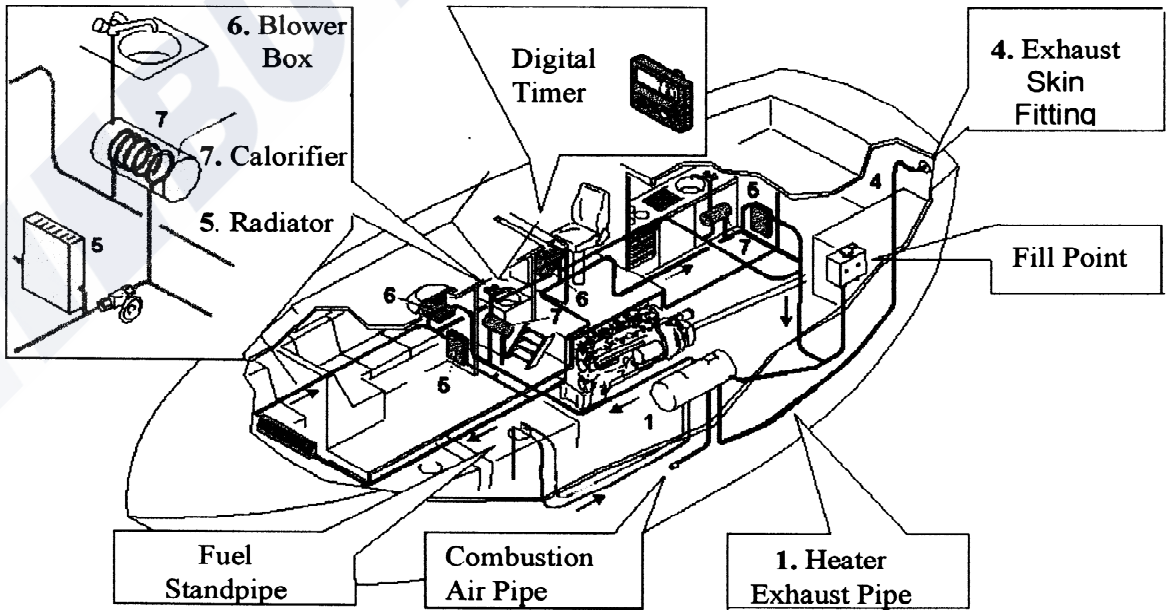
Do not mount the heater as shown below



If the heater is mounted in these orientations air will be trapped inside the heat exchanger.

The heater will be shipped with a serial number / ID label attached on one side and a duplicate spare on the other. Please mount the spare label on the other side of the heater or somewhere on the heater were it is visible.

Figure 1
Typical Water Heater System



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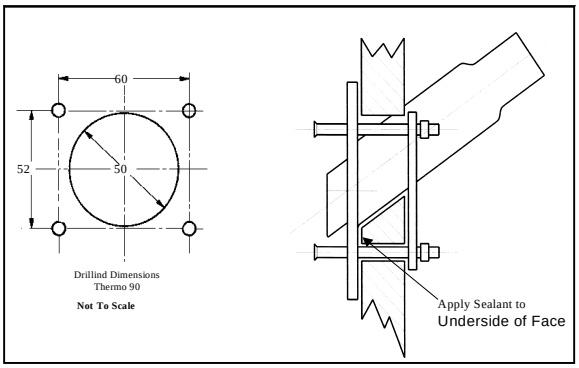
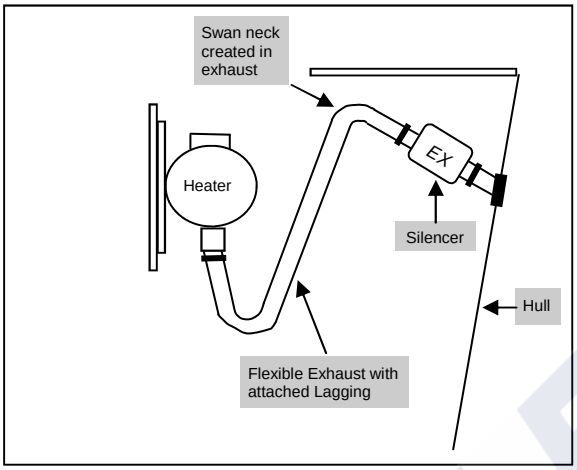
EXHAUST SYSTEM

Length of the combustion air inlet & exhaust lines in total:

With exhaust silencer:	max 2.0m
Without exhaust silencer:	max 5.0m





Exhaust Connection - Typical

Create a swan neck in the exhaust to prevent water ingress. The heater requires a dry exhaust, not water injected.

Minimum bend radius: 50mm

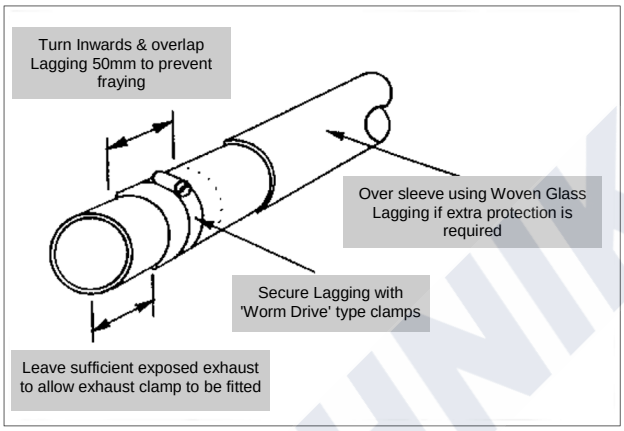
Total bends

Combustion air pipe:	max 270°
Exhaust pipe:	max 270°

For every 90° of bend in combustion air and exhaust pipes the exhaust system total length must be de-rated by 500mm.
The exhaust from the heater must not be connected to any other exhaust system.

Route the flexible exhaust, securely attached in such a way that the heat cannot affect adjacent plastic piping, electric cables etc.

The exhaust pipe should be wrapped in the woven glass protective sock and secured with stainless ties supplied with the kit. If addition protection is required, over-wrap with woven glass tape available from your Webasto Dealer.



Exhaust Insulation

The skin fitting is normally fitted on the transom or cockpit combing. The hull side is acceptable for motor boats, but bear in mind the bow wave line and beam sea risk. It must also not point in the direction of travel, or be susceptible to high land wind pressure, which may blow out the flame within the heater.

Measure the diameter of the skin fitting to be fitted and cut the hole using a hole saw.
A suitable pilot hole should be drilled first!

- Do not fit the skin fitting below the water line.
- Do fit the skin fitting as high as possible to stop water ingress
- Do make sure that exhaust clamps are tight to avoid gas leakage
- Do make sure the exhaust glasses cannot reach the combustion air intake
- Do not cover the exhaust with the heater running.

We recommend the application of a suitable high temperature sealant being used on all the exhaust connections sufficient to fill the corrugations in the flexible pipe ONLY but not enough to block or impair the exhaust system.

We recommend the use of Webasto PC diagnostics to verify the exhaust emissions of the installation. Your local Webasto agent can supply this instrument or may be able to offer a commissioning / calibration service.

For CO2 emissions refer to the table of specifications in this book.

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FUEL CONNECTION

If you are installing the heater to Lloyds specifications, Specialist advice should sought.

The Fuel system conforms to ISO 7840 & the Inland Waterways specifications when installed correctly as detailed. Always ensure only clean fuel is used. The heater is designed to run on EN590 Diesel & BS2869A2 Gasoil.

The use of fuels containing high levels of sulphur, water or other contaminants may increase the service interval required.

Several specific regulations apply including the use of flame resistant fuel pipe such as copper pipe, and fire resistant fixings. Use a sharp pipe saw and NOT a hacksaw if the supplied copper pipes are shortened. If the pipes are shortened the pipe ends must be re-flared with a suitable flaring tool as per the picture below. Ensure afterwards that the bore of the pipes are still 2mm. Use a 2mm drill bit as a gauge. Connect the flared copper pipes with the small black ISO7840 hose pieces to the Fuel Pump, Heater, Standpipe and other fuel system parts that have a barbed nipple connection and secure with worm drive clamps.

The best technique is to fit the rubber pipes on to the standpipe, fuel pump and the heater nipples and then insert the copper pipe flared ends fully into the other ends of the rubbers. The reason for this is to ensure there are no gaps inside the rubber pipes that could harbour air pockets as shown below. Apply a dab of diesel to the pipe ends before assembly. This will make the installation easier and reduce the likelihood of the bore of the rubber pipe being torn and causing a blockage.

