

Coolant Heaters

**Thermo 230**

**Thermo 300**

Operating Instructions

Installation Instructions

Service Parts Listing

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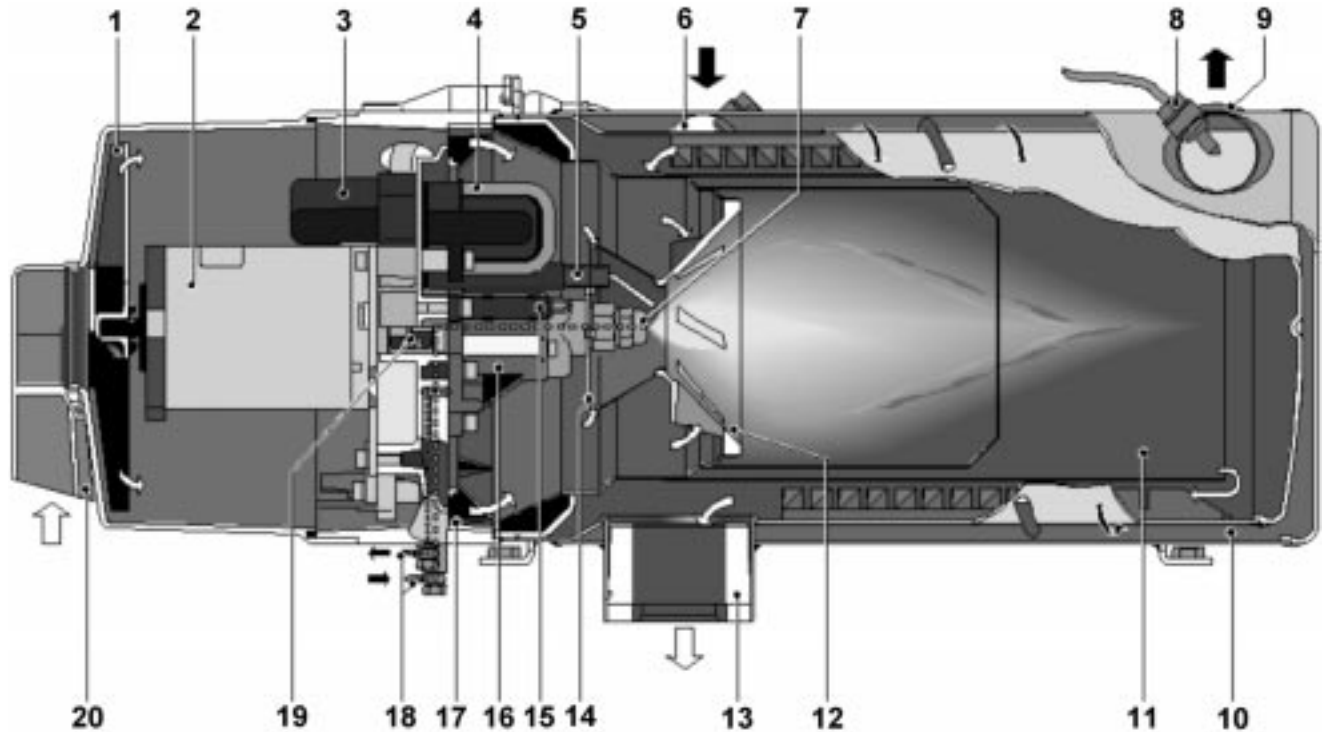
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## 1. Introduction

### 1.1 General Description



1 Combustion air fan	7 Fuel nozzle	13 Exhaust pipe	18 Fuel supply / return
2 Motor	8 Temperature sensor	14 Photo disc	19 Coupler
3 Electronic control unit	9 Overheat thermostat	15 Flame detector	20 Combustion air intake
4 Electronic ignition coil	10 Heat exchanger	16 Fuel pump w/ solenoid valve	
5 Ignition electrodes	11 Combustion chamber	17 Combustion air adjusting shutter	
6 Water pipes	12 Combustion air swirler		

Fig. 101: Webasto Thermo 230/300 Heater

**The Webasto Thermo 230 and 300 Heaters for use on diesel powered transit buses and coaches are designed to:**

1. **Preheat Engine block** of liquid cooled engines to ensure reliable starting in cold weather and to reduce cold start wear and emissions (white smoke).
2. **Boost heating levels** with the engine running. The heater will boost the heating system in cold weather when an engine is running at light loads, even at high speeds or idling. The heat rejection of modern diesel engines to the coolant, especially in buses, is often not adequate to heat the vehicle's interior.
3. **Increase Driver Visibility** in poor weather conditions by providing higher levels of heat for quick defrosting/defogging of windshield and side glass.

**1.2 Legal provisions**

Heater installation must be performed in accordance with the manufacturer`s installation instructions.

Any deviations from these instructions are only permitted with written approval from Webasto Thermosystems.

Installations not complying with the installation instructions will release Webasto Thermosystems from any product liability.

OEM installations must be approved by Webasto Thermosystems.

**1.3 Meaning of Warning, Caution and Note****WARNING**

This heading is used to highlight that non-compliance with instructions or procedures may cause accidents leading to severe injury or death.

**CAUTION**

This heading is used to highlight that non-compliance with instructions or procedures may cause damage to equipment.

**NOTE**

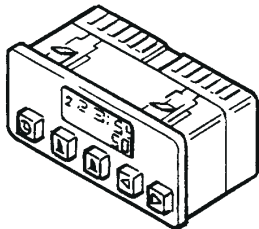
This heading is used to highlight and draw specific attention to information.

## 2. Operating your Webasto Heater

Before switching the Webasto water heater on, set vehicle heating system to the “heat” position and open any shut off valves. Depending on the type of control installed in the of the vehicle, the heater can be operated by the following methods.

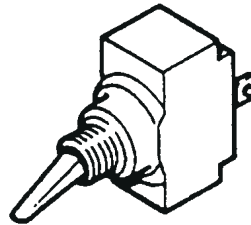
### 2.1 Switching On

Using a timer:



Timer

Using a switch:



Switch

Upon actuation of the “instant heat” button the “operation indicator” on the timer lights up.

