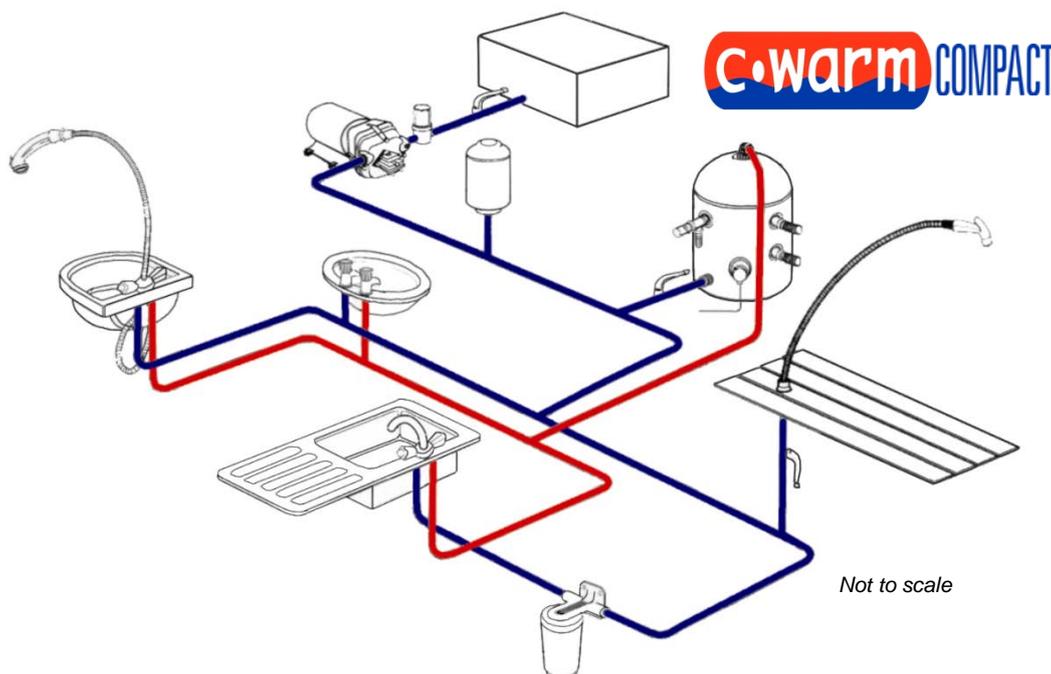


WATER STORAGE HEATERS ('calorifiers')

To obtain the best performance from your **C-Warm COMPACT** water storage heater please read these instructions carefully. Failure to observe the recommended procedures may result in damage to equipment or in personal injury, and may invalidate the supplier's warranty.



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1. INTRODUCTION

A **C-Warm COMPACT** water storage heater offers you the benefits of stored hot water on board your boat, at no extra cost in fuel.

Installation is straightforward. Provided a few simple rules are followed, your heater will give you lengthy service with virtually no maintenance.

C-Warm COMPACT storage heaters are designed for use with **INDIRECT MARINE ENGINE COOLING SYSTEMS** using a closed loop of hot water circulating through the engine heat exchanger. Twin coil models may also be used with a second engine or with gas or diesel burners. A mains voltage a.c. immersion heater can be fitted.

If an auxiliary burner is used follow the fitting and operating instructions supplied with it.

With water entering the coil at 82°C, a **C-Warm COMPACT** heater is designed to provide a full charge of hot water at 60°C within 15 to 25 minutes. The larger heaters have more coil turns, hence performance is virtually independent of the volume of water contained in the storage heater.

With **DIRECT COOLED ENGINES**, the temperature of the water leaving the engine is more variable. For effective use of a storage heater, the temperature of the water entering the coil should be at least 50°C.

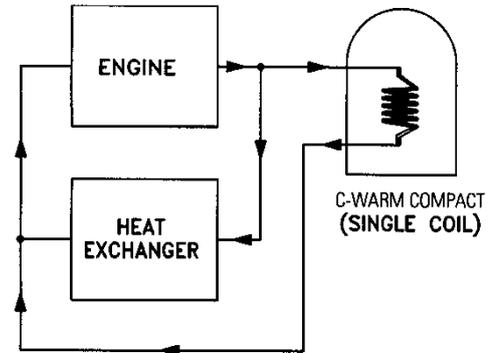
Before you adapt a new engine's cooling circuit to take a water storage heater, check with your engine supplier to ensure that you do not invalidate the engine's warranty.