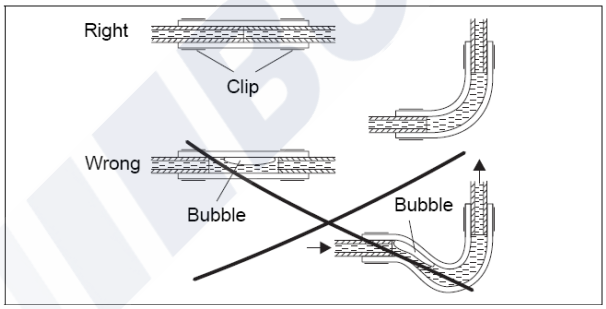
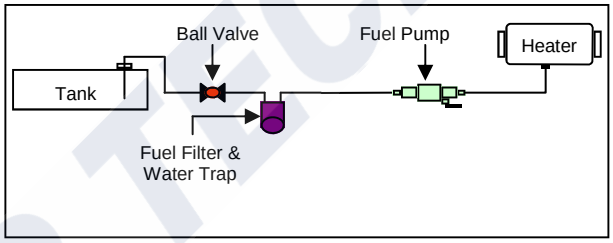


Illustration of how to insert a copper pipe into a rubber joiner.

If other pipe fittings are needed due to different fuel supply arrangements i.e. in-line filters or water traps etc other than those supplied these can be obtained from your Webasto Dealer.

Flared end of copper pipe

Follow the diagrams below for connecting the fuel supply and positioning the components, noting the mounting parameters, for the fuel pump, which are critical to ensure correct operation of the heater. Mount the fuel pump using the “P” clip according to Pump Diagram. Ensure the correct direction of flow is observed. Depending upon the quality of fuel used and the point where the fuel is extracted from the vessels fuel system, an additional water separator and or fuel filter may be required prior to the dosing pump.



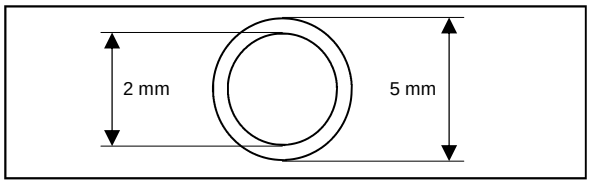
Fuel Supply System - Typical

The *Ball Valve, Filter / Separator* are optional and may not be part of your kit. All optional parts mentioned are available from your Webasto Dealer.

The copper fuel pipe used in the system should be:

2 mm Inside Diameter
5 mm Outside Diameter

The copper pipe supplied with the kit meets this standard.



Fuel pipe dimensions

Ensure that the 2mm I.D. - 5mm O.D supplied copper pipe is used.
If you fit any additional filter or valves in the fuel system make sure the pipes / hoses are flared copper and are connected with ISO7840 50mm long hose sections clamped at each end.

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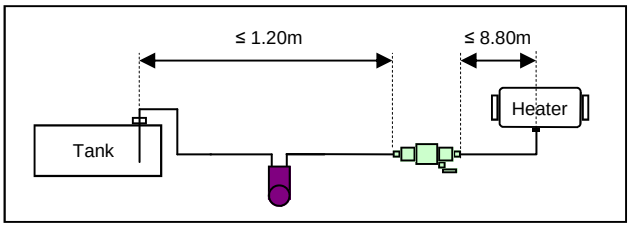
FUEL CONNECTION
(Continued)

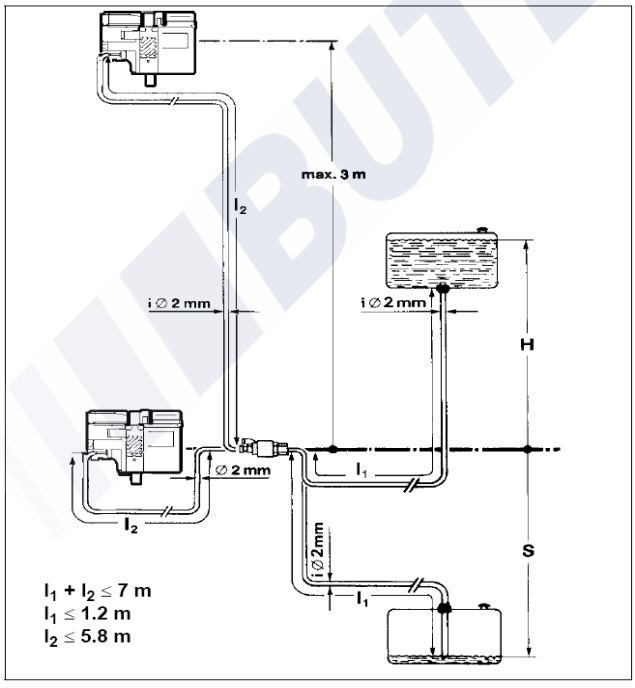
The suction hose length, (Fuel Tank to Fuel Pump) including the pick up pipe length, (if applicable) should be no longer than 1.20m, use the 1.2m copper pipe supplied.
The maximum height of the Heater above the Fuel Pump should be no more than 3.0m.
The Fuel Pump Must NOT be mounted above the heater or any exhaust pipe.



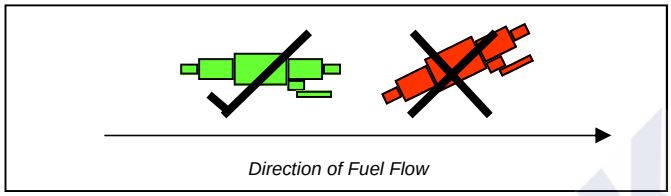
Fuel System - Pipe Maximum Lengths

All fuel lines must be correctly installed and securely mounted and protected against heat, impact and abrasion damage.

Fuel Pump mounting orientation is critical to correct performance. Mount horizontally using anti vibration clip with electrical connector inlet orientated downwards as shown in drawing below. Do not mount close to heat sources, (engines or exhausts). Ensure pump is mounted to avoid mechanical damage. The pump must not be mounted more than 3m below the heater. Refer to the drawing below for the correct heights etc.



Fuel System - component heights

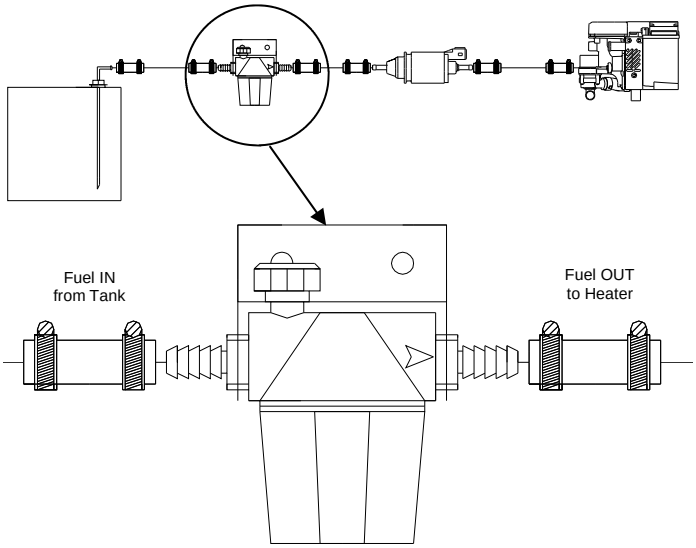


Fuel Pump Orientation

Ensure the fuel lines are installed securely with rubber lined P-Clips and routed in such a way that they will not suffer from mechanical damage.
Do not install the fuel lines adjacent to any heat source. Do not clip the fuel lines to any exhaust system. Do not clip any wiring harness or cable to the fuel lines. When route the pipes try to avoid forming tight angles in the copper pipe. All bends must be gentle and sweeping with a large radii.

Ensure the fuel lines are installed securely with rubber lined P-Clips and routed in such a way that they will not suffer from mechanical damage.
Do not install the fuel lines adjacent to any heat source. Do not clip the fuel lines to any exhaust system. Do not clip any wiring harness or cable to the fuel lines. When route the pipes try to avoid forming tight angles in the copper pipe. All bends must be gentle and sweeping with a large radii.

When fitting the optional fuel filter (Sub-kit 4110766A). mount the fuel filter in between the standpipe & fuel pump. Observe correct orientation as shown below! The mounting bracket should be installed as shown below with the bracket holes sitting on top of the hose tail flats. When fitting the hose tails to the filter body DO NOT use PTFE tape! Use a liquid sealant e.g. Loctite 572



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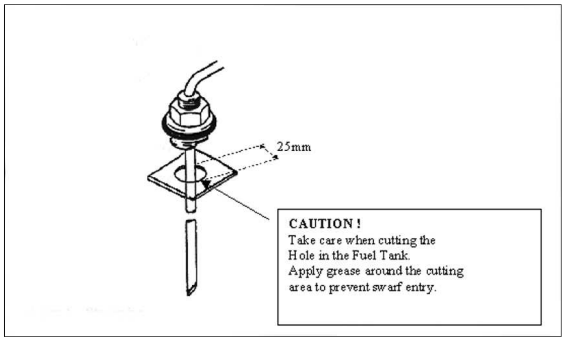
FUEL STANDPIPE CONNECTION

When fitting the Webasto standpipe drill the fuel tank using a “25mm” hole saw, or using a cone cutter in preference to filing. **Note:** before drilling, grease the top of the fuel tank around the intended drilling area to collect any swarf which will be present.



Webasto Standpipe

Ensure that the aforementioned guidelines are referred to when choosing the positions of components, such as the heater and fuel pump.