Or

When the switch is used for switching “ON” the Webasto heater, the operation indicator integrated in the switch is illuminated.

The heater motor and coolant circulating pump begin to run. After approximately 10-25 seconds the solenoid valve opens and fuel is sprayed into the combustion chamber. At the same time, the electronic ignition coil produces high voltage (8000 V) and the mixture of fuel and air in the combustion chamber is ignited by a spark produced at the tip of the ignition electrodes. The flame is detected by the photo cell, then the electronic ignition coil stops producing high voltage and combustion continues by itself (spark on electrodes is only required to ignite the flame). At this point the heater is working and produces heat.

**The Webasto heater will cycle on and off until:**

1. The Webasto heater is switched off.
2. Time has elapsed on the timer.
3. The vehicle battery voltage drops below 20.0V.
4. The Webasto heater runs out of fuel.
5. A fault lock out occurs, indicated by the operating indicator light being off during the cool down cycle (i.e. overheat).

#### **WARNING**

Due to the danger of poisoning and asphyxiation the heater must not be operated in enclosed spaces such as garages or workshops without adequate exhaust extraction.

#### **WARNING**

The heater must be switched “OFF” while refueling and at fueling stations.

#### **WARNING**

Do not operate any Webasto heater in an area where toxic or explosive materials or fumes may be present.

## 2.2 Switching Off

When heating is no longer required, switch the Webasto heater off. The solenoid valve interrupts the fuel supply, combustion stops and the indicator light turns off. The Combustion air fan and the water pump remain on for another 2-3 minutes (after run cycle) purging the combustion chamber of any fumes.

**NOTE**

Restarting the Webasto during the after-run period is allowed.

## 2.3 Engine Pre-heating

1. Set the timer 30 min. to 1 hr. before you want to start engine. The heater will start up at set time. (See timer operating instructions beginning on page 203).  
Or switch the toggle switch or “instant on” switch on your timer in the vehicle dash to “ON”. The heater will start up.
2. When time is elapsed on your timer or engine preheat is no longer required, switch the Webasto heater “OFF”. The heater will go through the after-run cycle.

## 2.4 Boost Heating for Engine and Passenger Compartment

1. Switch the toggle switch (or the “instant on” button of the timer) in the vehicle dash to “ON”. The heater will heat the coolant to a temperature of 185°F (85°C). Above this temperature only the water pump will run.
2. When boost heating is no longer required, switch the Webasto heater “OFF”. The heater will begin a brief after-run (cool-down) cycle.

## 2.5 Operation with 7-Day Digital Timer Model 1531

The “Digital Timer with 3 time settings” permits the Webasto heater to be switched on and off instantly, or automatically at 3 programmable starting times.

The operating time of the heater can be pre-selected.

It is possible to program 3 different heating programs according to your individual needs.

Only one preset starting time can be activated at any one time.

When the vehicle’s ignition is switched on, the current time of the day and the day of the week are displayed.



**Programmed Heater Operation**

Three memory locations numbered 1 to 3 are available. Each memory location can be assigned a given time together with the day of the week.

**Pre-selected Starting Times**

The pre-selected starting time is the time at which the heater switches itself on automatically.

We recommend that memory locations 1 and 2 be used for presetting starting times within 24 hours of setting the timer.

Memory location 3 can be used for a starting time within the next 7 days of setting the timer.

**Operating Time**

The period of time during which the heater is in operation is referred to as operating time. The heater remains in operation for as long as the operating time has been preset.

Heater operation can be pre-selected for any time from as little as 1 minute to a maximum of 120 minutes (factory preset is 60 minutes).

**Remaining Operating Time**

The remaining operating time refers to the period of time the heater still continues to remain in operation. It can only be changed while heater is in operation.

**NOTE**  
If the ignition is switched off while the heater is in operation, the remaining operating time of 5 minutes flashes on the display and the heater continues to operate for this period of time.

**Setting the Digital Timer**

After the power has been connected, all symbols on the digital display are flashing. The time of the day and the day of the week must be set. All flashing displays and symbols of the timer can be set by means of the ◀ and ▶ buttons.

If the buttons are not pressed within 5 seconds, the currently displayed time or function will be stored.

When the ◀ and ▶ buttons are pressed for more than 2 seconds, the quick digit advance mode is activated.