SAFETY

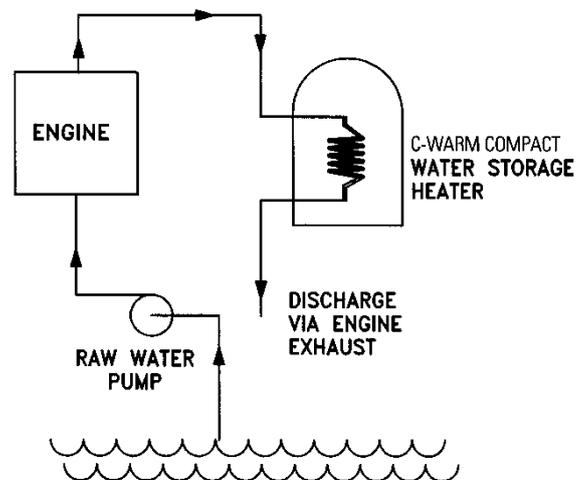
Your **C-Warm COMPACT** water storage heater is part of an unvented ('closed') pressurised water system. Most domestic systems in the UK are vented to atmosphere ('open'). In continental Europe and elsewhere unvented domestic systems are the normal type.

With proper protection against overheating, unvented systems present no hazard to the user. Safety precautions are required by law

INDIRECT COOLED ENGINE



DIRECT COOLED ENGINE



for unvented systems installed in houses in the UK. The requirements are set out in Building Regulations and local Bye-laws. Although no such regulations exist (at the time of printing) for unvented systems in boats, these instructions describe and recommend precautions that comply with UK law for domestic systems.

WATER QUALITY

C-Warm COMPACT heaters are designed for use with clean, fresh, drinkable water. Salty or heavily chlorinated water is more corrosive than pure

water, and the working life of the heater and its fittings may be shortened.

CAN I USE A C-WARM COMPACT STORAGE HEATER TO HEAT SEAWATER?

Copper is moderately resistant to corrosion in hot sea water, so the heater itself can be used with sea water, though its working life may be shortened. Because the temp/pressure relief

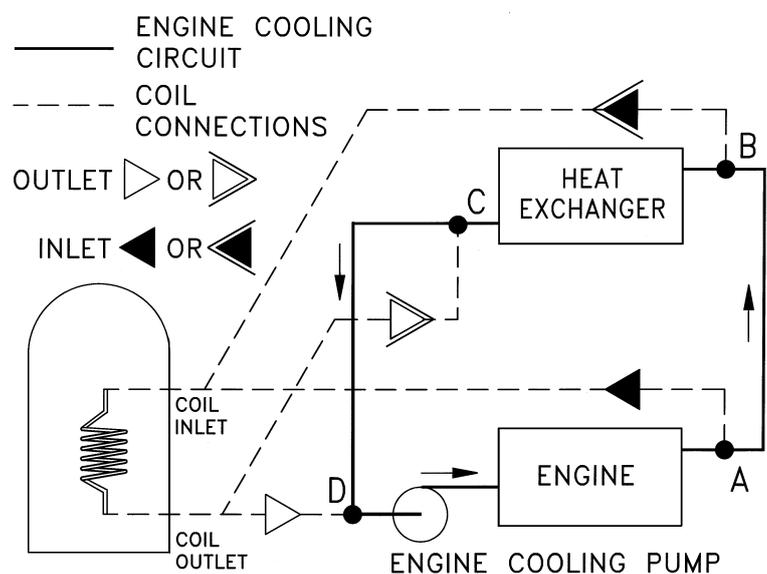
valve may corrode, **C-Warm COMPACT** is **not recommended for seawater installations with an electric immersion heater**

ADAPTING THE ENGINE COOLING CIRCUIT

The schematic diagram shows the installation principle. Contact your engine supplier for advice about the recommended connection points on your engine.

INDIRECT COOLED ENGINE

For maximum flow through the coil, the inlet connection should be close to the engine (A) and the discharge connection should be close to the circulation pump (D). Somewhat less flow through the coil can be attained, if required, by taking off hot water from a point (B) downstream of (A) and returning it to point (C) upstream of (D), so that the pressure difference between the coil take-off and return is a little less. Marinised engines are often supplied with plugged take-off points for connection to a calorifier. Check with your engine supplier



DIRECT COOLED ENGINE

Some direct-cooled engines provide for a relatively high engine block temperature. The recommended connection points for the **C-Warm COMPACT** heating coil will vary according to

the engine design. Check your engine manual and if necessary contact your engine supplier for advice.

