



Webasto BlueCool Premium  
**Thermo 90 ST - Chiller**  
Installation Manual

 **CAUTION**

- Improper installation or repair of Webasto heating and cooling systems can cause fire or the leakage of deadly carbon monoxide leading to serious injury or death.
- Installation and repair of Webasto heating and cooling systems requires special Webasto training, technical information, special tools and special equipment.
- NEVER attempt to install or repair a Webasto heating or cooling system unless you have successfully completed the factory training course and have the technical skills, technical information, tools and equipment required to properly complete the necessary procedures.
- ALWAYS carefully follow Webasto installation and repair instructions and heed all WARNINGS.
- Webasto rejects any liability for problems and damage caused by the system being installed by untrained personnel.



<b>Contents</b>	<b>Page</b>
<b>Foreword</b>	<b>4</b>
General . . . . .	4
Scope and Purpose . . . . .	4
Safety and Important Information . . . . .	5
Symbol Identification . . . . .	6
Heater Dimensions . . . . .	6
Packaged Components . . . . .	7
<b>Installation</b>	<b>8</b>
General Information . . . . .	8
Installation Site / Installation Position . . . . .	9
Hose Connections to Chiller Unit . . . . .	10
Fuel Supply . . . . .	12
Combustion Air Supply . . . . .	14
Heater Exhaust . . . . .	15
Electrical System . . . . .	17
Information about Air Guidance . . . . .	20
<b>Circuit Diagrams</b>	<b>21</b>
<b>Initial Start-up</b>	<b>23</b>
General . . . . .	23
Description and Operation . . . . .	23
<b>Technical Data</b>	<b>24</b>
<b>Troubleshooting</b>	<b>25</b>
Fault lock-out . . . . .	25
Version with Light . . . . .	25

## 4 Foreword

---

### 1. Foreword

#### General

Webasto Product North America, Inc. is pleased to provide this installation manual with the Thermo 90 ST designed for the BlueCool Premium System. When used according to the guidelines stated in this manual, you can expect to provide years of trouble-free, enjoyable operation for your customer.

We encourage our customers to write to us with their comments or criticisms concerning this manual or product. Thank you for your participation.

Please write to us at:  
Webasto Product North America, Inc.  
Technical Documentation Group  
15083 North Road  
Fenton MI 48430

You are also invited to fill out our online questionnaire concerning our technical documentation and web site at:  
[www.techwebasto.com](http://www.techwebasto.com)

If you have immediate questions concerning this manual, the installation procedures within or the product itself, please call our technical support team at: (800) 860-7866 or send a fax to: (810) 593-6001

#### Scope and Purpose

This manual is intended to provide the information necessary to ensure proper installation and operation of the Thermo 90 ST in conjunction with the BlueCool Premium System. Improper installation can result in unsatisfactory performance and/or premature failure of these units. BEFORE proceeding, please read this manual completely. In the interest of product improvement, specifications and design are subject to change without prior notice.

## 2. Safety and Important Information

Failure to follow the installation instructions and the notes contained therein will lead to all liability being refused by Webasto Product. The same applies if repairs are carried out incorrectly or with the use of parts other than genuine spare parts.

All Webasto BlueCool (WBC) products are 110 or 220 volt components that are only allowed to be installed, connected and maintained by trained and duly certified personnel. The electrical power supply must be permanently disconnected before any work is started on the systems.

The year in which the heater is used for the first time must be permanently recorded on the heater's factory plate by deleting the inapplicable year figures.

### **The heater must not be operated:**

- In filling stations
- In places where explosive vapors or dust may build up (e.g. near fuel, coal, wood, or dust).
- In enclosed rooms (e.g. winter storage facilities)

### **The heater must not:**

- Be exposed to temperatures of more than 248°F (120 °C) (storage temperature), otherwise the electronics may suffer permanent damage.

### **The heater must:**

- Be operated with the fuel specified on the factory plate.
- Be switched off if considerable quantities of smoke is generated, in case of unusual combustion noises or if you smell fuel. Switch it off by removing the fuse. The heater must not be restarted until the unit has been checked by personnel duly trained by Webasto.
- Be operated for 10 minutes at least once a month. The heater must be inspected by a specialist at the beginning of the heating season or earlier.

## Symbol Identification

The purpose of safety symbols is to attract your attention to possible hazardous conditions. This manual uses a series of symbols and signal words which are intended to convey the level of importance of the safety messages. The progression of symbols is described below. Remember that safety messages by themselves do not eliminate danger and are not a substitute for proper accident prevention measures.



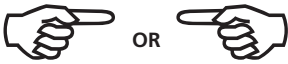
Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury or property damage. It may also be used to alert against unsafe practices.



These symbols are used to alert the installer to important or useful information about proper installation of the equipment.

## Heater Dimensions

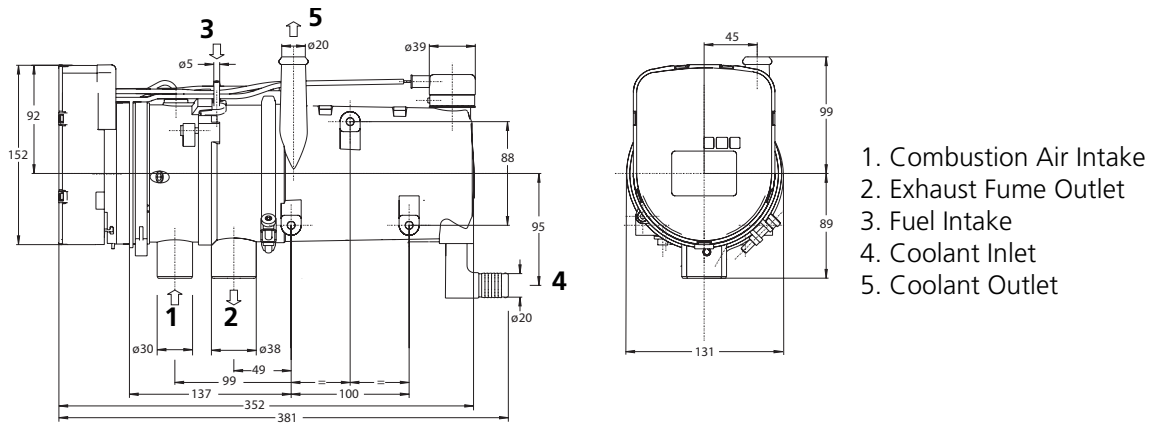


Fig. 1 Dimensions of the Thermo 90 ST

## Packaged Components

<i>Category</i>	<i>Description</i>	<i>Qty.</i>
<b>Intake and Exhaust</b>	TUBE FLEX SS 38MM X 2M	1
	TUBE FLEX PAK 30MM X 2M	1
	CLAMP EXHAUST 1 1/2 "	4
	CLAMP HOSE AIR INTAKE	2
	THRU HULL EXHAUST	1
<b>Fuel System</b>	FUEL LINE METAL (3/16" DIA) 25 FEET	1
	COMPRESSION FITTING 3/16" COUPLING UNION	1
	STANDPIPE W/COMPRESSION FITTING	1
	COUPLER FUEL LINE STRAIGHT	1
	CLAMP HOSE 9.5-10.5MM	2
	FUEL PUMP ENCLOSURE	1
<b>Manuals / Warranty</b>	ENVELOPE WHITE 9"X12"	1
	WARRANTY CARD	1
	THERMO 90 ST INSTALLATION MANUAL	1
<b>Heater Parts</b>	THERMO 90 ST 12V MARINE HEATER	1
	HARNESS POWER / SWITCH	1
	INTERNAL HARNESS THERMO 90 S	1
<b>Parts Bag Clamps</b>	CLAMP HOSE 13-32MM 1/2" SS MARINE GRADE	6
<b>Parts Bag Mounting</b>	BOLT M6 X 25 SS	4
	NUT M6-1.0 SS	4