Link the fuel supply from the standpipe to the fuel pump and from the pump to the heater using the copper Fuel pipe with the black hose sections as unions as described previously. Remember to Flare the copper pipe ends if any pipes have been shortened. Remove any burrs from the Fuel pipe using a small file and blow any swarf out of the pipes prior to fitting.

Lay the fuel pipe straight, preferably running gently upwards towards the heater to ease the bleeding of any air in the fuel line. Avoid tight radius pipe bends as these cause a resistance in fuel flow. It is preferable to have a wide radius bend.

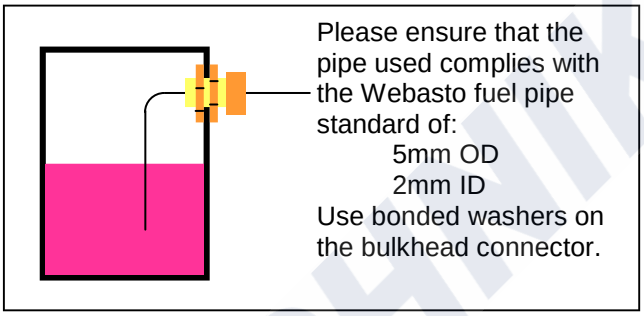
Securely clip the pipes at frequent intervals, away from any heat source.

Please note if any other pipe fittings or inline Valves or Filters etc are fitted into the fuel line that contain compression fittings make sure they do not contain brass olives as these are too brittle.
Only use copper olives. When using copper olives there is less chance of distorting the copper pipe.

If the supplied standpipe is too long for the fuel tank ascertain the correct length, (normally 4~5 inch from tank bottom) then using a very sharp knife blade score the pipe diameter and snap the excess off.

Ensure the standpipe is leak free after installation.

It is possible to use instead of the Webasto standpipe a piece of pipe that complies with the Webasto standard of 5mm OD & 2mm ID. Below is a picture of how this can be achieved using readily available parts.



Alternative Standpipe

A suitable hole needs to drilled to suit either a through bulkhead connector or a weld in place threaded 'bush'. If a bulkhead connector is used, use bonded washers, (doubtless seals) between the metal of the tank and the connector shoulder.

If it is decided to weld in a bush, make sure the male insert has a tapered thread.

Thread a piece of pipe to the specification detailed above through the fitting into the fuel tank.
Bend at 90 degrees taking care not to kink the pipe and collapse the internal bore.

Tighten up the nut and olive to secure the connection. Do not over tighten the fitting and crush the pipe.

A fuel resistant thread sealant must be used on both options. Do not use PTFE tape!

Ensure the penetration into the fuel tank is leak free afterwards.

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COMBUSTION AIR INTAKE

Webasto Marine Comfort

Do not extract combustion air from passenger compartments.

The heater is supplied with a length of combustion air pipe. This should be placed in such a position to provide dry, cool air to the heater unit. Always fit pipe!

If mounted in the engine room, ensure that no foreign bodies enter the intake pipe.

Avoid mounting the pipe in such a manner that drive belt dust could enter the heater!

Do not let the pipe hang down if a potential exists for bilge water to enter the pipe if the vessel heels over in heavy seas.

The combustion air pipe supplied is the maximum length permitted and should not be extended.

Do not extract combustion air from the vessel's engine air intake or filter system.

Fit the round black combustion air silencer to the end of the pipe and securely mount.

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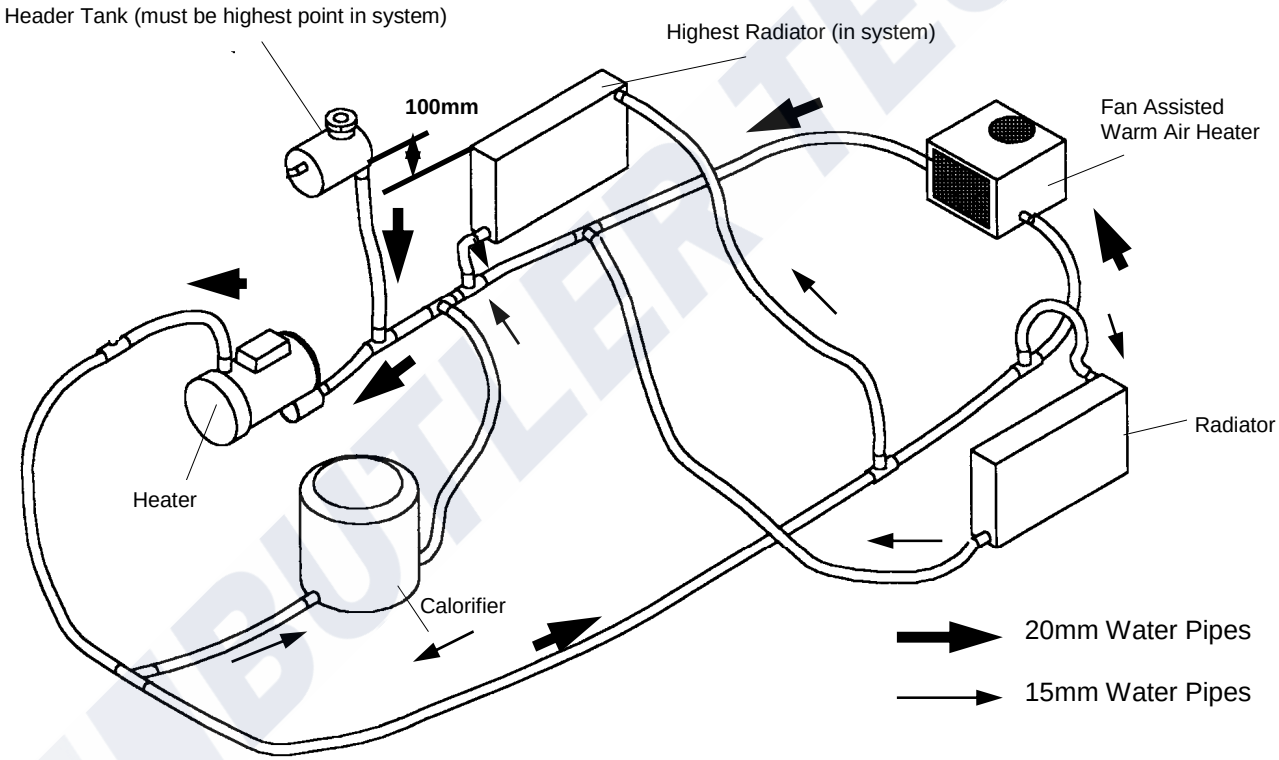
WATER PIPES

Non-Pressurised System

The Thermotop C / E marine kit includes a Water Header Tank and rubber hoses suitable for connection to 22mm pipe work. As numerous systems are used on vessels, no other pipe work is supplied as standard.

Pictured below is a Thermotop C / E marine kit installed as an un-pressurised independent closed system, an example is shown below. However, with modifications it can be used to provide engine pre-heating or to operate an independent un-pressurised system.

TYPICAL WATER CIRCUIT WITH HEADER TANK



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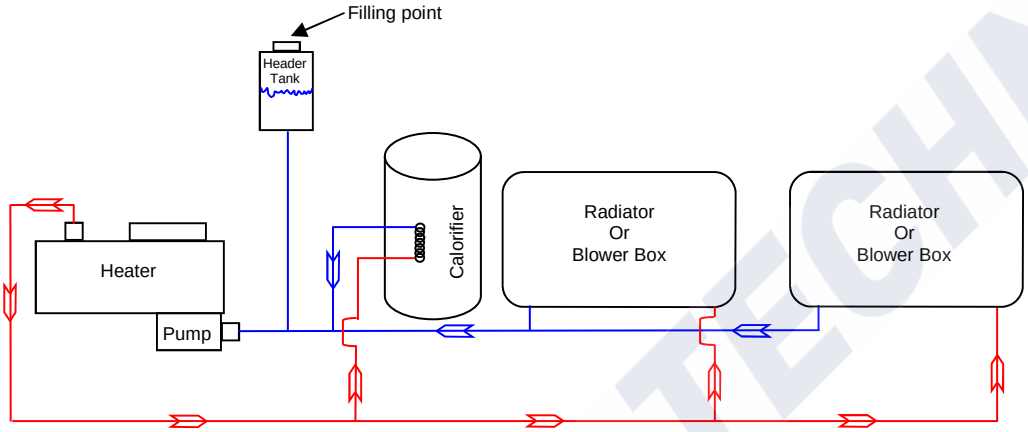
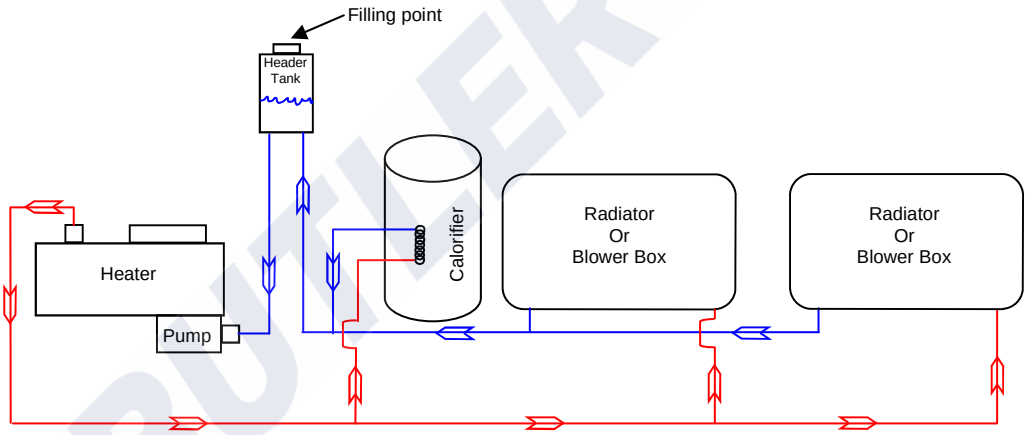
PLUMBING OPTIONS
WATER