2. INSTALLATION

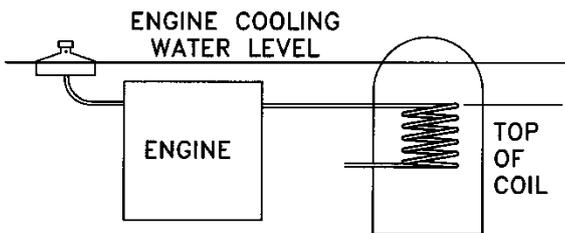
BEFORE YOU START

1. Check that you have received the correct **C-Warm COMPACT** heater and accessories. Check immersion heater power and voltage. Report any damage or discrepancies to your supplier without delay.
2. Check the dimensions of the heater and recheck the dimensions of the space for its installation in your boat.
3. Read through these instructions carefully, noting additional items required for installation.

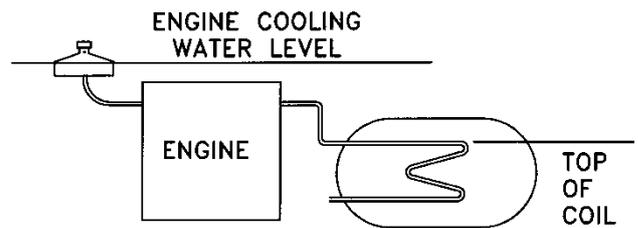
LOCATION

Your **C-Warm COMPACT** water storage heater may be located in any convenient and accessible position subject to the following considerations:

1. With pumped cooling water circulation, the storage heater can be located above or below engine level. For best circulation, natural convection should assist the pumped flow.
2. There must be no air locks in the cooling water circuit. Either locate the water storage heater with its upper coil connection below the engine's water filling point, or fit an auxiliary header/filler tank above the highest point in the cooling water circuit.



VERTICAL MODELS



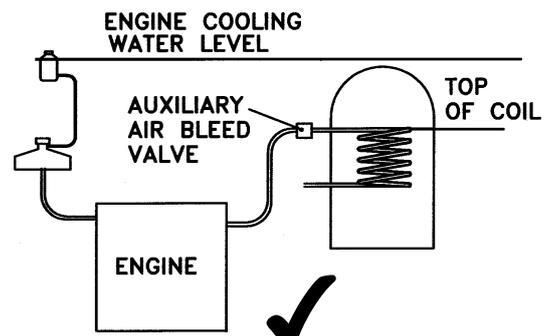
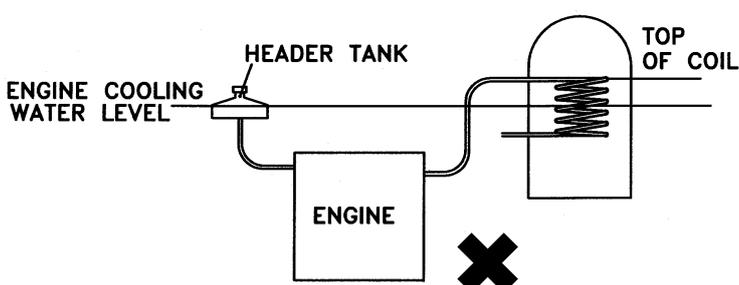
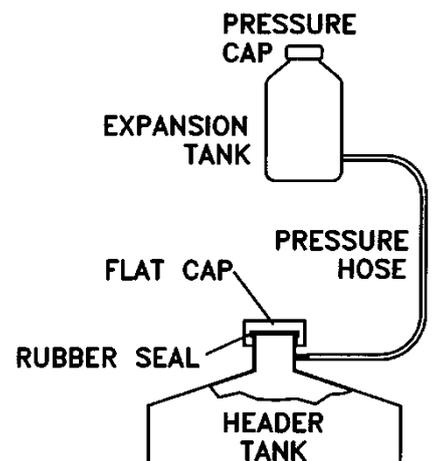
HORIZONTAL MODELS

3. The longer the pipe run between water storage heater and engine, the more work the engine's cooling water circulation pump has to do. Minimise the reduction in water flow rate by locating the storage heater near the engine.
4. Vertical **C-Warm COMPACT** storage heaters **MUST** be mounted vertically, horizontal heaters **MUST** be mounted horizontally.