### 1. Installation

#### General Information

##### **IMPORTANT**

- The Thermo 90 ST must be installed outside the passenger cabin.
- The following temperature ranges apply to some components:
  - ABS pipe system (G. Fischer) and fittings from -40°F - 140°F (-40°C to +60°C). Use a pipe system designed for temperatures up to 248°F (120 °C), e.g. Hep2O made by Hepworth.
  - Radial blower on the heat exchanger (arranged on inlet side) up to 131°F (55 °C)
- For this reason, a Thermo 90 ST with a specialized control unit must be used. The heater has a pre-programmed nominal temperature of 126°F (52 °C).
- Thermo 90 ST Heater – 12 volt diesel
- Thermo 90 ST Heater – 24 volt diesel
- If the volume of water in the circuit is too small less than 2.5gal. (10 liters), the heating system may shut down prematurely. To avoid this, a storage tank should be installed ahead of the heater.
- The heater is incorporated into the water circuit of the air conditioning unit by means of an additional, electrical 3-way valve. Activation is controlled by the TECC card within the Webasto Blue Cool Premium (WBPC) air conditioning unit.
- The heater is powered by a 12 or 24 volt battery voltage. The heater is activated by the electronic control unit via a 12 or 24 volt signal wire. The Webasto BlueCool Premium Air Conditioning Unit functions with 110 or 220 volts.
- The circulation pump (P1) operates continuously when the system is switched on. This means there is no need for the circulating pump on the heater. As a result, it is integrated directly at the heater inlet. **A cool down cycle is assured from program version 413 of the TECC card onwards.**
- The Thermo 90 ST offers excellent heat capacity to an air handler power up to 31,000 BTU.
- If an external heater is incorporated into a Webasto Blue Cool Premium System with an electrically operated 3-way valve, **function F 04: "Automatic with External Heater"** or **function F 05 "Heat Cycle Only with External Heater"** must be preset on the Chiller Control and the operating element must be blocked by a code.
- When connecting the heater, it is essential that the correct terminal is selected for the nominal temperature.

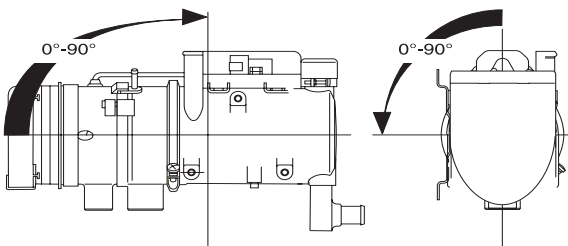
**NOTE:** If the vehicle manufacturer has issued separate instructions, they must be followed.





## Installation Site / Installation Position

The heater must be installed in as low a position as possible to allow the heater and circulating pump to be bled automatically. This is particularly important as the circulating pump is not self-priming.



*Fig. 2 Correct installation positions for the Thermo 90 ST*

## Mounting the Heater

The heater must be secured with at least three M8 screws. The screws must be tightened with a torque value of 13 lb-ft. (18 Nm).

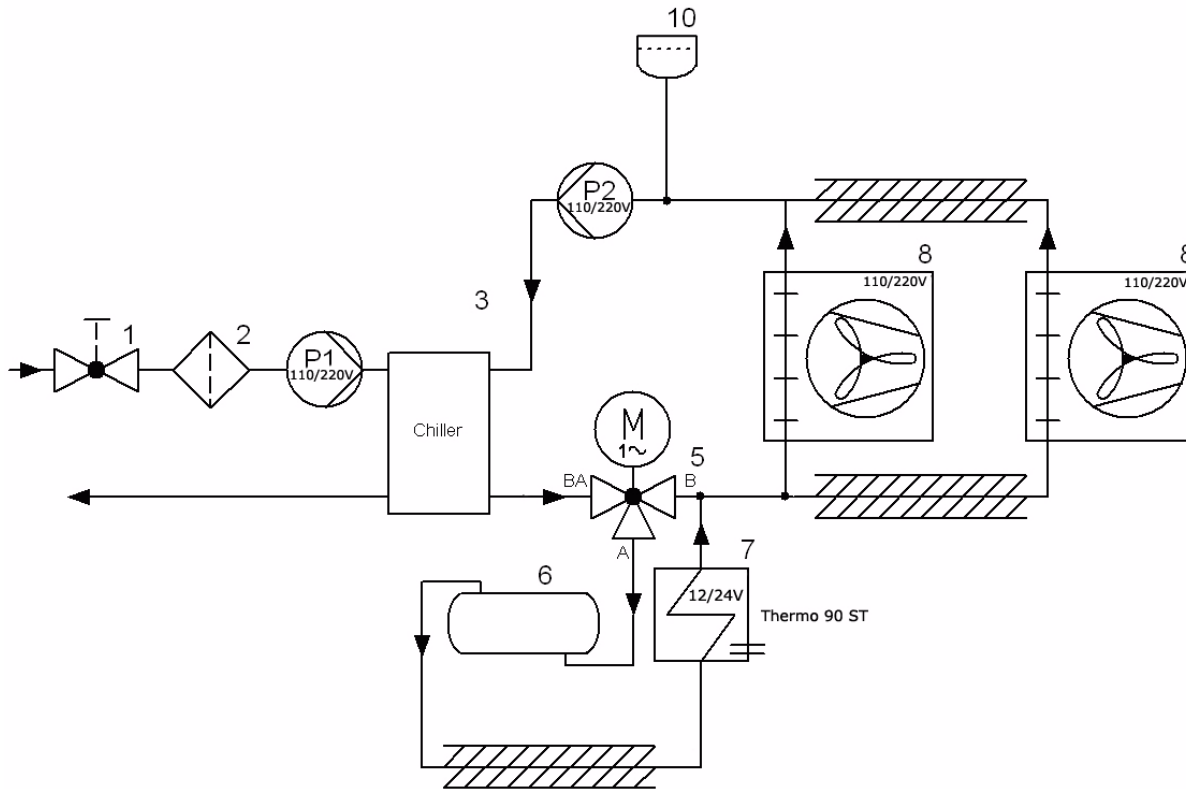
## Model plate

The model plate must be positioned so that it cannot be damaged and must be clearly legible when the heater is installed (otherwise a duplicate model plate must be used). Inapplicable years must be erased from the model plate.

## 10 Installation

### Hose Connections to Chiller Unit

The Thermo 90 ST is intragrated into the Chiller unit water circuit via a electrically actuated 3-way valve assembly.