The hot water plumbing arrangements can use typical domestic components, i.e. pipe, elbows, tees etc. The heating system flow and return lines, (called the 'spine') need to be made up with 22mm OD pipe, Copper, Hep2o, Speedfit etc. The heater is supplied with a length of 22mm ID rubber hose, cut this hose to suit and interface into the spine with 22mm pipe and jubilee clips or use threaded hose tails connected to push fit fittings or compressions. The radiators can be connected as shown using 22x15x22 unequal Tees. Good plumbing practice Rules! Try to keep elbows to a minimum, use swept bends where possible. Try to ensure a gentle rise on the flow and return pipes to ease the commissioning process as air locks in pipe work installed behind joinery can be problematic to overcome! These rules apply to both non-pressurised and pressurised systems

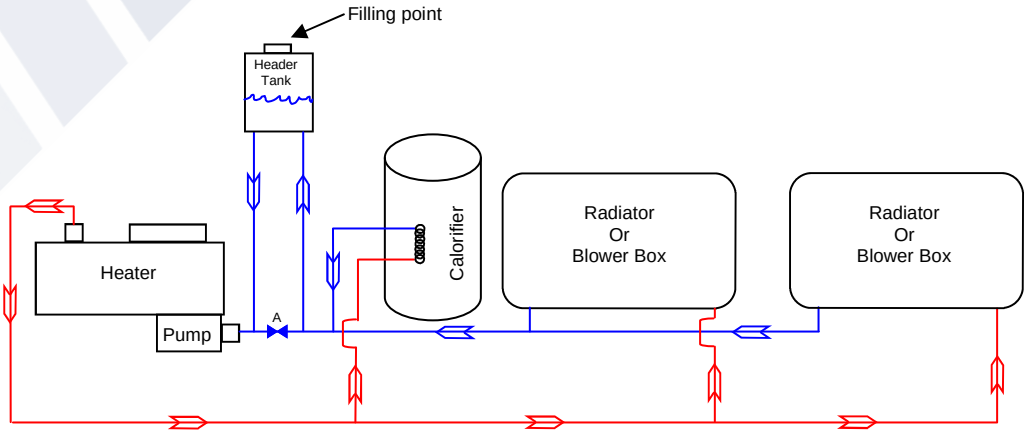
Examples of typical non-pressurised gravity plumbing arrangements.



Example 1. Gravity system with a one pipe header tank.



Example 2. Gravity system with a two pipe header tank.



Example 3. Gravity system with a two pipe header tank and bypass valves

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PLUMBING OPTIONS
WATER (non-pressurised)

Webasto Marine Comfort

All these systems are filled via the header tank with a mixture of 75% Water & 25% Glycol.

Example 1. Gravity system with a one pipe header tank.

By far the simplest gravity fed system.
Quick and easy to fill up with coolant.
The header tank is connected via an equal T piece in the return line of the heating spine within about 30cm of the coolant pump inlet.
This is the quickest and most cost effective system to install with regards to material costs.
However, it is by far the most onerous system to commission.
The main drawback of installing a one pipe header tank system is the difficulty in removing the air from a dry system during commissioning.

Example 2. Gravity system with a two pipe header tank.

Similar to the first system but instead of relying on air to naturally travel up one single pipe via a T piece, this system deliberately circulates water through the header tank to remove large amounts of air. The tank is plumbed into the system as in example 1 above but instead of the T piece, the pipe is cut and an elbow is fitted on each end and two pipes are run vertically up to the header tank.
With this type of arrangement all the large pockets of air will be taken from the system.
There are two problems with this system, firstly, when the visible air bubbles have been removed there is no reason to waste energy pumping water up to the tank and then back down. The header tank ends up being a radiator! Secondly, the water turbulence is constantly introducing micro bubbles into the water. These air bubbles act as an insulator and reduce the thermal efficiency of the water that's being circulated.

Example 3. Gravity system with a two pipe header tank and bypass valves

The header tank uses two vertical pipes, one in and one out as in the above example
However, the two vertical pipes connect to the spine via 2 Tee pieces.
In between the two Tees, a ball valve is fitted.
The reason for this is to speed up the air purging as in example 2, but to also negate the formation of micro bubbles.
How it works. When the system is dry and being commissioned we need to get as much air out of the system as possible so we Close Valve A. This forces the water up into the header tank and back down to the circulation pump and is a good performance indicator of the air / water content during the commissioning process. When all the visible air bubbles have been removed Open Valve A. The micro bubbles will now eventually vent from the water and into the header tank. As opposed to example 2 the header tank in this system no longer acts as a radiator or imposes any additional flow resistance.
This is the most efficient non-pressurised header tank system.

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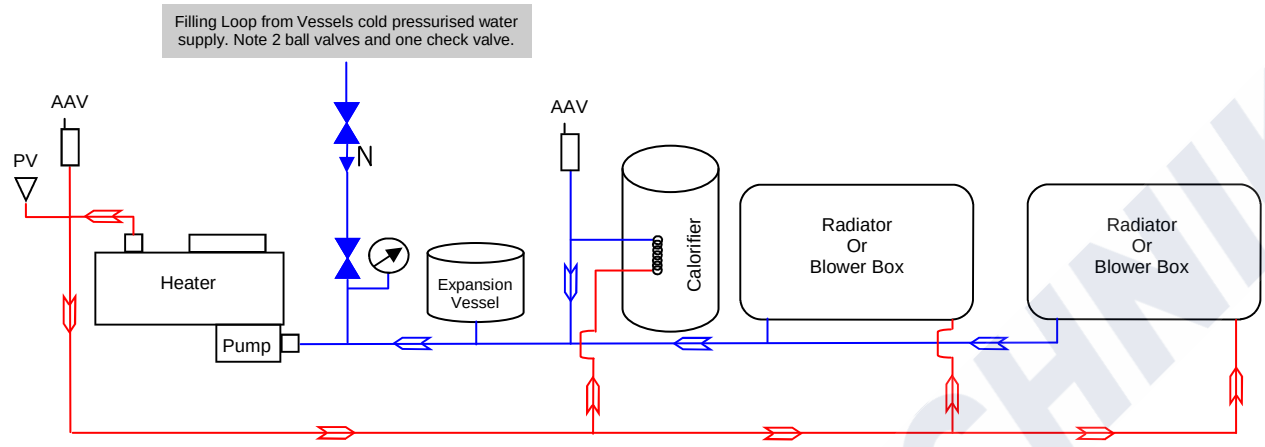
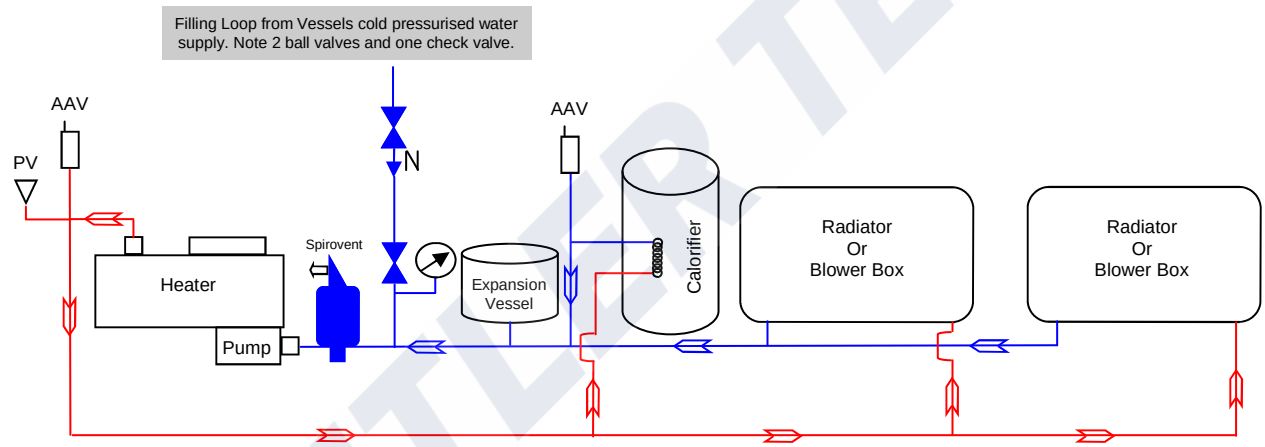
PLUMBING OPTIONS
WATER (Pressurised)

Examples of typical Pressurised plumbing arrangements.