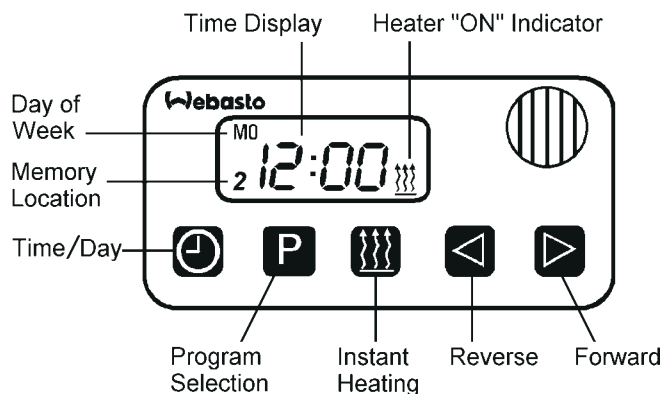

























Fig. 201: 7-Day Digital Timer – Model 1531

2.6 7-Day Digital Timer Programming and Operating Instructions

Setting the time and day of the week	Press the  button for more than 2 seconds. Time display flashes. Press the  or  button to set time of day. Wait 5 seconds. Time is now stored. Day of week flashes. Press  or  button to set day of week. Wait 5 seconds. Day of week is now stored.
Viewing the time	With ignition "ON": Continuous display of current time and day of the week. With ignition "OFF": Briefly press  button. Display of current time and weekday appears for 5 seconds.
Switching heater on for instant heater operation	With ignition "ON": Press  button. Heater is switched on (continuous heating) and continues to operate until  button is pressed again or ignition is switched off. With ignition "OFF": Press  button. Heater is switched on for the preset operating time (the factory-set heater operating duration is 60 minutes).
Switching the heater off	Press  button. Heater starts its after-run cycle and is switched off thereafter.
Programming heater starting time	Press  button. Memory location number flashes. Press  or  button to preset starting time. Wait 5 seconds. Preset starting time is now stored. Day of week flashes. Press  or  button to set day of week. Wait 5 seconds. Day of week is now stored. The number of memory location remains on the display. The timer is now in the programmed mode and switches heater on at the preset time.
Recalling pre-selected times	Press  button until the desired memory location number is displayed. Read off preset time.
Canceling pre-selected times	Press  button repeatedly until no more memory location number is visible on the display.
Programming duration of operating time	The heater must be switched off. Press the  button. Operating time flashes. Press  or  button to set operating duration time (between 1 and 120 minutes).
Setting the remaining operating time	Heater must be in operation. Press  button. Remaining operating time flashes. Press  or  button to set remaining operating time. Wait 5 seconds. Remaining operating time is now stored.

**NOTE**  
If the ignition is switched off while the heater is in operation, the remaining operating time of 5 minutes flashes on the display and the heater continues to operate for this period of time.


**NOTE**  
We recommend that memory locations 1 and 2 be used for presetting starting times within 24 hours of setting the timer. Memory location 3 can be used for a starting time within the next 7 days of setting the timer. By repeatedly pressing  button, starting time 1, 2 or 3 can be preset.

Table 201: Digital Timer Instructions

**3. Technical Data**

**3.1 Thermo 230/300 Heater Data**

Heater		Thermo 230	Thermo 300
Design		Coolant Heater with High Pressure Fuel Nozzle	
Heat Output	BTU/hr (kW)	80,000 (23)	104,000 (30)
Fuel		Diesel #1, Diesel #2, Arctic and Kerosene	
Fuel Consumption max.	Kg/hr (US. gal/hr)	2.5 (0.8)	3.3 (1.2)
Rated Voltage	(V)	24	
Operating Voltage	(V)	20 ... 28	
Power Consumption without Water Pump	(W)	65	110
Permissible Ambient Temperature during Operation	°C (°F)	-40 ... +60 (-40 ... +140)	
Storage Temperature	°C (°F)	+85 max. (+185 max.)	
Minimum Capacity of Cooling System	l (US. gal)	10.0 (2.64)	
Permissible Operating Pressure of Coolant	bar (psi)	0.4 ... 2.0 (06 ... 29)	
CO <sub>2</sub> in Exhaust Gas	% by Volume	10.5 ±0.5	
Dimensions of Heater mm (inch)	L	610 mm (24.01 in.)	
	W	246 mm (9.69 in.)	
	H	220 mm (8.66 in.)	
Weight of Heater including Control Unit	kg (lb)	19 (41.88)	