**Fig. 3 BlueCool Premium System with a Thermo 90 ST**

Components:

1. Stop valve at ship's side inlet
2. Sea water filter
3. Webasto Blue Cool Premium Unit 110 / 220 volts
5. 3-way valve
6. Intermediate storage tank (optional)
7. Water heater – Thermo 90 ST 126°F (52 °C)
8. Webasto BlueCool Air Handler 110 / 220 volts
10. Expansion tank
- P1 Sea water pump – 110 / 220 volts
- P2 Circulating pump – 110 / 220 volts

### Electrically actuated 3-way valve:

Electrically actuated 3-way valves of the relevant sizes are used in chiller systems with up to 36,000 BTU. The selection is made according to the diameter of the pipe used.

- 3-way valve 5/8" incl. fitting
- 3-way valve 3/4" incl. fitting
- 3-way valve 1" incl. fitting

The hoses must be installed without kinks and (to ensure perfect bleeding) rising if possible. Hose connections must be supported by hose clips to prevent them slipping.



**NOTE:** The hose clips must be tightened with a torque value of 35 lb-in. (4 Nm).

### **CAUTION**

The cooling system must be bled carefully before using the heater for the first time or after replacing the water. The heater and lines should be installed in such a way as to ensure static bleeding. Perfect ventilation can be identified by the circulating pump operating almost silently. Poor bleeding may cause the resetting temperature limiter to trip while the heater is operating.



**Fig. 4 Electrically Actuated 3-way Valve**

## 12 Installation

### Fuel Supply

The fuel can be used from the vehicle fuel tank or from a separate fuel tank. The values for the maximum pressure at the fuel extraction point are shown in the table below.

A sign must be affixed to the fuel filler neck warning that the heater must be switched off before refuelling.

Permissible fuel inflow height H	At max. pressure (PSI) in fuel line
0.00' (0.00m)	2.9 PSI
3.28' (1.00m)	0.16 PSI
6.56' (2.00m)	0.44 PSI
Maximum fuel intake height S (Ft.)	At max. negative pressure (PSI) in the fuel tank
0.00 (0.00m)	-1.5 PSI
1.64' (0.50m)	-0.88 PSI
3.28' (1.00m)	-0.29 PSI

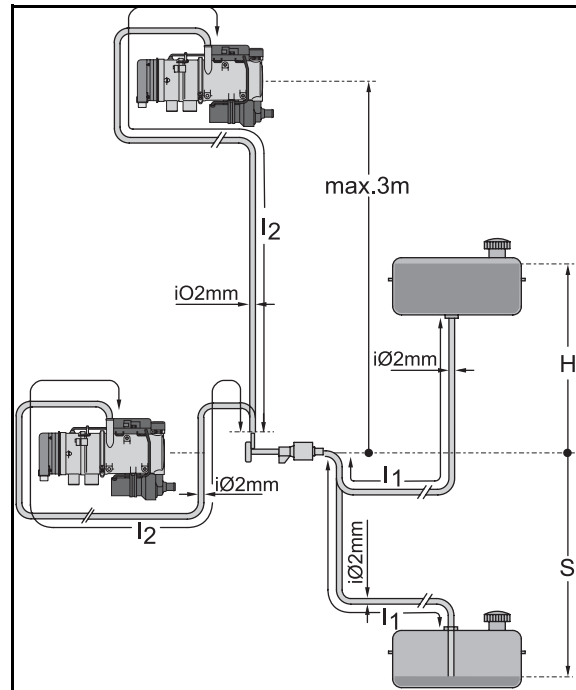


Fig. 5 Fuel Supply

### Connection to Fuel Source

The fuel can be taken from the vessels fuel tank or a separate tank

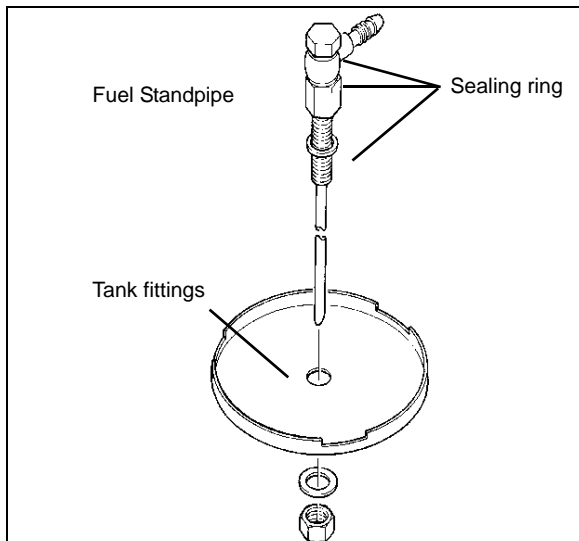


Fig. 6 Fuel Pickup from the Plastic Tank

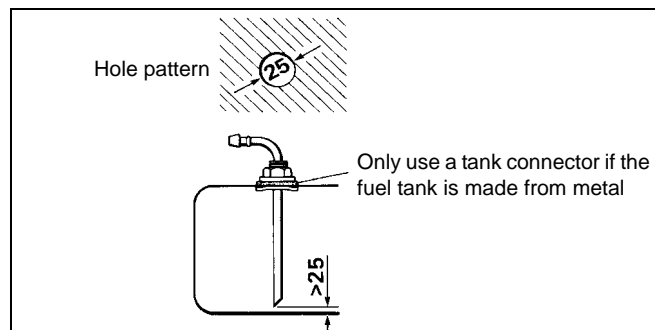


Fig. 7 Webasto Tank Connector

**NOTE:** Ensure to deburr the sharp edges from the standpipe after cutting.

**NOTE:** Refer to fig. 7. The fitting must be made from metal!



Since the lines cannot be routed with a constant rising gradient, the internal diameter must not exceed a certain size. Air or gas bubbles will accumulate in lines with an internal diameter of more than 4 mm and will cause malfunctions if the lines sag or are routed downwards from the metering pump to the heater. The lines should not be routed downwards from the metering pump to the heater. Unsupported fuel lines must be secured to prevent them sagging. They must be installed in such a way that they cannot be damaged by flying debris and high temperatures (e.g. exhaust line).

**Connecting two pipes with a hose**

The correct procedure for connecting fuel lines with hosing is illustrated in Fig. 8



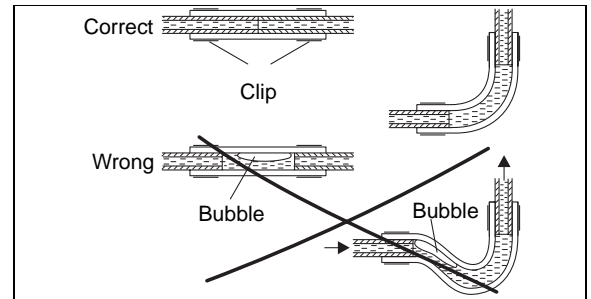
Ensure that there are no leaks.

**Installation location**

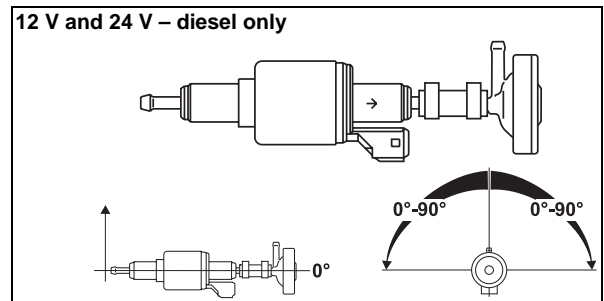
Before installing the metering pump, ensure that the maximum pressure occurring at the pickup point is less than 3 PSI. It is advisable to install the metering pump in a cool place. The maximum ambient temperature must not exceed 104°F (40 °C) at any time during operation.