Example 1. Typical Pressurised system using Auto Air Vents - (AAVs).



Example 2. Typical Pressurised system using Auto Air Vents - (AAVs) & Spirovent

Note the inclusion of the Pressure Relief valves, (marked as PV). One of these should be mounted in the hot water outlet pipe no more that 30cm away from the heater. Preferably at a high point.

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PLUMBING OPTIONS
WATER (Pressurised)

Example 1. Pressurised system with AAV's

This is the most efficient, reliable and robust system and is most suitable for a marine installation. There is no need for a header tank to be fitted and therefore radiators can be installed at any height in any position. This is especially useful when installing a system in a boat with decks on different levels.
The air purging and filling process is very easy and straight forward.
There is no need to top up any header tanks.

To charge the system a 'filling loop' or connection to the vessels pressurised water system is required. As indicated in the drawing, two ball valves and a non return valve are required so as to prevent any glycol contamination of the vessels cold water supply.

An expansion tank is connected via a T piece to the return spine close to the circulation pump return. This tank has inside a rubber bladder that should be delivered pre charged to 3 bar.
In between the above mentioned tank and pump, the 'filling loop' is Teed into the return spine also, as seen in the diagram.

A pressure gauge is fitted to indicate the system pressure.
When filling this system for the first time proceed as follows.
Pre mix the water / glycol.
Remove one of the vent caps from each radiator, (the threaded boss that holds the bleed screw on the radiator). One radiator at a time.
Make sure both the valves on each radiator are fully open.
Carefully fill each radiator as much as you can with this pre mixed fluid and replace the threaded boss on each radiator. Now the system should be almost full.
With the filling loop connected open both the valves on the filling loop pipe and watch the pressure gauge. Fill to 1 bar (14.5psi). You will probably hear air escaping from the auto air vents, this is normal.
Now the system is under pressure, open each radiator in turn and bleed any trapped air.
Recharge and repeat as necessary.
Switch on the heater so the pump is circulating and check the pressure gauge and recharge the water system up to 1 bar if required.
Ensure both the valves on the filling loop are turned OFF when filling has been completed.

DO NOT overcharge the system above 1 BAR (14.5 psi) when cold.
It is normal when the system is up to full operating temperature for the pressure to rise up to 1.5 BAR (21.75psi) ± 5%.

Example 2. Pressurised with AAV's & Spirovent
Exactly the same system as above but with the addition of a Spirovent unit that will remove the micro bubbles quicker than AAV's alone.

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PLUMBING OPTIONS
WATER (Hints & Tips)

Webasto Marine Comfort

In order for the heater to work effectively a few simple rules need to be adhered to.

The heating circuit the Webasto is connected to is very similar to a domestic installation with a hot water cylinder and radiators but with a few subtle differences.

Supplied Water Pump.
The water circulation pump is physically small compared to a domestic pump such as those made by Grundfoss or Wilo and consequently the flow rates are smaller also. It is not permitted to fit a larger capacity pump, the supplied pump must be used. The supplied pumps flow characteristics are matched to the heaters thermal transfer properties.

Do not use Thermostatic Radiator Valves.
Only use standard lock shields on the radiators. TRV's will cause differential pressure problems that will effect the balance of the water flow and consequently have an effect on the heater with regards short cycling.

Correctly load the heater.
If the heater has a maximum output of 5.2Kw, (Thermotop C) then it is advisable to have a load 10% greater than the heater output. In the case of the Thermotop C the desired loading should be approximately 5.7Kw. This will ensure that the heater will fire at full load for longer and the amount of time idling will be conversely less. Operating the heater in this manner will yield a greater lifespan of the burner and increase the interval between services.

Blower boxes.
Try to avoid installing blower boxes as they are not really suitable for use with these types of heater. The problem is that nobody manufactures a blower box specifically for hot water applications. The technology is derived from air-conditioning where it is desirable to have a long winding flow across the matrix to evaporate all the gas and to dehumidify the cabin. To use this same technology for heating will never work effectively as we need a buffer of water at each end of the matrix so there is parallel flow across the whole of the matrix and therefore a small Δt, (delta t, the temperature difference between the flow & return). With the standard air-conditioning derived units the Δt will be unacceptably large by the time the liquid has exited the matrix because of the distance the liquid has to travel.

Balance the system
Balance the radiators with the lockshields and remember to fit a lock shield / balancing valve to the Calorifier coil outlet pipe. Also, do not pipe the Calorifier in series with the spine.

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PLUMBING OPTIONS

WATER (Hints & Tips)

Webasto Marine Comfort

Glycol, (Antifreeze) Percentage of concentration.

As with any type of water heating system it is necessary to add some kind of corrosion inhibitor. In the case of Webasto diesel marine water heater we use ethylene glycol otherwise know as glycol or antifreeze. The antifreeze must be glycol and NOT methanol based. The other important issue to remember is using the correct quantity. For Webasto heating systems we recommend a glycol content of 25% maximum. The reason we need to add glycol to the heating circuit is to prevent corrosion and freezing. The only drawback to using glycol is that it is not a very good vehicle for carrying heat so we only use 25% maximum. It is the water that gets hot and not the glycol. If we used 100% glycol the radiators would take an extremly long time to get up to temperature if at all!

Glycol Pre-Mixing.

Be absolutly sure to pre mix the glycol & water before filling the system as the glycol will not mix on its own without assistance. If the glycol is not pre mixed there will be slugs of hot water and cool glycol circulating around the system.

Additives

Please do not add any additives to the water cooling circuit. The only things that are permitted inside the heaters hot water circuit are : Water and Glycol. Do not add any additives for instance 'leak cures' or other 'plumbing fixes in a bottle'. It's a pointless exercise fixing symptoms, fix the problem. If you have a leak then you need to fix the leak!

Types of Pipe.

If your going to use Hep2o pipe then use Hep2o fittings and pipe liners. Likewise if your using JG Speedfit use JG Speedfit fittings. Do not mix and match different brands. Chrome pipe should be avoided when using any push fit pipe fittings. The problem with chrome is that its an extremely hard metal and the push fit fittings cannot bite into the chrome and consequently when they are under pressure they will pop off and you will get wet.

Pipe Preparation.

Use they correct tool to cut the pipe, copper pipe use a pipe saw, plastic pipe use a plastic pipe cutter such as those made by Hilmor. Do not use a hacksaw.
If plastic pipe is used then always fit the push in liners.
When the heating circuit is completed, prior to connection to the heater make up some temporary tails and affix to the heating spine to flush out any installation debris / dirt that may have found its way into the system.

Bleed the water system

Ensure that all the air is bled from the water circuit and the header tank level is maintained or if a pressure system is used make sure the pressure remains constant as the air is been expelled.

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Webasto Marine Comfort

ELECTRICS

Please check the rating plate voltage on the heater and ensure it is the same as your vessels DC power supply.

Each heater is supplied with a pre wired harness to suit the Thermotop C / E heater's specific requirements. It is, therefore not recommended that modifications to the wiring harness are carried out without prior consultation with Webasto's Technical department.

It is essential that all electrical connections are installed correctly. Loose or dirty connections will cause a high resistance in the wiring. This in turn may cause under-voltage at the heater.

The Thermotop C / E electrical system comprises of one main wiring harness but has five distinct sections which are labelled accordingly.

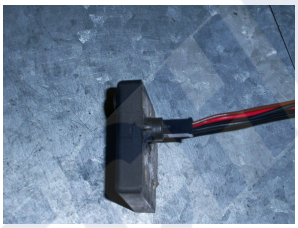
Installation Procedure for the Harness

When the heater, fuel pump and timer have all been mounted start off by clipping the two fuse carriers together and then attach these to a secure position with the small bracket / clip provided.
Then with the batteries isolated proceed to connect the harness to the individual components in the following order.

1 Plug the two multi core plugs into the top of the heater, labelled 'Heater'.

2 Plug the cable labelled Fuel Pump into the fuel pump.

3 If your heater kit is supplied with the square black Webasto timer proceed as follows. Plug the small square plug labelled Timer / Programmer into the timer. Note, the 2 wires (Brown & Purple) adjacent to this plug are not normally used and need insulating and tying back.



* If your heater is supplied with a rotary On/Off switch you will have a small adapter wiring harness that goes in between the switch and the small plug on the main harness.

4 The wire marked +VE Supply or RED is connected to the battery isolator switched side.

5 The wire marked -VE Supply or BROWN is connected to the battery negative terminal or the Load side of the Shunt if one is fitted.

The electrical side of the installation is now complete.

The small yellow wire marked 'Diagnostic' is for Webasto Service only and must not be connected to the vessel, (Webasto USB Diagnostics Tool).