Table 301: Thermo 230/300 Heater Data

3.1.1 Thermo 230/300 Heater Dimensions

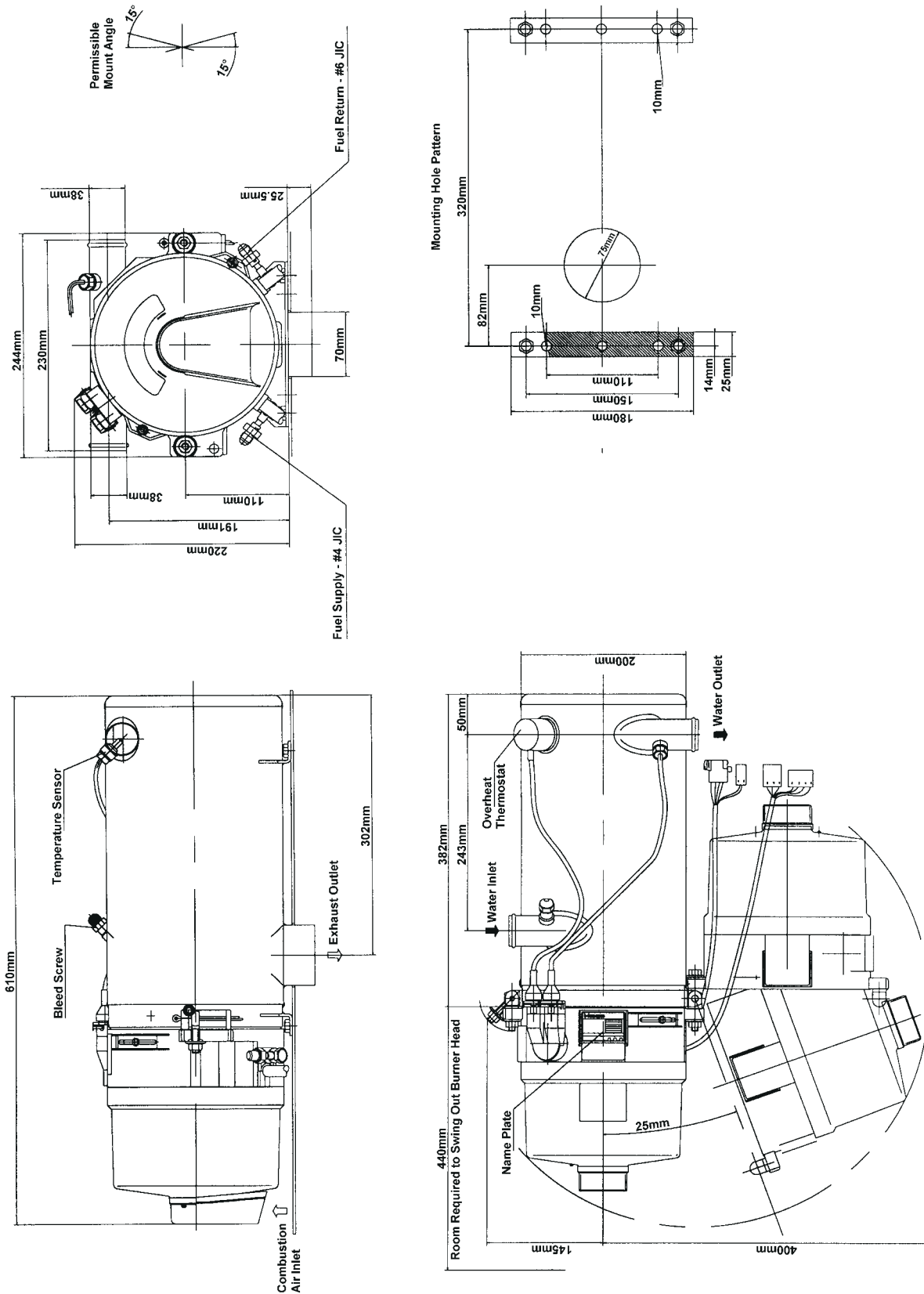


Fig. 301: Thermo 230/300 Heater Dimensions

3.2 Coolant Circulation Pump Data

Circulating Pump		U 4814	U 4851
Flow Rate l/hr	l/h (gal/min)	5200 (22.9) against 0.2 mbar	6000 (26.4) against 0.4 mbar
Rated Voltage	(V)	24	24
Operating Voltage Range	(V)	20 ... 28	18 ... 32
Power Consumption	(W)	104	209
Dimensions	L	221 mm (8.7 in.)	285 mm (11.22 in.)
	W	100 mm (3.94 in.)	115 mm (4.52 in.)
	H	105 mm (4.14 in.)	110 mm (4.33 in.)
Hose connection	mm (inch) O.D.	38.0 (1.5)	38.0 (1.5)
Weight	kg (lb)	2.1 (4.63)	2.7 (5.95)