The metering pump and fuel lines must not be installed within range of the radiated heat from hot vessel parts. A heat shield must be used if necessary.

The pump should ideally be installed near the vessels fuel tank.



**Fig. 8 Pipe / Hose Connections**



**Fig. 9 Metering Pump**

**Installation and attachment**

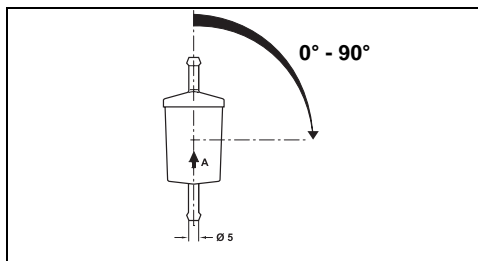
The metering pump must be secured with the supplied vibration-damping mounting clamp. Its installation position is limited as shown in Fig. 9 in order to ensure effective auto-bleeding.

Fuel filter

Only a Webasto filter P/N: 50487171A is permitted when a fuel filter is needed. Install vertically if possible. (See Fig.10).



**NOTE:** Ensure to follow the correct fuel filter direction flow marked on the side of the filter.



**Fig. 10 Fuel Filter**

## 14 Installation

### Combustion Air Supply

#### **⚠ WARNING**

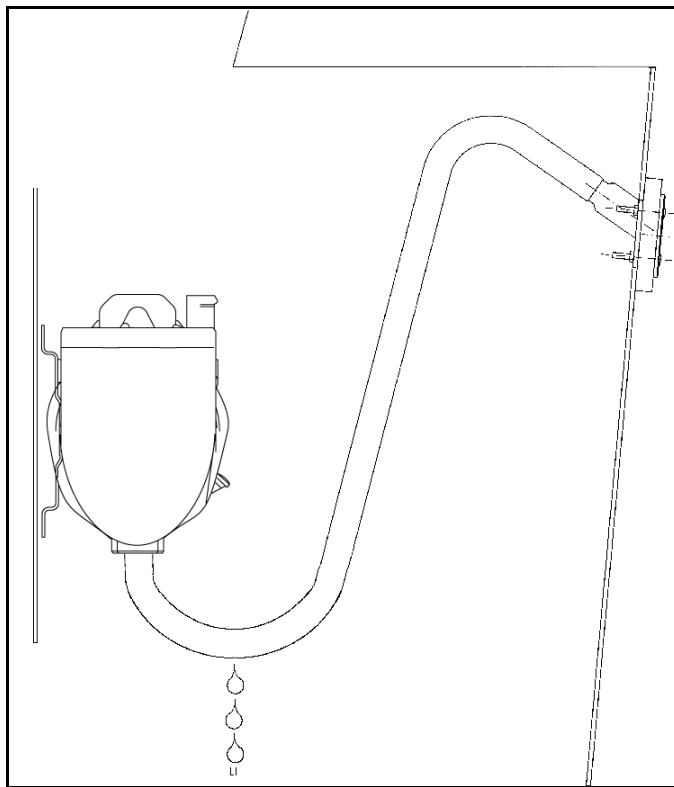
**Asphyxiation risk! The combustion air required for the heater may only be drawn in from the outside or from spaces that are not occupied by persons e.g. ventilated foredeck box or ventilated \*engine compartment (Diesel only).**

The combustion air intake line (internal diameter at least 1 1/8" (30 mm) may be 1 1/2" (0.5 m) to 16 1/2" (5 m) long with several bends totalling 360°. The minimum bending radius is 1 3/4" (45 mm). The combustion air intake must not be routed above the exhaust outlet.

Where combustion air is drawn from an internal source, the combustion air tube should be routed away from the heater with a downward pitch to prevent condensation or moisture from collecting in the tube.

Where combustion air is drawn from an external source, the end of the combustion air intake tube must be routed with a goose-neck bend with a downward pitch toward the outlet so any water that may penetrate, can drain out and not into the heater. A 3/16 in. (5mm) condensation weep hole must be provided at the lowest point between the goose-neck to allow drainage of any trapped condensation or splash water.

**Keep combustion air intake tube opening clear of obstructions!**



**Fig. 11 External Combustion Air Intake with Drain Hole**

To avoid pressure differences between exhaust gas outlet and combustion air inlet, the openings of the through-hull fittings should be located in an area where equal pressure prevails. Do not point the inlet of the combustion air tube in the direction of travel when intake air is drawn from an external source.

Secure the intake tube to the heater with the provided hose clamps. Ensure the fuel pump connector harness is in place in the slot provided in the air intake port before tightening clamp. Secure the tube to the adjacent structures with P-clips or nylon wire ties.

## Heater Exhaust

Route the flexible exhaust in such a way that the heat cannot affect adjacent heat sensitive materials, plastic piping, electric cables and sails etc. Make sure to use the glass / silicon protective insulating sleeve supplied in the kit to ensure surrounding objects are protected.

If additional protection is required, it is recommended to over-sleeve with an additional layer of insulation (available from your local Webasto marine dealer).

### **CAUTION**

DO NOT connect the heater exhaust into the engine or generator exhaust. Doing so will result in unacceptable back-pressure levels and may damage the heater or cause operational failure.

DO NOT install a flapper valve (clamshell) over the exhaust outlet as this will cause excessive back pressure within the exhaust system and heater.

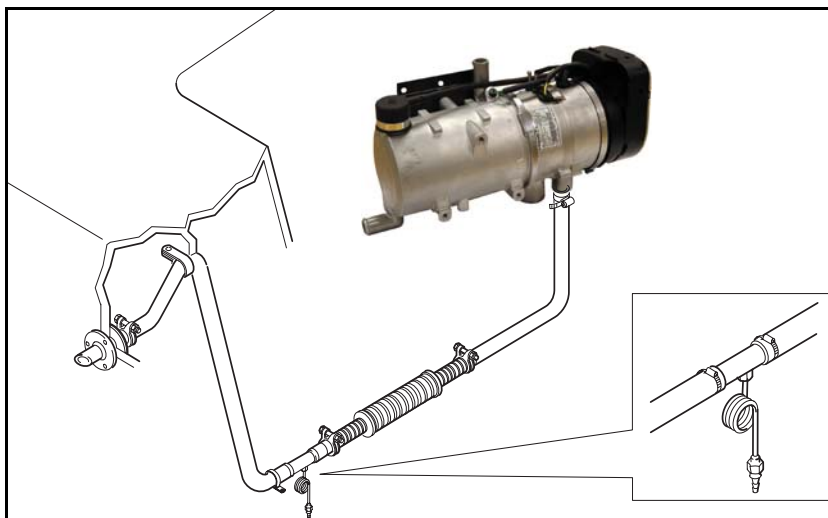
DO NOT cover or block the exhaust outlet while the heater is in operation.