Refer to the schematic diagram for the fuse sizes.

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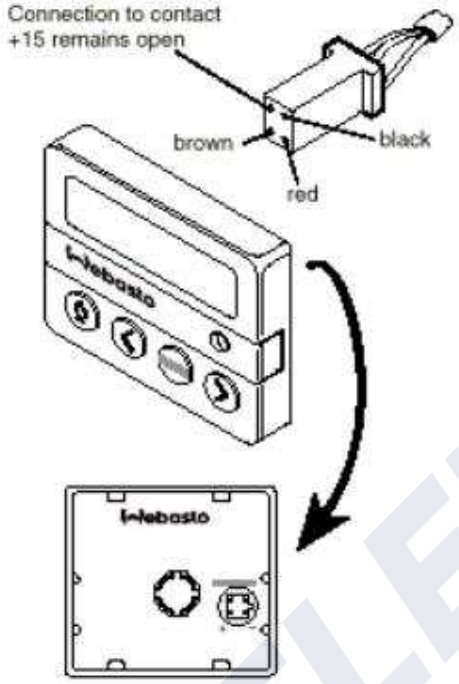
ELECTRICS
(Timer Override Supplement)

Webasto Marine Comfort

The standard non marine Thermotop C / E heater wiring harness is not configured to run continuously. If you have purchased the dedicated kit the small square black plug for the programmer should have four wires already attached. If you only have three wires refer to the drawing below.

Timer Overide

Webasto Feel the drive



The standard scope of supply for the Thermo Top timer is either a 30 minute or 60 minute version. These are identified by the colour of the display.
Red display = 60 minute operation.
Green display = 30 minute operation.

The Timers can be modified to allow continuous running for applications such as marine etc.

The override is activated by applying a 12v positive feed onto pin +15 of the Timer which is the spare pin usually left open contact.

Option 1 – Permanent override

Connect a cable into pin +15 & splice into the black cable from pin +. This has the effect of, when the timer is switched on the output activates the heater & also signals the override. A switch could be used on the +15 signal wire to decide whether 1 hr (switch contacts open) running or constant (switch contacts closed) running.

Option 2 – Time Delay

Connect the override cable to an ignition source (e.g. cig lighter). This will give the function of override only when the ign key is in auxiliary position. When the key is removed & the vehicle is locked the override is disconnected allowing only the maximum running time of the Timer.

Use cable p/no – 678.69B

Red = 12v positive
Brown = 12v negative
Black = 12v switched feed to turn the heater on.

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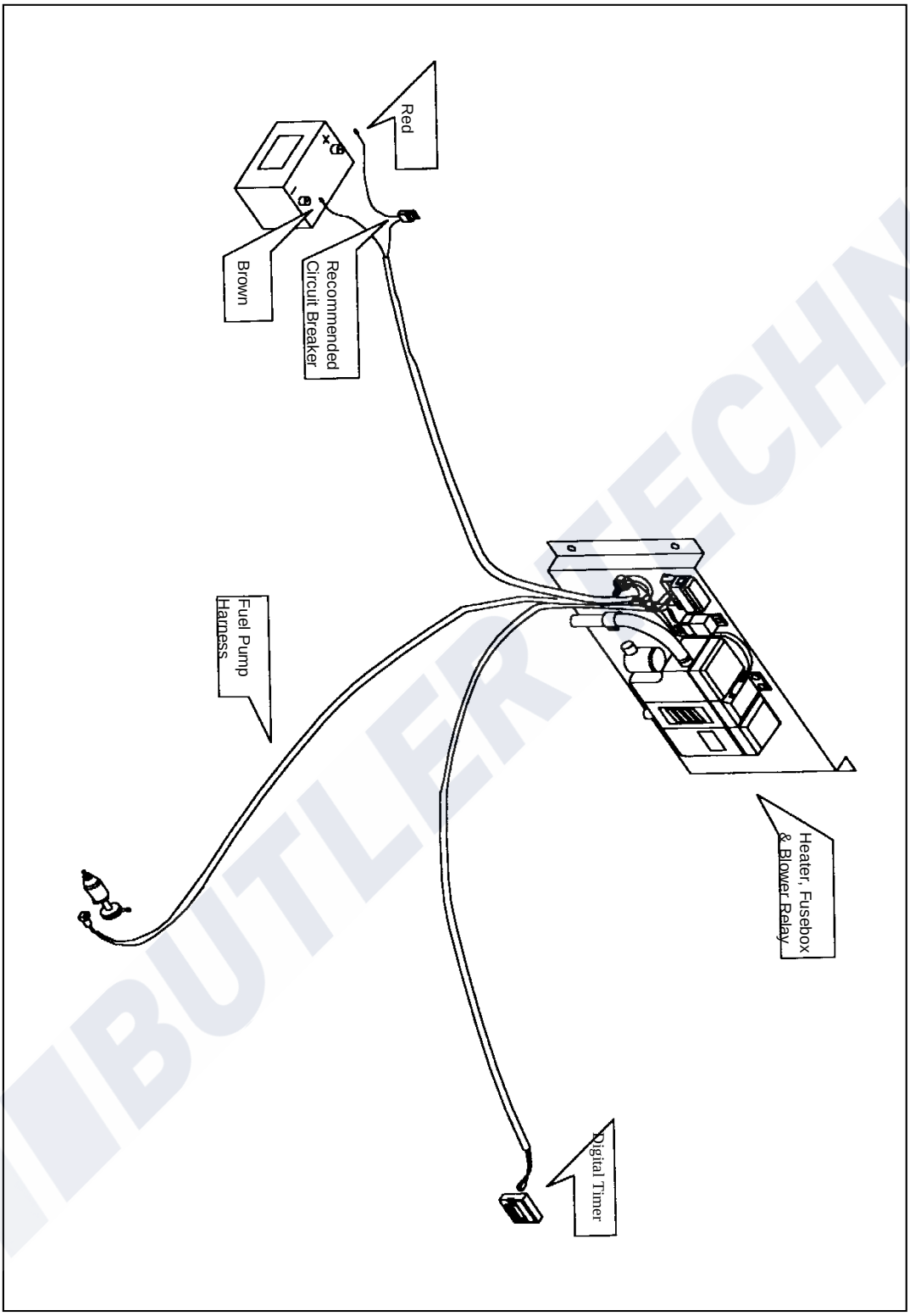
ELECTRICS

Harness General Layout



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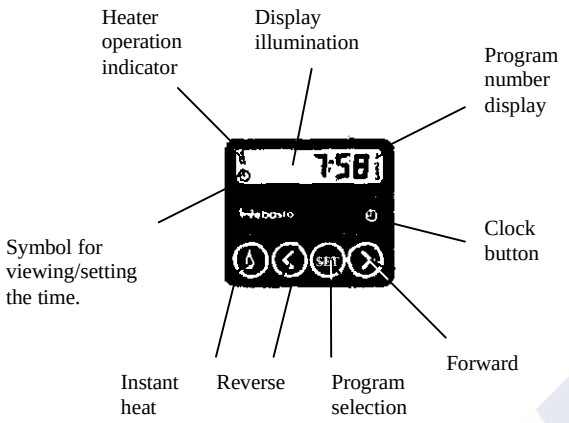
HEATER CONTROL

The Thermotop C / E marine Heater is controlled by a 3 event Digital Timer. The start of the heating operation can be precisely preset anywhere between “1 minute” up to “24 Hours”. Three starts may be programmed only one of which, however, can be activated.



Note:
Be sure to take into account the switching from summer time to winter time (and visa versa).

SETTING THE TIMER

Switching the heater on	Manually: by pressing the “instant heat” button. Automatically: by programming the heater starting time. The program number is shown on the display and the display is illuminated.
Switching the heater off	Manually: by pressing the “instant heat” button.
Setting the time of day	Press the “clock“ button and subsequently, either the forward or reverse buttons.
Viewing the time	Press the “clock” button.
Programming heater starting time	Press the “set” button. Within 10 sec. Press the “forward” or “reverse” button until the desired time of heater start up is shown on the display. If a different program number is required press “set”.
Erasing programmed times	Briefly press the ”set” button.
Selecting preset starting time	Press the “set” button within 10 sec. Periods until the program number associated with the desired preset time is displayed.

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COMMISSIONING

Webasto Marine Comfort

Upon completion of the installation, check the integrity of all joints. Fill the heating system with 75/25 water/antifreeze mixture through the fill point. Bleed as much air as possible from the system and the radiators before commencing the start up procedure.

Header Tank Installations

Check all electrical connections. Turn the isolation switch to the 'ON' position.
Switch the heater on at the operating switch. The heater will commence it's start up procedure.
Several start attempts may be required in order to bleed enough fuel through to the heater to enable start up. Satisfactory operation will only be achieved once all air bubbles have cleared from the fuel lines.

Once the heater is running, air will bleed out of the water system, and the header tank will require constant refilling to the max mark It may be necessary to bleed the radiators. Bring the heater up to full temperature and check that all air locks are bled from the heating system. Switch off the heater and allow to cool (overnight if possible), and check the water level and top-up as required.