Table 302: Coolant Circulation Pump Data

3.2.1 Coolant Circulation Pump Dimensions

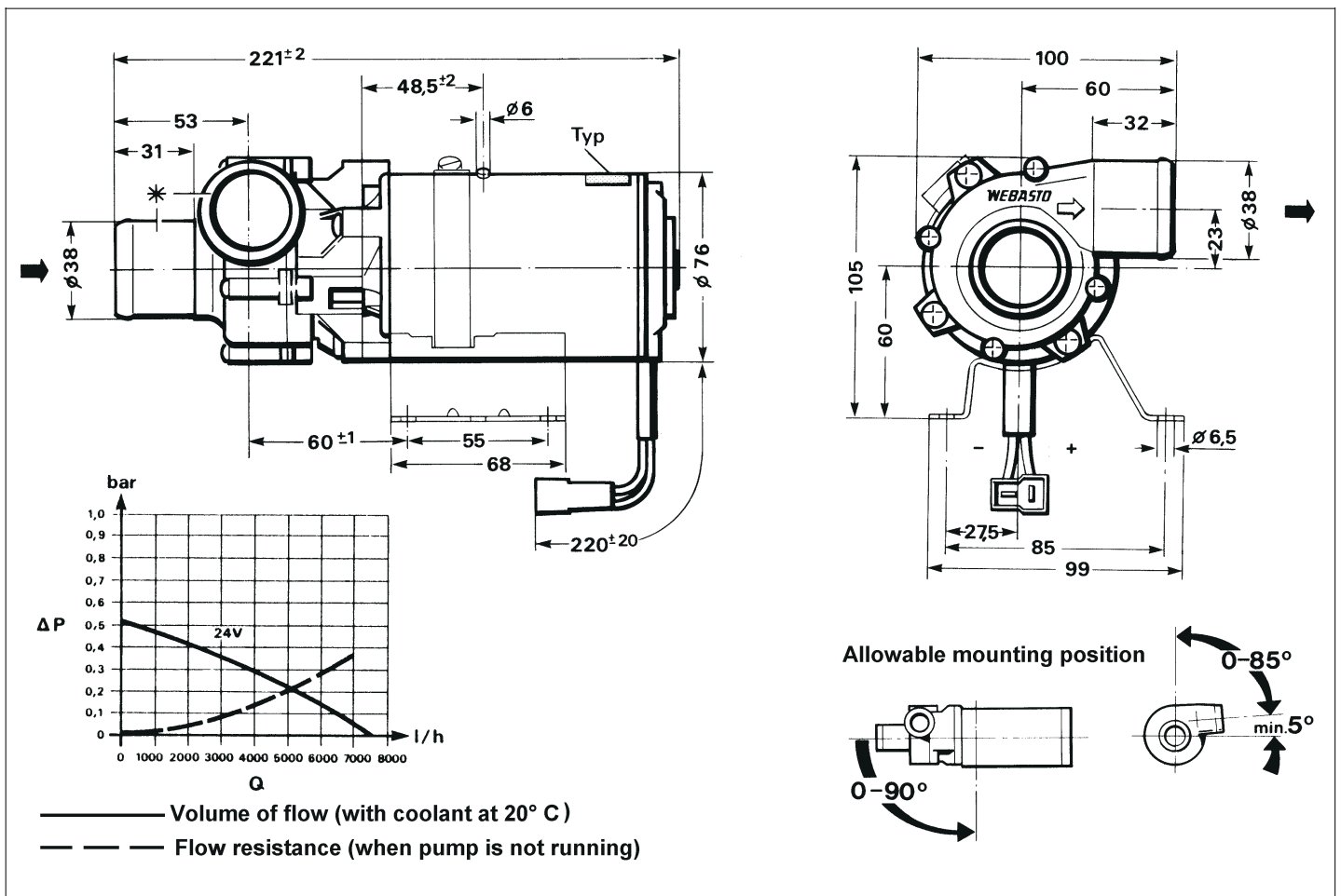


Fig. 302: Coolant Circulating Pump Assembly - U 4814

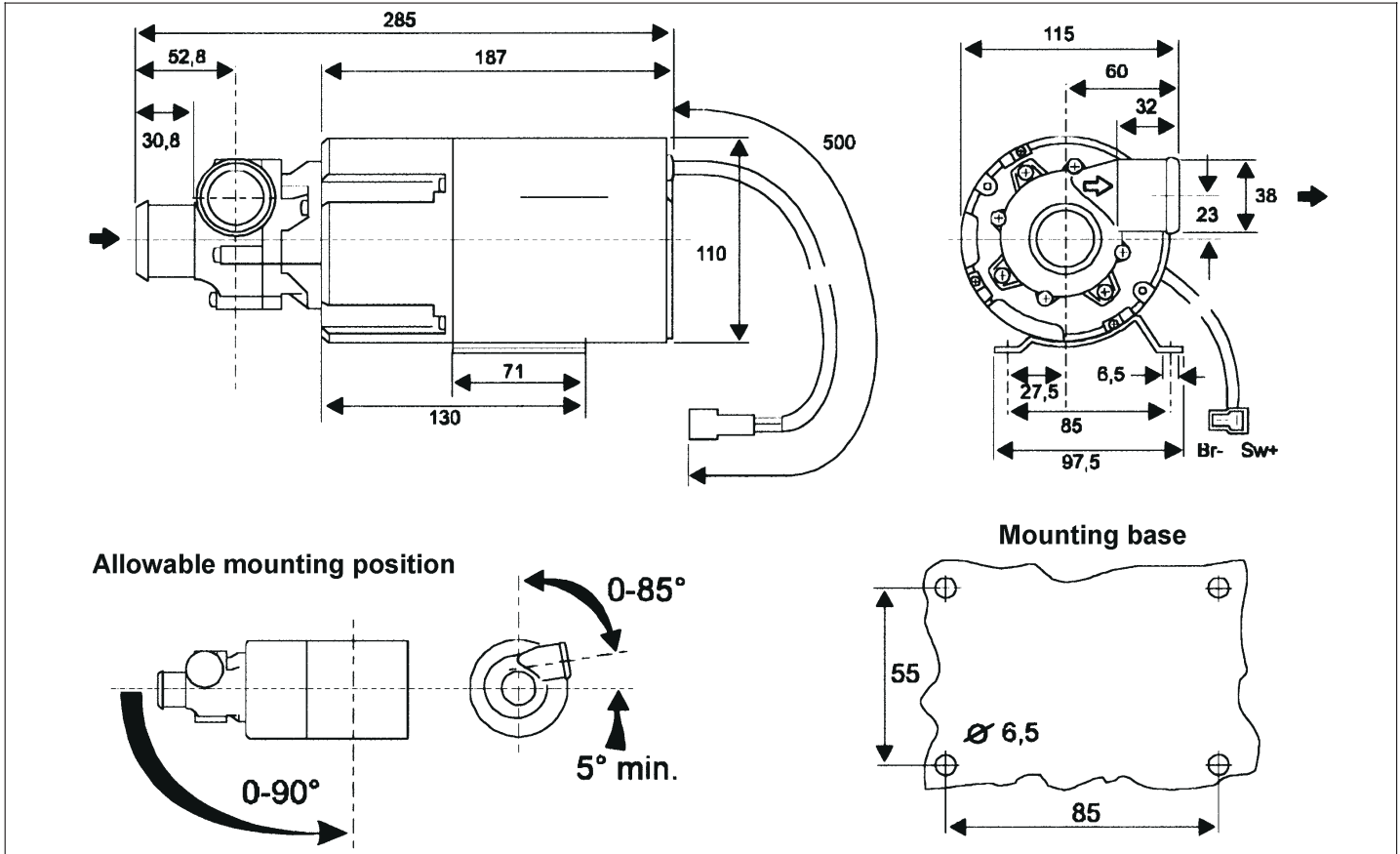


Fig. 303 Coolant Circulating Pump Assembly - U 4851

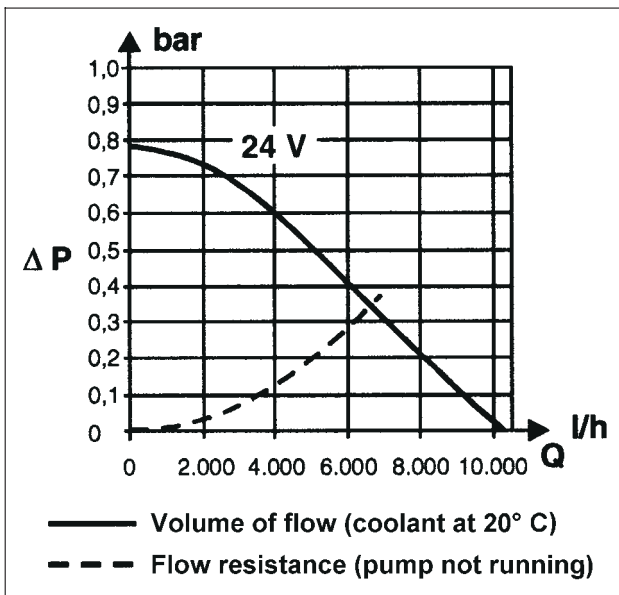


Fig. 304 Pump Operating Data - U 4851

## 4. Installation

### 4.1 General Information

Webasto will take you step by step through the installation process to ensure successful operation for years to come. The installation must be performed in accordance with the installation instructions provided in this manual.

**IMPORTANT!** The proposed heater installation must be approved by Webasto Thermosystems.

### 4.2 Installation Location

The heater and circulation pump are to be integrated into the coolant system (or into a separate heating circuit, if applicable) of the vehicle. The heater should be installed as low as possible in the coolant system to assure static bleeding of the heater and the circulating pump.

The heater is to be installed in a clean and dry environment, usually a separate compartment, accessible for service, typically towards the rear of the vehicle. The heater may also be located in the engine compartment. The installation enclosure must provide adequate ventilation for combustion air requirements [4 in<sup>2</sup> (20 cm<sup>2</sup>)]. When installing the heater, make certain that the clearances required for accessing the unit for servicing are observed (e.g. removal of the combustion chamber). See figure 301, page 302.

### 4.3 Mounting the Heater

1. Drill all required holes to dimensions shown in figure 301, page 302.
2. Bolt heater rigidly inside enclosure or engine compartment.