HOW TO FIT AN AUXILIARY HEADER TANK

For installations where the coil connection is above the level of the engine's water filling point.

1. Blank the existing header tank by using a flat cap that does not obstruct the overflow pipe.
2. Fit a new expansion tank nearby, at a height just above the top of the **C-Warm COMPACT** coil. Connect it to the overflow outlet on the original header tank, using a suitable pressure hose (see diagram) The expansion tank for a car radiator is suitable for engine cooling systems up to about 200 litres in total volume.
3. Fit an air bleed close to the top coil connection of the water storage heater. On filling the system with water, ensure that all the air in the cooling circuit escapes via this bleed or from the engine.
4. On starting the engine check for loss of liquid and for air locks in the extended cooling circuit.

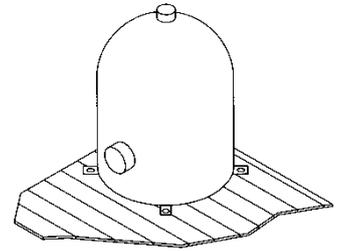


FIXING THE WATER STORAGE HEATER IN PLACE

When full of water the heater has a substantial mass. It must be secured firmly in place to prevent damage to the heater and pipework or to the supporting structure, from the effects of rough weather or other shocks of marine use.

1. Support the WEIGHT on a strong base
2. Support the MASS against horizontal forces

1 litre of water
weighs 1 kg



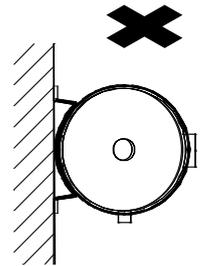
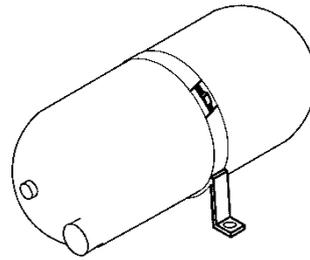
The exact method you use to hold the heater in place will depend on the construction of the vessel and on the available space.

CWC20-V and CWC40-V (vertical)

Locate the heater on a firm level base strong enough to support at least twice the weight of the (full) heater. Secure the feet to the base

CWC18-H (horizontal)

Attach the bracket to the heater, then screw the bracket down. If preferred, a second bracket can be fitted (available as an optional extra: contact your supplier for details)



CONNECTING THE PIPEWORK

C-Warm COMPACT heaters may be connected into the engine cooling and pressurised water systems with any suitable pipe material. Most commonly used are:

Copper pipe

If copper pipework is preferred for the pressurised water connections, suitable adapters and compression fittings should be used. These may be obtained from a plumber's merchant or from most 'Do-it-Yourself' stores. See page 10 for connection sizes.

Flexible hose

If flexible hose is preferred for the pressurised hot and cold water connections, suitable connectors will be required. Use opaque hose (to discourage algal growth) and stainless steel hose clips. See page 10 for connection sizes.

Connecting the coil into the engine cooling circuit. Use ½" bore rubber (car or lorry) heater hose, obtainable from vehicle accessory suppliers. This will minimise the engine vibration reaching the heater.

Connect the coil into the engine cooling circuit and/or auxiliary heater. Fasten the hose securely to the connectors using stainless steel hose clips. Do not allow loops of hose to form air locks.



Do not over-tighten the coil connections. Over-tightening may distort the copper wall of the storage heater, causing immediate or eventual leakage. Max. torque should not exceed 70Nm (50lb.ft)

- The heating coil may safely remain incorporated into the engine cooling circuit whether the heater itself is full of water, partly full or empty.

Connecting the cold water inlet and the hot water outlet into your pressurised water system. Use 15mm bore pipework.

The cold water inlet line should be fitted with a drain cock, close to the heater, to allow drainage if maintenance becomes necessary, and to avoid the risk of freezing in the winter.

FITTING THE TEMPERATURE-AND-PRESSURE RELIEF VALVE

The relief valve fitted to the heater is non-adjustable and is pre-set to lift at 3bar (44psi) or at 95°C.

Most marine pressurised water pumps have pressure switches set to cut out below 2.5bar

(36.5psi). Check that your pressure switch cuts out at or below this pressure. Use of a pressure switch cutting out at or close to 3bar (44psi) could lead to continuous discharge of water through the relief valve.