Pressurised Expansion Vessel Installations

Pre fill the heating water system as detailed above but with 75% water / 25% antifreeze. With this system it may be necessary to fill the radiators with a filling tool or make up a pipe and inject the coolant through a radiator bleed vent. Because this system needs to be pressurised the remainder of filling will need to be done with the filling loop. Open both ball valves on the filling loop and commence filling until the pressure gauge reads 1bar (14.5psi).

It will be necessary to fill the system up and bleed all the radiators and recharge again. This process will have to be repeated a number of times.

Check all electrical connections. Turn the isolation switch to the 'ON' position.
Switch the heater on at the operating switch. The heater will commence it's start up procedure.
Several start attempts may be required in order to bleed enough fuel through to the heater to enable start up. Satisfactory operation will only be achieved once all air bubbles have cleared from the fuel lines.

Switch on the heater, make sure the pressure gauge does not drop below approximately 0.5 bar / 7psi. After a few minutes of running vent the radiators again and recharge the system with the filling loop to 1bar / 14.5psi.

Be aware that the pressure may drop during this period due to the AAV's (Auto Air Vents) if fitted. When all the air is out of the system and the pressure is at 1bar / 14.5psi turn off both of the ball valves on the filling loop.

Switch off the heater and allow to cool.
When cold, check the 'cold water pressure' and recharge to 1bar / 14.5psi if required.
Turn off the ball valves on the filling loop.

If the system is over charged by mistake the excess pressure can be removed by either bleeding the radiators or turning the knob on the pressure relief valve.

Note when the system is operating the pressure will increase by approximately 25% of the cold pressure.

Priming the fuel system

To prime a dry fuel system the heater needs to be switched ON and the heater will go through its start up procedure. During this time the air fan & the water pump will start. The fuel pump will begin dosing after a few moments. Fuel pump operation is characterised by a 'ticking' sound from the fuel pump. You will find that this can be a lengthy process and the heater will go through a number of start and shut down cycles until the fuel finally gets to the heater. For information the fuel dosing pump dispenses 0.063ml of fuel every 'tick'. Depending on the pipe lengths & the number of start attempts you may find the heater 'locks-out', to recover from a 'lock-out' situation remove the main fuse from the wiring harness and replace it after 30 seconds and the heater will be reset.

Tip: When priming the system remove the fuel pipe from the heater fuel inlet stub during priming. Be sure to catch the fuel in a suitable container. When a steady fuel flow occurs from the pipe, refit the pipe back to the heater inlet.

If the Webasto fuel filter kit is fitted, (4110766A) make sure the fuel tap is fully open, (fully anti-clockwise).

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Fuel Filter module

Servicing

Servicing the fuel filter (if fitted)

Some heater kits are supplied with a filter kit, but not all. If you do not have a filter and require one the part number for the approved filter is 4110766A. Please be aware this is the ONLY Webasto approved filter for use in a marine application.

The Webasto filter kit has been selected specifically to be used with this type of heater.
Do not fit any other type of filter as it may have a detrimental effect on the heaters operation and may not comply with the relevant standards:

ISO 7840
ISO 10088
Boat Safety Scheme (UK)
Recreational Craft Directive (EU)

The filter is a combined water trap, 44 micron washable filter element and a fuel isolator.

To service the fuel filter proceed as follows.

1 Shut down the heater and isolate the electricity supply by removing the fuse.
2 Turn OFF the fuel tap on top of the filter module by turning the round knob fully clockwise.
3 Place a cloth under the filter to catch any spillages and unscrew the filter bottom by holding the filter top section with one hand and with the other hand unscrewing the bottom section. Do not use any tools or the unit may be damaged!
4 With the filter bottom removed carefully remove the gauze filter element and the flat rubber washer. Place the rubber washer to one side.
5 Discard the contents of the filter bowl taking care not to loose the small 15mm ‘O’ ring in the base.
6 Clean the gauze element in a bowl of fresh fuel or paraffin.
7 Re-assemble the filter ensuring the 15mm ‘O’ ring is in the bottom of the filter bowl and check the flat rubber washer is placed on top of the filter element.
8 Fill the bowl with fuel and hold the filter head steady with one hand and screw the filter bowl back on to the filter head and tighten only hand tight.
9 Open the fuel tap on top of the filter module by turning fully anti-clockwise and restart the heater.
10 The heater may need to go through a few start attempts as a small amount of air will have been inducted into the supply line.
11 If during this initial start-up period the heater fails to start and ‘locks-out’ remove the main fuse and wait 30 seconds and then re-insert the fuse and switch the heater on again.
12 The heater will eventually start-up when all the air has been pushed out of the supply line but be aware that the pump only delivers 0.063ml of fuel on each pump stroke so this may take some time.

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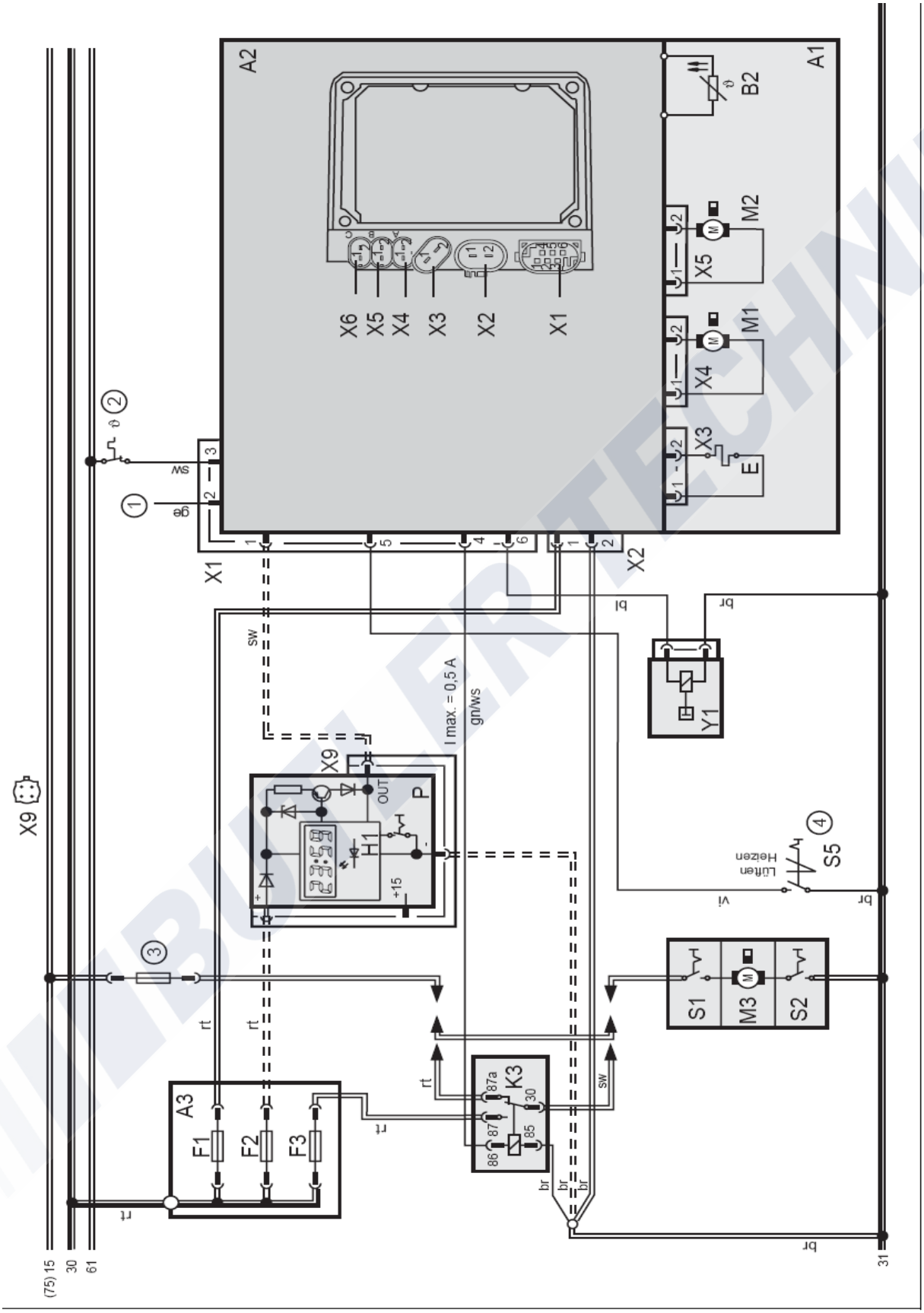
Electrical Schematic
(Webasto timer version)