The end of the exhaust pipe must be routed with a goose-neck bend and be pitched downward toward the outlet. Any splash water that may have penetrated can thus drain back out again and not into the heater. **This is a dry exhaust and not water injected.**

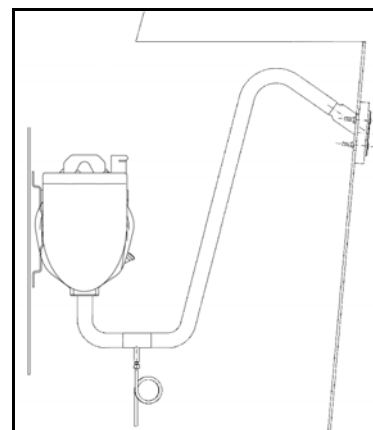
The exhaust pipe is to be kept as short as possible. The maximum length of 5 meters (16 1/2') without muffler or 2 meters (6 1/2') with muffler must on no account be exceeded. The total radius of bends should not exceed 270 degrees with a minimum bend radius of 50mm (2 in.).

The exhaust tube and exhaust components must be securely fastened using approved exhaust tube clamps and P-clips as supplied with the heater kit.

At the lowermost point of the exhaust pipe, a condensation water drain should be installed in which condensation or excess water collecting in the exhaust pipe can be drained off at regular intervals. Make sure to fill condensation drain with water to provide a seal against exhaust gas leakage once drain has been installed.



**Fig. 12 Exhaust System Layout**



## 16 Installation

---

### **WARNING**

Avoid asphyxiation! If the exhaust pipe is routed through the inside of the vessel, exhaust gas tube must be as leakproof as possible:

- use only Webasto approved exhaust clamps and firmly tighten clamps.
- an approved exhaust sealant can be used on the inside of the exhaust tube at all connection points
- use condensation water drain
- if desired, use an optional gas tight exhaust muffler to reduce interior noise

### **CAUTION**

- DO **NOT** fit the skin fitting below the water line.
- DO **NOT** cover the exhaust while the heater is in operation.
- DO fit the skin fitting as high as possible to avoid ingress of water.
- DO make sure exhaust clamps are tight and fit well to avoid gas escape.
- DO make sure that exhaust fumes cannot reach the air intake.



## Electrical System

### General Information

Electrical connections are to be carried out in accordance with the circuit diagrams contained in this installation manual.

When installing the electrical system make sure that the components are installed in protected, dry areas to prevent corrosion.

If vessel only has one battery, we recommend a second battery be installed for the operation of the heater. To avoid having to charge the battery too often, its capacity should not be too small.

If you have highly sensitive electronic components on board, a special electrical interference suppression may become necessary. In this case, please consult a competent specialist workshop.

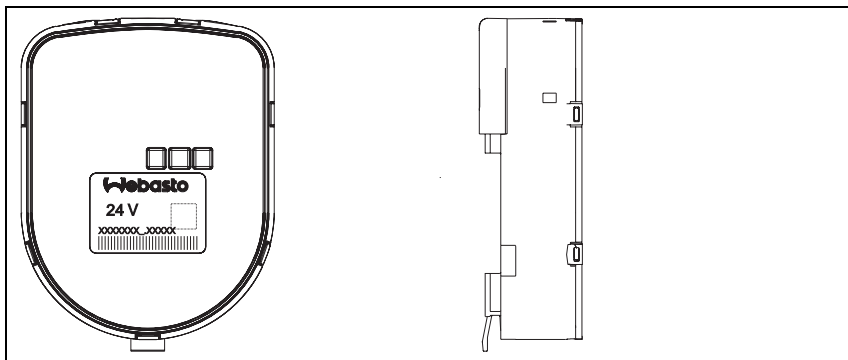
When actuating the battery disconnect switch (if equipped), wait until the cool down cycle of the heater has been completed.

### Control Module / Heater Connection

The electrical connection of the heaters is undertaken in accordance with the circuit diagrams in Figures 13, 15, 17, and 18.

#### Thermo 90 ST Control Module

The control module offers protection type 6K9K if it is installed in the position shown in Fig. 13.



**Fig. 13 Thermo 90 ST Control Module, Arbitrary Installation Position**

## 18 Installation

### TECC Program 412 and Higher with Thermo 90 ST and Electrical 3-Way Valve

Because an external water heater (Thermo 90 ST) is being installed with a BlueCool Chiller Unit, the TECC Card must be reprogrammed for proper operation. This step must be completed in order for proper operation of the Thermo 90 ST.

#### DEEP PROGRAMMING MODE:

Numbering below in \*\* represent reference numbers in Fig 14.

#### Setting Code 2:

1. Programming Code 2: With unit on, lower temperature set-point to 59° F (15° C).
2. Turn the system off by pressing the <on / off button> - \*14\*.
3. Simultaneously press the <Snow Flake> and <Sun> buttons - \*11\*.
4. Now in deep programming mode, hit the <F> button twice. The number 2 will be displayed \*15\* on the left along with the current value code to the right \*16\*. e.g. 2 00
5. To change this value, use the <Snow Flake> or <Sun> buttons to increase or decrease the value. For c5 configurations, use the following value:
  - Programming at nominal temperature 59°F (15 °C) Code 2 value 00 (C1 and T1 closed in heating mode)
6. To confirm a function change, hit the <F> button once to proceed to the next category and hit the <on / off> button to confirm.
7. Change is successful when the message " N E N O " is displayed.



Fig. 14 Chiller Control

#### Setting Code 9:

1. Programming Code 9: With unit on, raise temperature set-point to 84° F (29° C).
2. Turn the system off by pressing the <on / off button> - \*14\*.
3. Simultaneously press the <Snow Flake> and <Sun> buttons - \*11\*.
4. Now in deep programming mode, hit the <F> button nine times. The number 9 will be displayed \*15\* on the left along with the current value code to the right \*16\*. e.g. 9 03
5. To change this value, use the <Snow Flake> or <Sun> buttons to increase or decrease the value. For c5 configurations, use the following value:
  - Programming at nominal temperature 84°F (29 °C) Code 9 value 03 (C2 and T1 closed in heating mode)
6. To confirm a function change, hit the <F> button once to proceed to the next category and hit the <on / off> button to confirm.
7. Change is successful when the message " N E N O " is displayed.

#### Setting the Proper Function:

1. To change the function mode: turn the unit on by pressing the <on / off> button.
2. Hit the <F> button until the Function category is reached. The letter F will be displayed \*15\* on the left along with the current value code to the right \*16\*. e.g. F 04
3. To change the value, use the <Snow Flake> or <Sun> buttons to increase or decrease the value. For c5 configurations, F 04 and F 05 will be the only recommended and usable selections. Refer to the descriptions below to determine which value is correct for the end user.
  - F 04 = Auto Cycle Switching with External Heat Source (AC Heat, Fuel/Water Heater, etc.) - No Reversed Cycle Valve.
  - F 05 = Heat Cycle Only with External Heat Source Alone.
4. To confirm a function change, hit the <F> button once to proceed to the next category and hit the <on / off> button to confirm.
5. Change is successful when the message " N E N O " is displayed.

For electrical connections between the TECC Card and the Thermo 90 ST, refer to Figures 14, 15, 17, and 18.