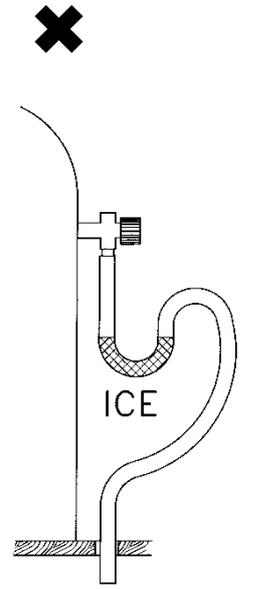


WARNING



The temperature-and-pressure-relief valve is essential for the safe operation of your C-Warm COMPACT heater.

Removing the relief valve, or any alteration to or interference with its function, or fitting of any valve other than that supplied with the heater, carries a risk of serious personal injury or death in the event of overheating. It will also invalidate the supplier's warranty.



THERMOSTAT SETTINGS

The **control thermostat** on the immersion heater is pre-set to cut out when the water temperature reaches 60°C. This is ample for domestic use.

In an attempt to reduce the likelihood of scalding, we recommend that the control thermostat is set no higher than 65°C

The **high temperature cut-out thermostat** is pre-set to 85°C and comes with a tamper proof seal. If required the **high temperature cut-out thermostat** can be altered, however it should be set at least 15°C above that of the control thermostat setting.

Check the thermostat settings before using your immersion heater for the first time.

Isolate the immersion heater from its power supply before removing the cover. If necessary adjust the control thermostat setting by turning the dial with a screwdriver blade until the arrow points to the desired temperature.

DO NOT set the high temperature cut-out to operate below the cut-out temperature of the control thermostat.

In the event of a high temperature cut-out the system should be thoroughly checked. It is advisable to replace the thermostat before the immersion heater is used again. Contact your supplier for a replacement thermostat.

WIRING INSTRUCTIONS

1. It is essential that the correct size of fuse or circuit breaker be fitted.
2. Check that the mains supply voltage corresponds with the voltage indicated on the heater.
3. Isolate the electrical supply to the cable.
4. Make the supply cable connections as follows.
5. Standard colours in the UK are:
 - Brown = Live
 - Blue = Neutral
 - Green/Yellow = Earth



THE IMMERSION HEATER MUST BE EARTHED



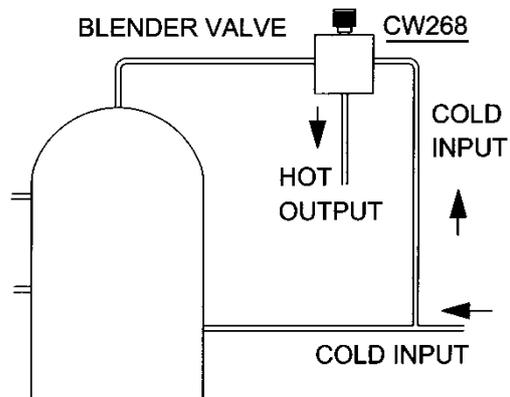
Before you switch on the immersion heater, check that the water storage heater is full of water, and that the temperature-and-pressure relief valve has been properly fitted.

IF YOU ARE IN ANY DOUBT ABOUT FITTING THE IMMERSION HEATER, OBTAIN THE SERVICES OF A QUALIFIED ELECTRICIAN.

3. REGULATING THE TEMPERATURE OF THE HOT WATER

C-Warm COMPACT storage heaters are highly efficient, and the stored water can reach almost the same temperature as the water in the engine cooling circuit. (90°-95°C). Domestic hot water is not normally hotter than 60°C.

If necessary you can limit the temperature of the hot water supply by fitting a blender valve in the hot water discharge line, to add a controllable proportion of cold water. This method has the potential advantage of extending the capacity of the C-Warm heater



(X litres of water at 85°C plus Y litres of cold water = X + Y litres of water at 55°C)

MAKING SURE THE WATER STAYS HOT

C-Warm COMPACT's efficient insulation will keep your stored water hot for many hours after the engine has stopped.

- Long pipe runs can delay the arrival of hot water at the hot taps, wasting water. Heat loss can be minimised by insulating the hot water pipes.
- Occasionally a thermo-syphon will start of its own accord in the engine cooling circuit, silently extracting heat from your stored water and warming the (stationary) engine! This is an unlikely event, but if it does happen, contact your supplier for advice.