### 4.4 Exhaust Pipe Connection

Rigid exhaust pipe is recommended in installations where the use of an exhaust deflector is not suitable. The exhaust pipe must have a minimum internal diameter no less than 2 3/4" (70mm) and a length no greater than 16' (5m). The pipe may have several bends totaling no more than 270° overall. Do not cut and weld pipe to make 90° angled corners.

**NOTE**

This manual does not cover all possible installations. For special applications use this manual as a general guideline only. Contact Webasto Thermosystems directly at 1-800-555-4518.

**WARNING**

The heater must not be installed in either the driver's compartment or in the passenger area of vehicles.

**NOTE**

The circulating pump is not self priming.

**WARNING**

Exhaust pipes must be so routed that the possibility of exhaust fumes entering the vehicle is unlikely.

1. Install exhaust deflector on heater exhaust outlet or install exhaust pipe.
2. Route the exhaust system so that the possibility of discharged exhaust gasses entering the vehicle is prevented.
3. Direct the discharge opening of the exhaust system in such a way as not to be pointed in the direction of travel, and so located that the possibility of clogging caused by snow, mud or debris is prevented.
4. Any condensation water collecting in the exhaust pipe must be discharged. If necessary, drill a drain hole at the lowest point to allow drainage.

### NOTE

Route the exhaust system away from any parts of the vehicle that may be damaged by heat (i.e., brake lines, electrical wiring, hoses and fuel lines).

### NOTE

Additional flexible exhaust tubing Webasto part number 479 721.

### 4.5 Combustion Air Supply

Never draw combustion air from inside the passenger area of a vehicle, or from areas where fumes and gasses can accumulate.

Where heater is installed in a sealed compartment, adequate ventilation for combustion air requirements [4 in<sup>2</sup> (20 cm<sup>2</sup>)] must be provided.

Combustion air can be drawn from a remote (protected) area in order to provide a clean air supply.

For installations requiring remotely drawn combustion air, use approved ducting with an unrestricted internal diameter no less than 2 1/4" (55mm) and a length no greater than 16' (5m). The ducting may have several bends totaling no more than 270° overall. Approved combustion air ducting can be ordered through Webasto under part number 887 29A.

To connect combustion air intake ducting [2 1/4" (55mm)] to the heater, several types of fittings are available that snap directly onto the combustion air inlet of the heater.

For a straight connection, order a straight adapter under part number 101 377 and snap it onto the combustion air inlet and attach air ducting.

In the event there is insufficient room for a straight attachment, a 90° snap-on fitting (P.N. 101 404) and an adapter ring (P.N. 823 15A) are available. Simply snap them onto the combustion air inlet of the heater and attach ducting.

For installations where ducting is not required, the heater is factory equipped with a splash deflector that simply snaps onto the combustion air inlet.

### WARNING

Never draw combustion air from inside the vehicle, or from areas where fumes or gases can accumulate

### CAUTION

Combustion air ducting must be non-restrictive. Do not connect to existing vehicle air ducting or filtration systems.

### NOTE

Approved combustion air ducting can be ordered under Webasto part number 887 29A.



## 4.6 Plumbing Into the Coolant System

### 4.6.1 General Information

An efficient heating system must have an adequate supply of hot water to all heater cores. The amount of hot water available to a typical three or more heater core system depends on the water pumps capability and the amount of restriction within the coolant system.

Webasto high performance circulating pumps designed for extensive heating applications are available. Installing a Webasto heater and circulating pump in accordance with the following instructions will maximize the heating systems efficiency.

Coolant typically is routed out of the engine, through the Webasto coolant heater and then through the vehicle's heating system. A path for coolant flow must always be maintained while the Webasto heater is in operation. A bypass loop will be required if an uninterrupted coolant flow path cannot be assured due to valves being closed while the Webasto heater is in operation. The coolant circulating pump(s) must operate while the Webasto heater is "ON."

The coolant circulating pump must be mounted as low as possible in the vehicle's cooling system. A minimum of 10% of a good quality antifreeze should be maintained in the cooling system at all times. Heater and water pump fit 1.5" (38 mm) I.D. heater hose meeting SAE 20 R3 specifications. Silicone hose requires special hose clamps.

### 4.6.2 Engine and Passenger Compartment Heating

#### A: Heater Cores arranged in Series (fig. 401)

A series heating system works in this fashion:

Heated water (coolant) from the engine travels through the first heater core in the circuit, then on to the next heater core in circuit, and on to the next, etc. Each core adds some restriction, resulting in decreased water flow. Not only is water flow reduced, but also water temperature is reduced by each successive heater core resulting in the last core receiving water that is usually too cool to be effective.

#### WARNING

When working on the coolant system, allow the engine to cool down and open the radiator cap carefully.

#### CAUTION

The Webasto heater relies on coolant flow to transfer heat from the heater to the vehicle's heating system. The coolant pump(s) must be operating and there must be a path for coolant to flow or the heater will overheat.

#### NOTE

Heater hose must meet SAE 20 R3 specifications. Silicone hose requires special hose clamps. Hose clamps must be tightened to 45 in/lb. (5 Nm) torque.