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Item	Designation	Comment
A1	Heater	Thermo Top E or Z/C
A2	Control unit	
A3	Connecting box	
B2	Temperature sensor	
E	Glow plug / flame monitor	
F1	Fuse 20A	Flat fuse DIN 72581 Part 3
F2	Fuse 1A	Flat fuse DIN 72581 Part 3
F3	Fuse 25A	Flat fuse DIN 72581 Part 3
H1	LED (in pos. P)	Switch-on indicator
K3	Relay	Vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulation pump
M3	Motor	Vehicle fan
P	Timer, digital	For programmed operation
S1	Switch for vehicle fan	S1 or S2 depending on vehicle
S2	Switch for vehicle fan	S1 or S2 depending on vehicle
S5	Switch	Summer / winter switch
X1	Plug connection, 6-pole	Water-repellent
X2	Plug connection, 2-pole	Water-repellent
X3	Plug connection, 2-pole	Water-repellent
X4	Plug connection, 2-pole	Water-repellent
X5	Plug connection, 2-pole	Water-repellent
X6	Plug connection, 2-pole	Water-repellent
X9	Plug connection, 4-pole	
Y1	Metering pump	

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

Cable cross-sections		
	< 7.5 m	7.5 - 15 m
	0.5 mm^2	0.75 mm^2
	0.75 mm^2	1.5 mm^2
	1.0 mm^2	1.5 mm^2
	1.5 mm^2	2.5 mm^2
	2.5 mm^2	4.0 mm^2
	4.0 mm^2	6.0 mm^2

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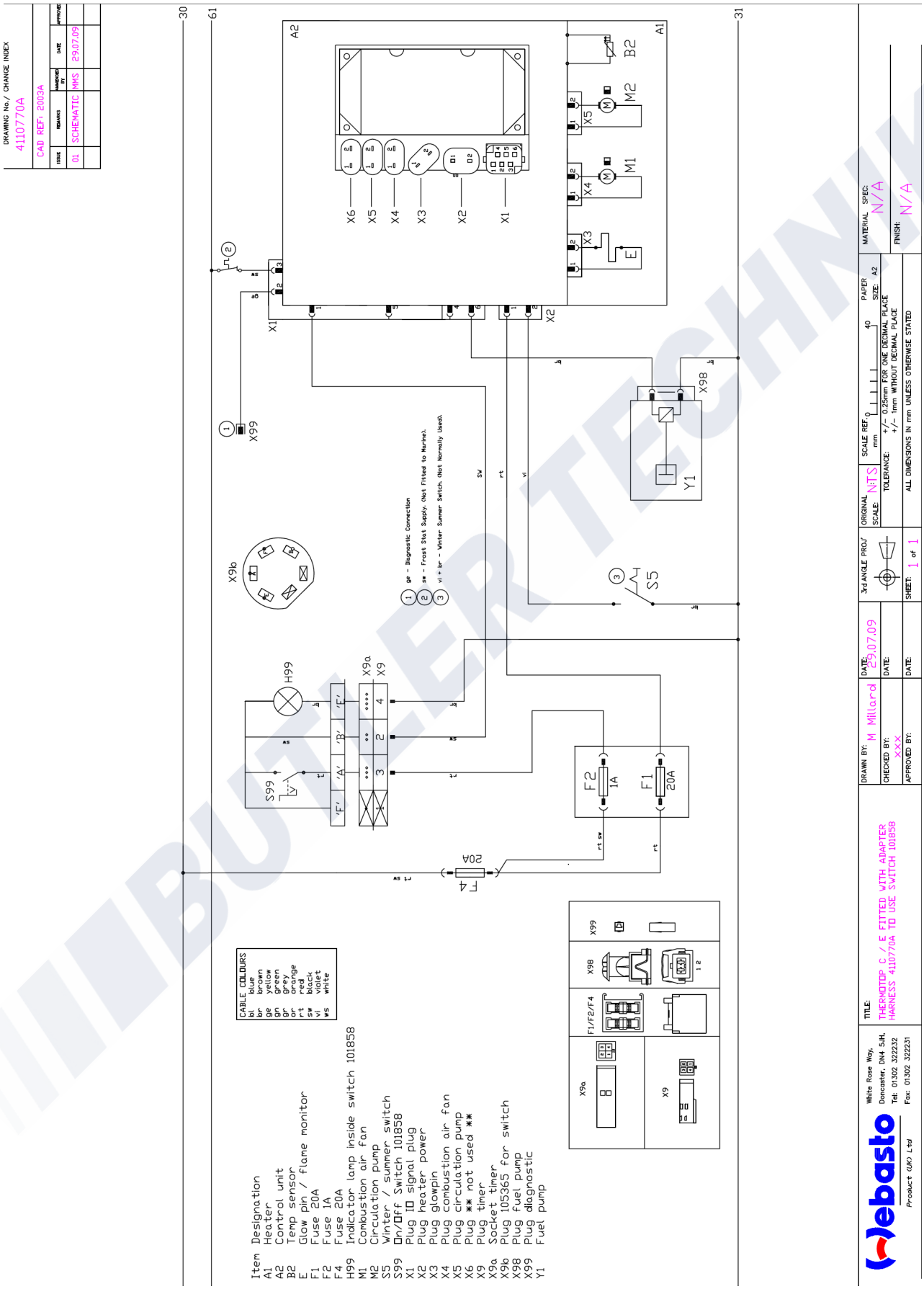
Electrical Schematic
(Rotary switch version)

Webasto Marine Comfort



Webasto Part Number : 4110310A
Issue No: 02 : 10th November 2010
Matthew Millard

Webasto Marine Comfort

Marine Water Heater Installation Checklist

	Installation Check Points	Yes / No
1	Heater securely mounted at the correct angle	
2	Additional Product ID label affixed to opposite side of heater	
3	Fuel Dosing Pump securely mounted within anti vibration clip	
4	Fuel Dosing Pump mounted clear of external heat sources	
5	Fuel Dosing Pump mounted level	
6	Fuel Dosing Pump electrical connector angled downwards	
7	Fuel Dosing Pump is protected from mechanical damage	
8	Standpipe cut at the correct length	
9	Standpipe installed securely and leak free	
10	Fuel lines all flared	
11	Flared ends of fuel lines still 2mm ID after flaring	
12	Fuel lines fixed securely along their entirety	
13	Fuel lines are routed away from external heat sources	
14	Fuel lines are protected or routed so as to prevent accidental damage	
15	Fuel lines terminated with ISO7840 rubber hose sections	
16	ISO7840 rubber hose sections pushed fully onto heater inlet and fuel pump flared stubs	
17	Flared ends of copper pipes push fully into ISO7840 rubber hose sections	
18	Fuel lines fitted with hose clamps securely	
19	The heater is mounted no more than 3m above the fuel dosing pump	
20	Distance between fuel standpipe inlet tip to the dosing pump is not more than 1.2m	
21	Distance between the dosing pump is not more than 8.8m	
22	The fuel being used is either EN590 Diesel or BS2869A2 Gasoil.	
23	The fuel is visually free from contamination of water, solids.	
24	There exists an adequate supply of fuel in the tank	
25	Exhaust flexible pipe is securely fixed at both ends to prevent gas leakage	
26	Exhaust is lagged with thermal insulation	
27	Exhaust insulation is secured with stainless steel ties	
28	Exhaust is safely secured / routed to prevent damage to adjacent parts	
29	Exhaust has a 'swan neck' formed to prevent the ingress of sea water	
30	Exhaust skin fitting is mounted as high as possible above the waterline	
31	Exhaust emissions have been checked and adjusted using PC diagnostics tool	
32	Combustion air pipe has been installed on the correct port on the heater	
33	Combustion air pipe is not drawing air from inside the passenger compartment.	
34	Combustion air pipe is fitted with silencer	

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	Installation Check Points	Yes / No
35	Electrical plugs are securely and correctly installed into the sockets on the heater body	
36	The power supply requirements of the heater match those of the power supply used	
37	Power supply positive cable is connected direct to the battery isolator load side	
38	Power supply negative cable is connected to battery negative terminal, (shunt excepted)	
39	Power supply cables are securely connected	
40	The fuses are ok	
41	The fuses are correctly inserted into the carriers	
42	The fuses are the correct size	
43	The plug supplying the fuel pump is securely connected	
44	The electrical connections on all plugs, sockets and terminations corrosion free	
45	The heater wiring harness is securely clipped to prevent heat or mechanical damage	
46	The connectors and terminations are not under any strain	
47	The battery is charged sufficiently to operate the heater	
48	The Webasto programmer plug has been configured for continuous operation	
49	The water plumbing is based on a 22mm central spine	
50	The Calorifier if fitted is fitted with a balancing valve / lock shields	
51	The Calorifier has not been piped in series with the hot output	
52	The radiators are not fitted with Thermostatic Radiator Valves	
53	The flow & returns of the Calorifier and radiators are all balanced	
54	The air has being bled from the system completely	
55	The correct water / glycol mixture has been used	
56	The water / glycol was pre mixed before use	
57	The water system has been flushed out prior to being connected to the heater	
58	The water system is leak free	
59	When plumbed as a gravity fed system the header tank is filled to 'max'	
60	When plumbed as a pressurised system the cold pressure is 1 bar	
61	When plumbed as a pressurised system the 2 filling loop valves are OFF	
62	The designed heating load is 10% greater than the heater max output	
63	The header tank is the highest point in the system	

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