TOO HOT? TOO COLD? A HEALTH NOTE

Legionella bacteria occur naturally in many water systems. People exposed to them can develop Legionnaire's disease.

Water temperature	Risk
Above 60°C	Can scald, but <i>Legionella bacteria</i> cannot survive
20° to 45°C	<i>Legionella</i> multiply
Below 20°C	<i>Legionella</i> will not multiply but remain a potential threat

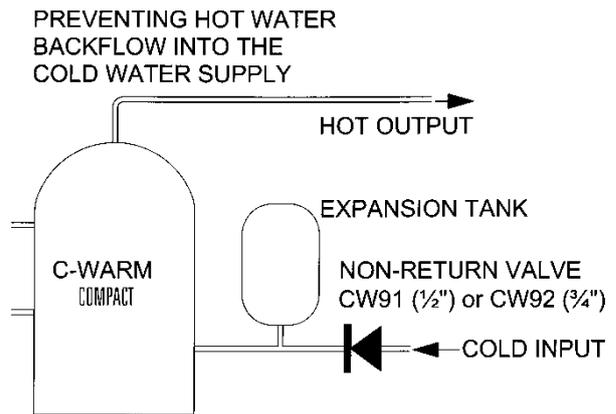
Store hot water at 60° or above. Use a blender valve in the hot water supply line to add cold water in controlled amounts

HOT WATER EXPANSION

If your system has no expansion tank, thermal expansion will cause the temperature-and-pressure relief valve to discharge a little hot water every time the stored water is heated. The valve includes a hose connector to allow this water to be drained into the bilge.

Set the gas pressure in the expansion tank to 4 psi (0.3 bar) below the cut out pressure of the pump.

You are strongly recommended to fit an expansion tank. (Without one the relief valve will weep every time the water is heated. Evaporation of the escaping water will cause a build-up of salts around the valve, eventually causing it to fail.



Expansion tank size			
Pump cut-out pressure (bar)	CWC18-H	CWC20-V	CWC40-V
1	CW269	CW269	CW269
1.4	CW269	CW269	CW269
2	CW269	CW269	CW385
2.5	CW385	CW385	CW288

REGULATING THE COLD WATER INLET PRESSURE

If the pressure system's pump cuts out at a pressure above or close to the pressure setting of the Temperature-and-Pressure Relief Valve (TPRV), you will require a PRESSURE-REDUCING VALVE in the cold water inlet to the water storage heater.

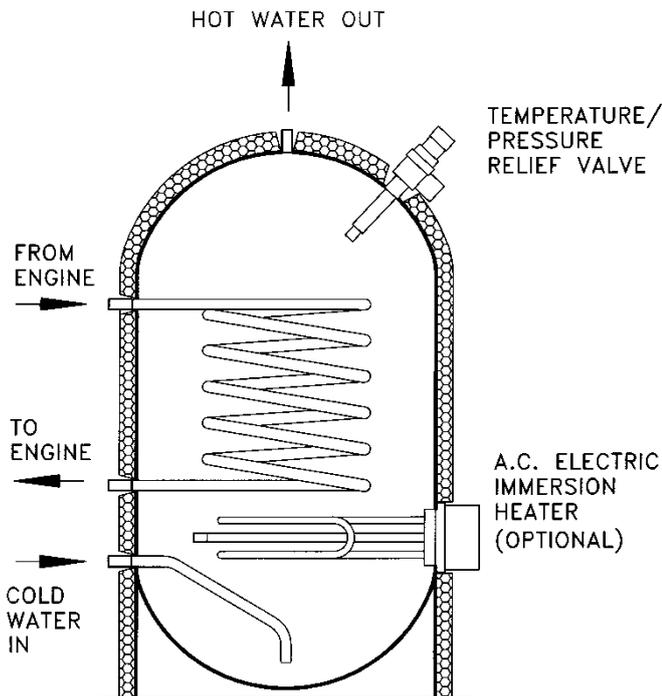
Expansion tank. When a Pressure-Reducing Valve is fitted, it is necessary to fit an expansion tank (*Why? See above*). The gas pressure in the expansion tank should be set to 4psi (0.3 bar) below the setting of the Pressure-Reducing Valve. This should be done before the system is started and with no water pressure in the system

Selecting a Pressure-Reducing Valve and an Expansion Tank. Please contact Cleghorn Waring to establish the correct size of expansion tank and the correct pressure setting for the Pressure-Reducing Valve. You will need to know the capacity of your water storage heater and the pressure rating of the TPRV.