SERIES PLUMBING

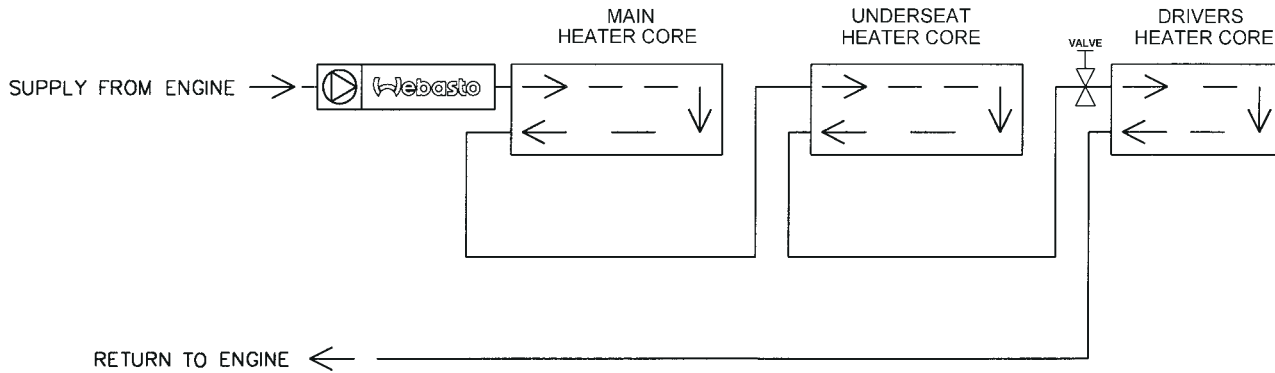


Fig. 401: Series Plumbing Circuit (Shown with heater installed)

**CAUTION**  
A path for coolant to flow must be provided whenever the Webasto heater is operating.

**B: Heater Cores arranged in Parallel (fig. 402)**

A parallel heating system works in this fashion: Heated water (coolant) from the engine travels through a common supply and return circuit, but unlike a series system, the heater cores are connected across the circuit at intervals along its length. Each core shares the available coolant and heat equally, resulting in increased heating efficiency and decreased coolant restriction.

**CAUTION**  
Water pump(s) must be operating when the Webasto heater is in operation..

PARALLEL PLUMBING

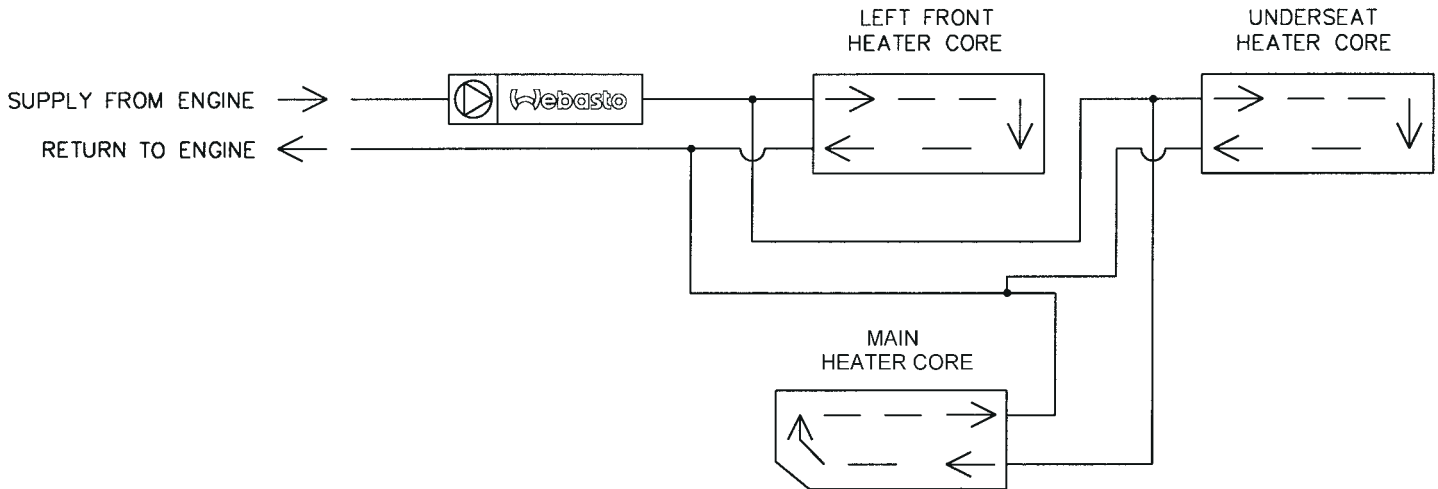


Fig. 402: Parallel Plumbing Circuit (Shown with heater installed)

A fuel fired Webasto heater used in conjunction with a high capacity coolant pump can significantly increase the available heat and coolant volume supplied to both series and parallel systems increasing interior heating efficiency. With the addition of a timer, the above systems can also provide pre-heating capability.

**C: Engine pre-heating and/or Boost Heating Only (fig. 403)**

This type of installation is used where engine pre-heating and or system boost heating is the primary requirement. The heater can be installed across the heating circuit before any of the vehicle heating cores or installed independently of the vehicles heating circuit by plumbing directly from and returning back into the engine. Depending on how the Webasto heater is controlled (timer, switch, vehicle system), heat can be supplied for engine pre-heating and maintaining higher operating temperatures. Interior heating efficiency will be enhanced by the higher operating temperatures provided by boost heating.

**WARNING**

When working on the coolant system, allow the engine to cool down and open the radiator cap carefully.

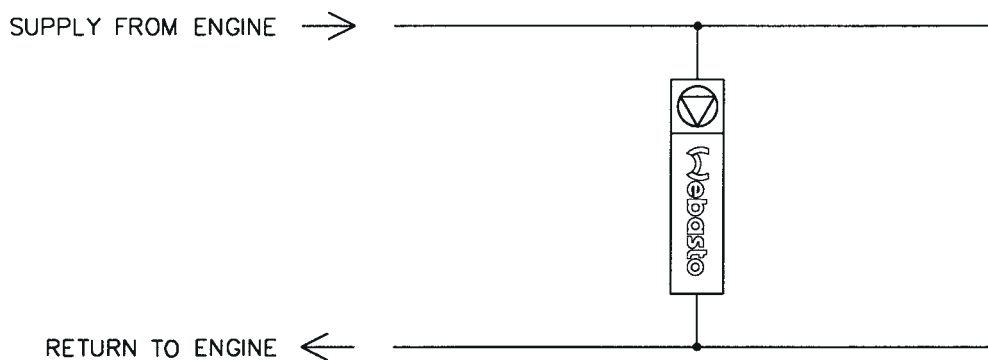
**ENGINE PREHEAT/BOOST HEAT ONLY**

Fig. 403: Engine Preheat/Boost Heating Circuit

**Instructions for options A, B or C (Typical installations)**

On typical systems, the coolant supply will originate at the engine. From there, it will travel through the supply hose to the Webasto coolant pump (or vehicle manufacturer supplied boost pump), through the pump and into the fuel fired heater where the coolant is heated during operation. The heated coolant then leaves the heater at the outlet and continues on through the vehicles heating system and returns to the engine.