Connections on the TECC Card:

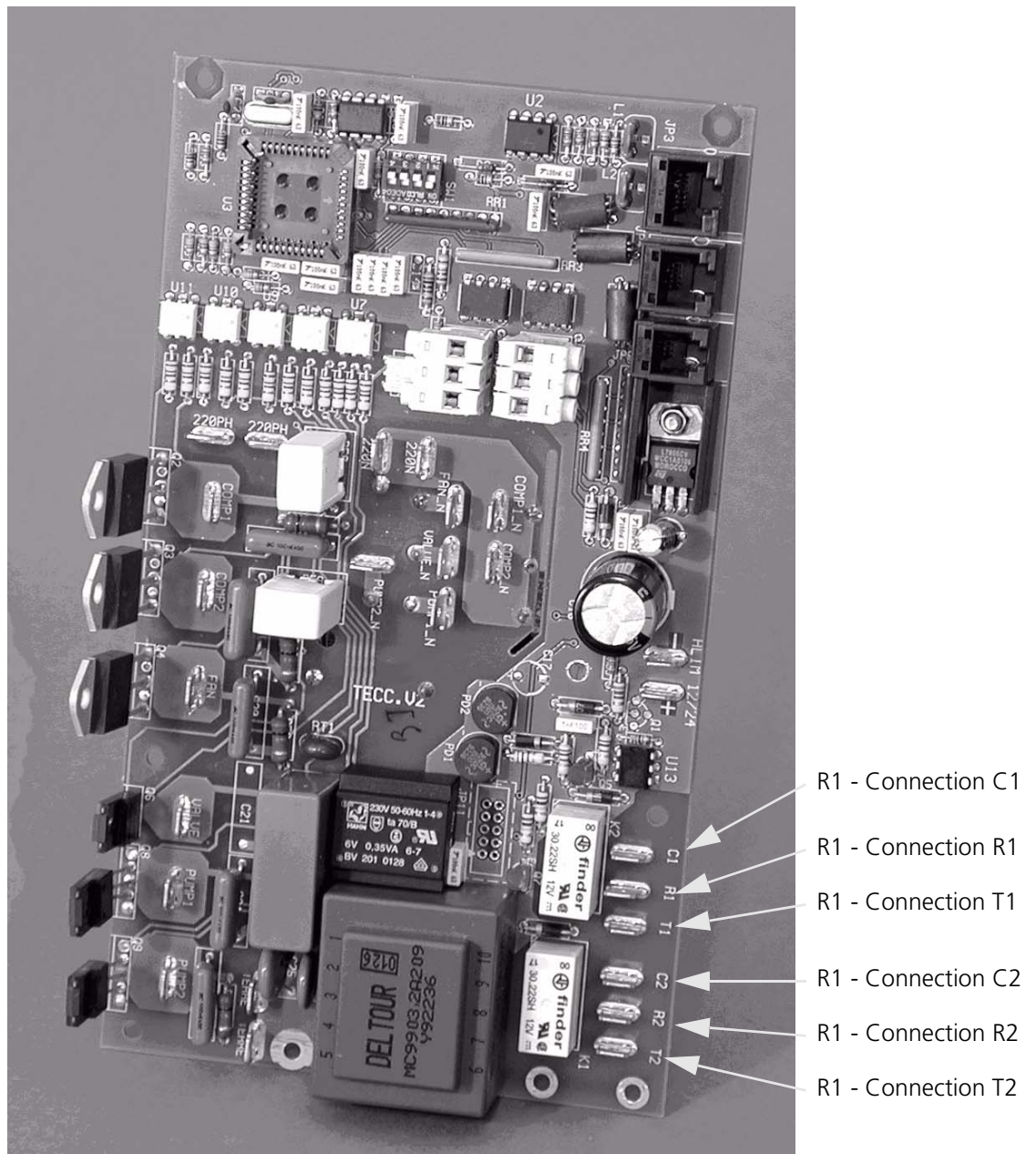


Fig. 15 Chiller Unit TECC Card

### Information about Air Guidance

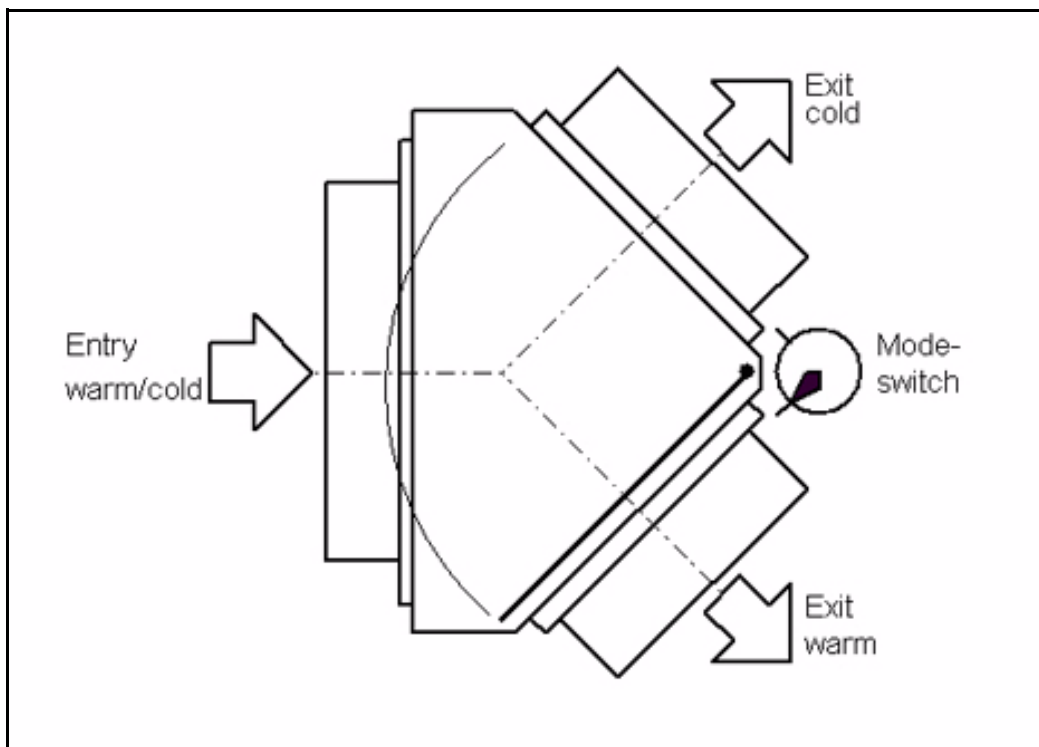
#### Inlets and outlets:

In principle, the air guidance in the ship is designed for air conditioning operation. This means the air is extracted at floor level and blown out at ceiling level. By nature, cool air subsides so this arrangement provides a natural circulation of air. In heating mode, this circulation is weaker and, theoretically, the air is only circulated by the blower.

#### Improvement possibilities:

One possible solution involves installing closable air outlets in addition to the aforementioned outlet grilles in the floor area. To do this, a switch must be integrated at a suitable point in the air guidance hoses of the air handler. It is possible to change from air conditioning to heating operation by operating the switch manually.