Using a Pressure-Reducing Valve in conjunction with a Blender Valve. If a blender valve is to be fitted, its cold water inlet should be connected into the pipework between the Pressure-Reducing Valve and the cold inlet fitting on your hot water storage tank.

4. USING THE HEATER

- 1 Check that the pipework is complete and fully connected.
- 2 If necessary, refill the engine cooling system with the recommended coolant.
- 3 To fill your pressurised water system, including your heater, with water proceed as follows:
 - check that the pipe work is complete and fully connected



- open all the hot and cold outlets
- fill the cold water supply tank
- open the isolating valve from the water supply tank to the pressurised system
- start the pump, which should prime itself in a few seconds. The system will begin to fill with water. As the system fills up, the taps will start to discharge air and water. Close each tap slowly,

until only one hot tap remains open. When this tap stops discharging air, the **C-Warm COMPACT** heater is full. Close the tap. The pump will stop within a short time.

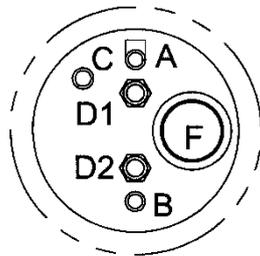
- check all the fittings and connections thoroughly for leaks
 - test the temperature-and-pressure relief valve by rotating the coloured knob one full turn anticlockwise; water should flow freely from the valve discharge
 - refill your water storage tank
 - check all the connections once more when the water is heated for the first time.
- 4 Your pressurised system and **C-Warm COMPACT** heater are now ready for use.
 - 5 Your engine cooling circuit will heat the stored fresh water in your **C-Warm COMPACT** heater automatically, whenever you run the engine. The engine cannot overheat **C-Warm COMPACT**: once the stored water has reached its maximum temperature, no added heat is absorbed from the engine cooling circuit.
 - 6 An electric immersion heater will switch itself on and off automatically, just as in a domestic water tank. Reset the main thermostat in the immersion heater if necessary (factory setting is 60°C). **Do not** adjust the high temperature cut-out thermostat (factory setting is 85°C).
 - 7 Apart from checking the operation of the temperature and pressure relief valve once a week (see instructions) your C-Warm storage heater needs no regular **maintenance**. Don't forget to empty it when you store the boat for the **winter!**

PROBLEM SOLVING

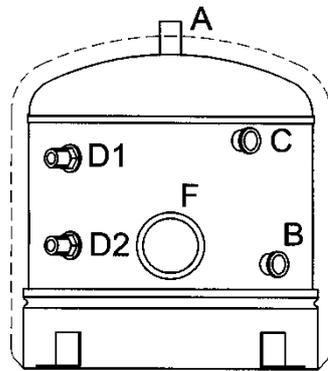
PROBLEM	POSSIBLE CAUSE	ACTION
Water not hot enough	Coil inlet temperature too low Air lock(s) in engine cooling circuit Top of storage heater above engine cooling header tank Thermostat in engine cooling circuit not adjusted correctly Thermo-syphon in coil circuit when engine is not running	Check coil inlet water temperature and correct if necessary Check for air locks Raise header tank Check setting on thermostat Contact your supplier for advice
Water too hot	Engine cooling circuit water too hot Immersion heater control thermostat set too high Immersion heater control thermostat has failed	Fit blender valve CW268 Adjust immersion heater control thermostat Check control thermostat. Do not reset high temperature cut-out until the cause of the overheating has been established
Water discharges continuously through temperature/pressure relief valve	Pump pressure switch cut-out setting is higher than relief valve setting. Pressure switch has failed Stored water too hot Immersion heater control thermostat set too high or has failed. Temperature/pressure relief valve has failed	Check pressure switch cut-out setting. Adjust or replace switch if necessary Replace pressure switch Fit thermostat CW276 Adjust or replace control thermostat Replace temperature/pressure relief valve
Water leaks from the temperature/pressure relief valve during heating	No expansion tank, or expansion tank not functioning properly	Fit an expansion tank as outlined in these instructions
Hot water flows back into cold water line	Thermal expansion	Fit non-return valve and expansion tank, as outlined in these instructions
Immersion heater does not operate	Electric supply failure Immersion heater has failed Control thermostat temperature set too low. High temperature cut-out has operated	Restore electric supply. Replace immersion heater (with twin thermostat type) Check control thermostat and correct if necessary. Check control thermostat and replace if necessary. Inspect system before using heater again. Reset high temperature cut-out. Check that high temperature cut-out setting is above control thermostat setting.

CONNECTIONS

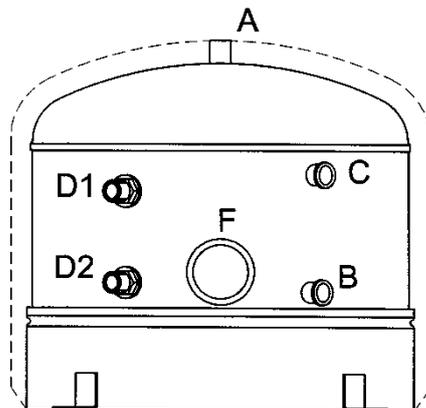
C-Warm COMPACT Model No	Capacity litres	A	B	C	D1	D2	F
		hot water outlet	cold water inlet	relief valve	coil inlet	coil outlet	Imm. heater
		BSP (gas) thread	BSP (gas) thread	BSP (gas) thread int.			
CWC18-H	18	½" ext.	½" ext.	½"	½"	½"	2¼"
CWC20-V	20	½" int.	½" int.	½"	½"	½"	2¼"
CWC40-V	40	½" int.	½" int.	½"	½"	½"	2¼"



CWC18-H



CWC20-V



CWC40-V

WARRANTY

We warrant that all new equipment sold by us is free from defects in material or workmanship. Our liability under this warranty is limited to making good any part or parts which shall be within one year from the date when the equipment was delivered new to the customer be returned to us and which we are satisfied on our examination to have been defective in material or workmanship. Included in this warranty are the costs of labour incurred by us in making good such part or parts.

This warranty is given on condition that:

- i we are notified in writing within fourteen days after such defects appear and the equipment or defective parts are returned to as soon as reasonably practical or where this is not practical made available for inspection by us
- ii the equipment has in our judgement been correctly installed and normally used in accordance with the instructions provided for its installation operation and maintenance
- iii unless performance figures and performance tolerances have been stipulated by the purchaser and agreed by us at the time of ordering the equipment we shall be under no liability in the absence of any defect in material or workmanship for failure to obtain any particular performance
- iv if the equipment has in our judgement been altered taken apart repaired tampered with neglected damaged or used in any way so as adversely to affect its performance or condition we shall not be liable for any fault arising from its use
- v we shall not be liable for faults arising from the use of any spare or replacement parts not authorised or recommended by us
- vi any equipment or defective part replaced by us shall become our property
- vii the decision whether to repair or replace a defective part under warranty claim shall be at our discretion
- viii excluded from this warranty are any parts which need replacement due to normal wear and tear
- ix carriage to our works of any equipment or parts returned to us under a warranty claim shall be the responsibility of and at the expense of the claimant
- x we accept no responsibility for loss or damage howsoever occasioned to customers' goods whilst such goods are in transit to or from ourselves or in the possession of or in transit to or from our agents
- xi we give no warranty in respect of equipment supplied by us except the foregoing warranty and without prejudice to the generality of the foregoing we shall be under no liability whether in contract or otherwise in respect of any defects in the goods or from any injury loss or damage resulting from such defects or from any work done in connection therewith and we shall not in any circumstances be liable for any consequential loss or damage suffered including any loss of use loss of contract or loss of profits. Our liability shall in no case exceed the value of goods in relation to which the claim is made
- xii the purchaser acknowledges that the equipment is sold to him in consideration of payment of the price and of the undertaking of the part of the purchaser to
 - a) observe all prudent trade practices in relation to installation and user so that the equipment is not used when it is in an unsafe condition for whatsoever reason
 - b) ensure in so far as the equipment is incorporated into other equipment that such other equipment is in good working order and that such incorporation is in accordance with what the manufacturer would require
 - c) ensure that his staff and all users of the equipment are adequately informed of their duties in relation to use of the equipment
 - d) observe the Health and Safety at Work legislation as amended from time to time in relation to the equipment supplied so that we shall not be liable in any respect as a result of the purchaser's failure to observe the conditions a) to d) set out above.

The foregoing warranty is given without prejudice to purchasers' statutory rights.