#### Principle of an Air Guidance Switch:



**Fig. 16 Air Guidance Switch**

#### Important points:



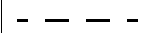



- The distance between the (hot) air outlet and the (circulating) air inlet must be at least 5' (1.5m). (Danger of air closed circuit)
- Consider the installation complexity (price)
- The customer must perform the changeover manually.
- Currently unavailable as a single part



## Circuit Diagrams

### Circuit diagram legend for the Thermo 90 ST

1. Temperature coding (temperature at water outlet):  
Refer to following circuit diagram legend for further information.
2. Vessel Fuse
3. Vessel Blower Switch

Cable cross-sections		
	< 7.5 m	7.5 - 15 m
	0.75 mm <sup>2</sup>	1.0 mm <sup>2</sup>
	0.75 mm <sup>2</sup>	1.0 mm <sup>2</sup>
	1.0 mm <sup>2</sup>	1.5 mm <sup>2</sup>
	1.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>
	2.5 mm <sup>2</sup>	4.0 mm <sup>2</sup>
	4.0 mm <sup>2</sup>	6.0 mm <sup>2</sup>

Cable Colors	
bl	Blue
br	Brown
ge	Yellow
gn	Green
gr	Grey
or	Orange
rt	Red
sw	Black
vi	Violet
ws	White

### Thermo 90 ST Circuit Diagram Legend

Item	Designation	Comment
A1	Heater	
A2	Control module	
B1	Flame sensor	
B2	Temperature sensor	
B3	Temperature limiter/ Overheating guard	
B4	Room thermostat	
E	Glow plug	
F1	Fuse 20 A	Flat fuse SAE J 1284
F2	Fuse 5 A	Flat fuse SAE J 1284
F3	Fuse 20 A	Flat fuse SAE J 1284
H1	"Heating" symbol in the display	Operating indicator (in item P2)
H2	Light max. 2 W	Operating indicator (in item S4)
H3	Symbol light	Light (in item P2)
H5	Lamp, min. 1.2 W	Switch-on indicator pumping device
H6	Red LED	Immediate heat button light, ready indicator, switch-on control (in item P2)
K3	Relay	Circulating pump remote control
K5	Relay	for vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
M3	Motor	Vehicle fan
P2	Digital timer	For programmed operation
S4	Switch	ON/OFF
S5	1 or 2-pin disconnecting switch	Emergency off switch, electric or pneumatic
S7	Pumping device switch	to positive
S8	Momentary-contact switch	Immediate heat button remote control
S9	Switch	Heating/Circulating pump remote control
S10	Switch	Battery switch in positive
X1	12-pin plug connection	to item A1
X3	12-pin plug connection	to item P2
X5	Plug connector, 2-pin	to Y1
X6	Plug connector, 2-pin	Diagnostics
X11	12-pin plug connection	To item A2 (ST 1)
X12	12-pin plug connection	To item A2 (ST 2)
X13	Plug connector, 2-pin	To item A2 (ST 3)
Y1	Metering pump	Fuel pump for heater
Y2	Solenoid valve	for pumping device

## 22 Circuit Diagrams

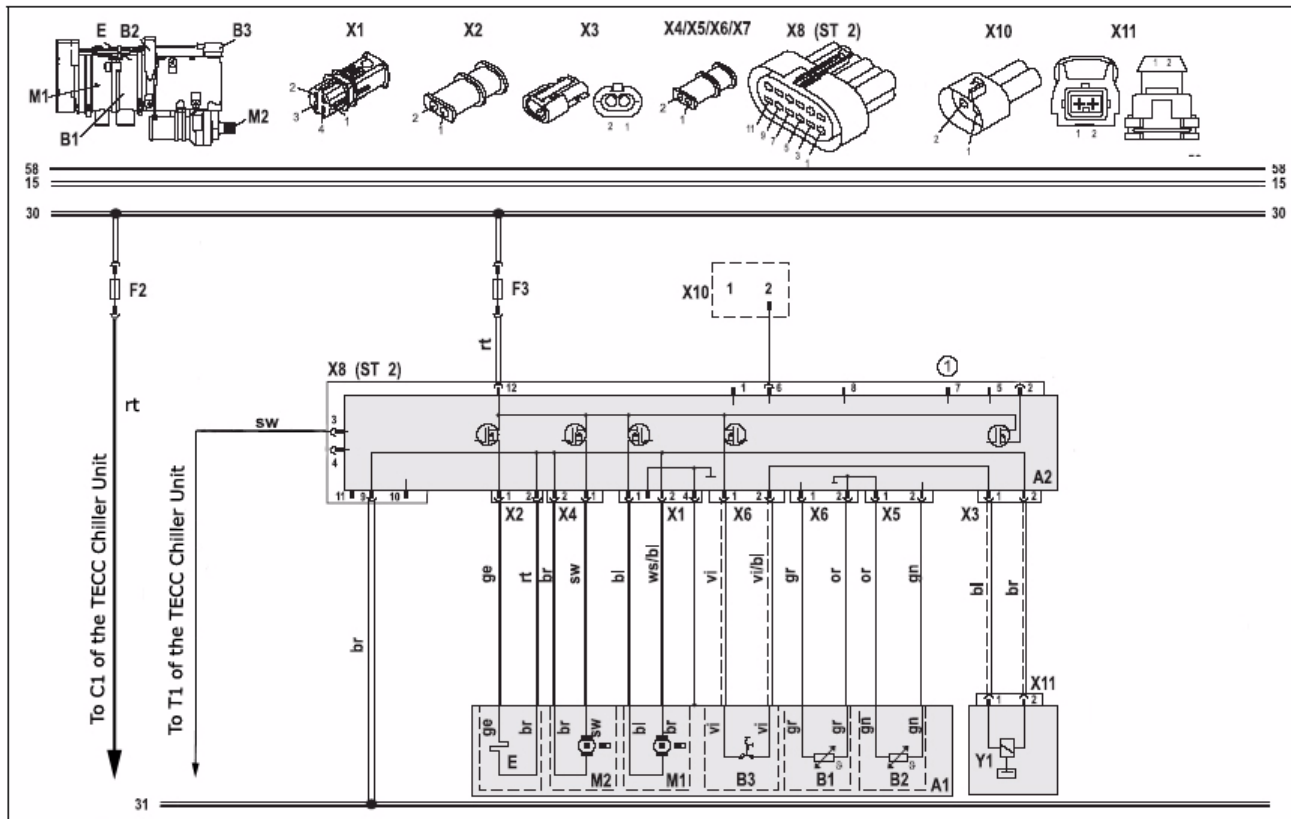


Fig. 17 System Circuit for Thermo 90 ST, 12 / 24V

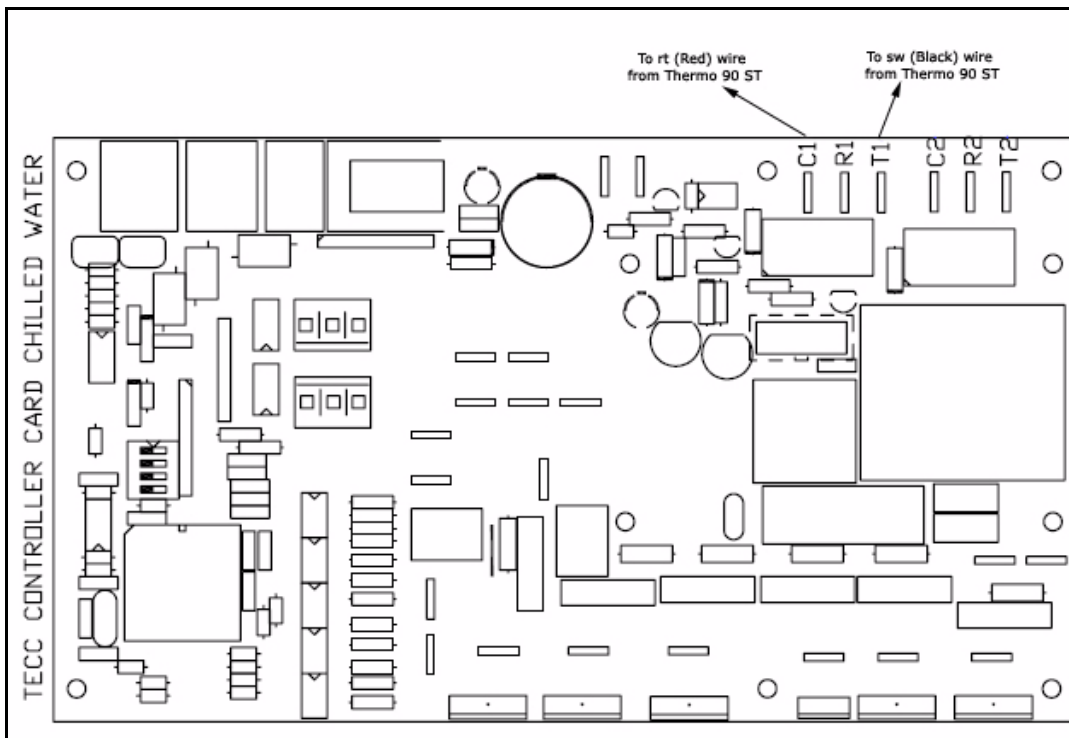


Fig. 18 TECC Card from Chiller Unit

## 1. Initial Start-up

### General

After you have installed the heater, bleed the water system and the fuel supply system carefully.

Conduct a trial of the heater to check all the water and fuel connections for leaks and to ensure that they are secure. If the heater suffers a fault during operation, the fault must be located and remedied.

### Description and Operation

After the heater is installed and the TECC Card is programmed to reflect Function F4 (*Preferred Function*), the end user will enjoy seamless comfort control. The TECC Card will now request the Thermo 90 ST rather than reverse compressor cycling when heat is requested.



**Note:** Other program functions are available. See *Setting the chiller control on page 16 for further information.*

### Air Conditioning Operation:

Display function F1, F2 and F3 - In air conditioning mode, the 3-way valve is de-energized and remains in a spring-loaded position. The cooled water flows through the air handler and cools the drawn in recirculated air. The water temperature at the chiller outlet is 39 - 50°F (4 – 10 °C) depending on the sea water temperature.

### Heating Mode:

Display function F4 and F5 - The 3-way valve switches to the spring loaded position if the automatic mode switches to the heating function (F4) or if "Heating operation with external heating" (F5) is selected. This means the heater is integrated in the water circuit and heats the water to max. 144°F (62 °C). The heat is given off by the air handler. A storage tank should be installed ahead of the heater if the water volume in the circuit is too small less than 2 1/2gal. (10 liters).

### Cool Down Mode:

To ensure adequate volumetric flow during heater cool down, the control program of the TECC card has been adapted to cool down the heater for 5 minutes. **The Cool Down is active from program version 413 onwards.**



## 24 Technical Data

### 2. Technical Data

Except where limit values are specified, the technical data below refers to the usual heater tolerances of  $\pm 10\%$  at an ambient temperature of 68°F (20 °C) and at nominal voltage.

#### **Electrical components:**

The control module, motors for combustion air blower and circulating pump, glow plug, and switch are designed for either 12 V or 24 V. The temperature limiter, temperature sensor and flame sensor are identical on 12 V and 24 V heaters.

#### **Fuel for Thermo 90 ST**

The diesel fuel specified by the manufacturer must be used. There are no known negative influences due to fuel additives. If low-temperature fuel will be used, the heater must be operated for approx. 15 minutes so the fuel line and fuel pump are filled with the new fuel.

Heater	Operation	Thermo 90 ST Diesel
EC licensing symbol		e1*2001/56*0019* __
Model		Water heater with Ferro-tec technology
Heat output	Max. regulating range	31,000 BTU 6,142 – 26,000
Fuel		Diesel
Fuel consumption	Max. regulating range	0.29 gal./h 0.05 – 0.24 gal./h
Rated voltage		12 or 24 V
Operating voltage range		10 - 5 or 20 - 30 V
Max. ambient temperature: Heater: - Operation - Storage Control module:- Operation - Storage Metering pump: - Operation - Storage		-40° - 230°F (194°F with control module installed on the heater) -40° - 230°F (194 °F with control module installed on the heater) -40° - 185°F -40° - 185°F -40° - 140°F -40° - 185°F
Max. operating pressure (heat medium)	Max.	29 PSI
Capacity of the heat exchanger		0.04 gal.
Max. combustion air intake temperature		+40 °C
Minimum capacity of the system		1 1/2 gal.
Delivery rate of the circulating pump against 2 PSI		436 gal./h
CO <sub>2</sub> in the exhaust fumes (normal function range)	Max.	10 - 12% by volume
CO <sub>2</sub> - adjustment values at approx. 68°F (20 °C) and geographic altitude above sea level	Max.	3280 ft. 11.3%
Heater dimensions (tolerance $\pm 3$ mm) * Control module installed on the heater		L 12" (307mm) or 13.85" (352*) mm with module attached W 5.16" (131 mm) H 9.13" (232 mm)
Weight		10.58 lb (4,8 kg)



### 3. Troubleshooting

#### Fault lock-out

- Fuel is supplied for max. 240 seconds if the flame does not start to burn.
- Fuel is supplied for max. 240 seconds if the flame goes out during operation.
- The fuel supply is shut off if the system overheats (temperature limiter is tripped). If the system overheats the button on the temperature limiter must be reset.

Once the cause of the fault has been eliminated, the fault lock-out is cancelled by switching the heater off and on again. If the under voltage guard switches off the system for longer than 20 seconds, the fuel supply is interrupted.

	Thermo 90 ST
12 V	10.5V – 0.5V
24 V	21V – 1V

#### Version with Light

If the system is operated with a light, the nature of the fault is indicated by a flashing code on an indicator light during the cool down time of the heater. After five short signals, count the long flashes:

- 1x No start (after 2 attempts to start)
- 2x Flame failure
- 3x Under voltage or over voltage
- 4x Premature flame recognition
- 4x Flame sensor interrupt or flame sensor short-circuit
- 6x Temperature sensor interrupt or temperature sensor short-circuit
- 7x Metering pump interrupt or metering pump short-circuit
- 8x Blower motor interrupt or blower motor short-circuit or blower motor incorrect speed
- 9x Glow plug interrupt or glow plug short-circuit
- 10x Overheating
- 11x Circulating pump interrupt or circulating pump short-circuit







**Webasto Product N.A., Inc.**

15083 North Road  
Fenton, MI 48430

Technical Assistance Hotline  
USA: (800) 860-7866  
Canada: (800) 667-8900

[www.webasto.us](http://www.webasto.us)  
[www.techwebasto.com](http://www.techwebasto.com)