1. Identify the type of system you are working with to determine the appropriate type of installation as shown in figures 401, 402 or 403.
  - find and identify heating circuit supply hose. This is the starting point for determining the type of plumbing configuration you will choose.
2. Connect heater into the system according to the examples shown in figures 401, 402 or 403.

**NOTE**

Silicone hose requires special hose clamps.

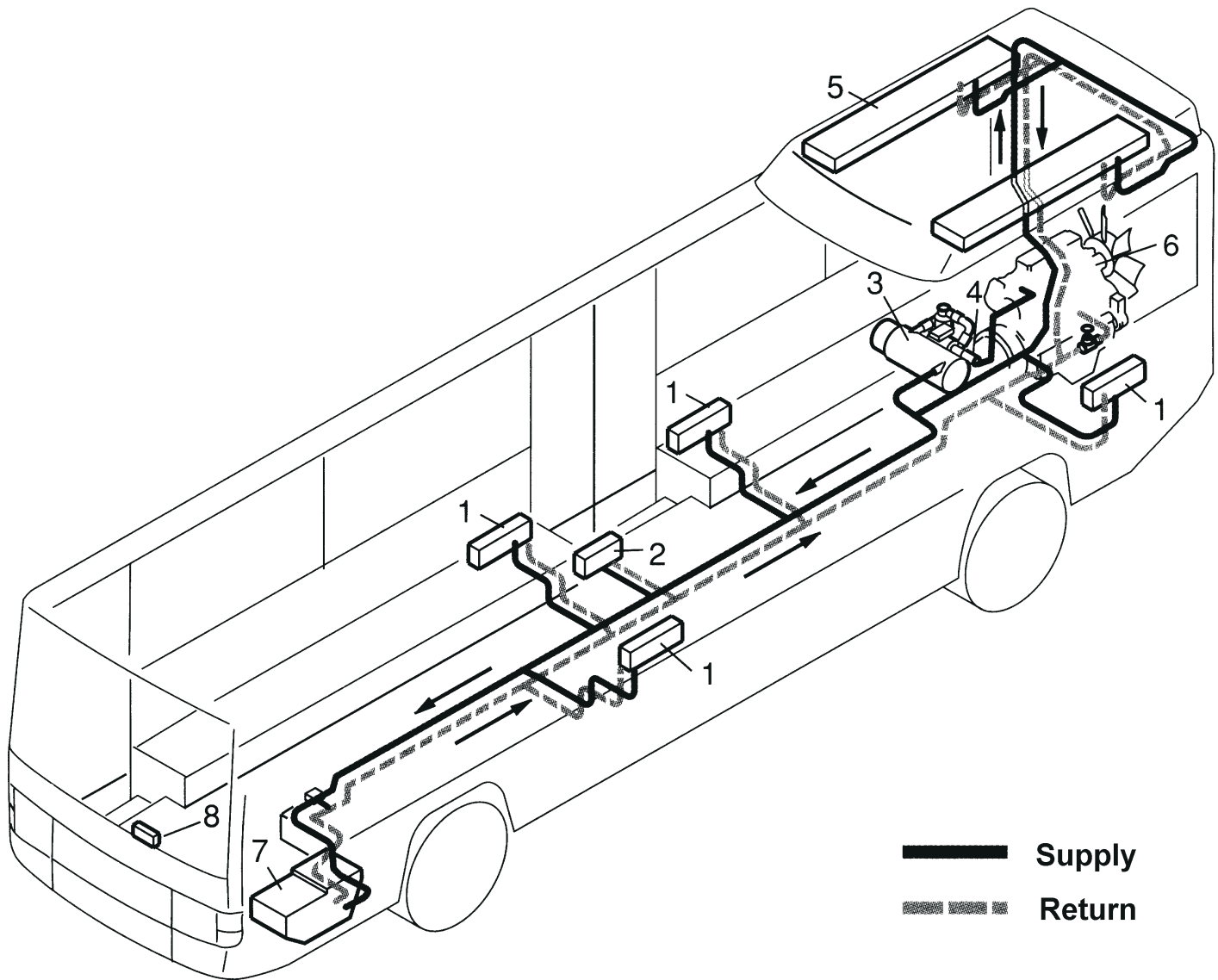
**NOTE**

Heater hose must meet SAE 20 R3 specifications.

**NOTE**

Hose clamps must be tightened to to 45 in/lb. (5 Nm) torque.

4.6.3 Example of a Heater Installation in a Bus



- |                           |                        |
|---------------------------|------------------------|
| 1 Heat Exchanger with Fan | 5 Heat Exchanger, Roof |
| 2 Stepwell Heater         | 6 Vehicle Engine       |
| 3 Webasto Coolant Heater  | 7 Drivers Heater       |
| 4 Circulation Pump        | 8 Heater Control       |

Fig. 404: Example of Heater Installation

## 4.7 Fuel System

### 4.7.1 General Description

The fuel is drawn from the vehicles fuel tank through a fuel standpipe. This standpipe can be utilized on vehicles with a spare threaded port as shown in figure 405. The Webasto heater utilizes 37° flare JIC fuel connection fittings. The fuel supply line fitting is a JIC #4 and the return line is a JIC #6.

### 4.7.2 Fuel Supply

#### **IMPORTANT!**

Keep the submerged end of fuel standpipe at least 2" from bottom of fuel tank.

The fuel standpipe and fuel line must be installed according to these instructions to insure proper heater operation.

#### **NOTE**

The heater is equipped with an internal self priming fuel pump.

#### **CAUTION**

If the fuel tank is higher than the Webasto heater, the top of the tank may not be more than 20" above the heater.

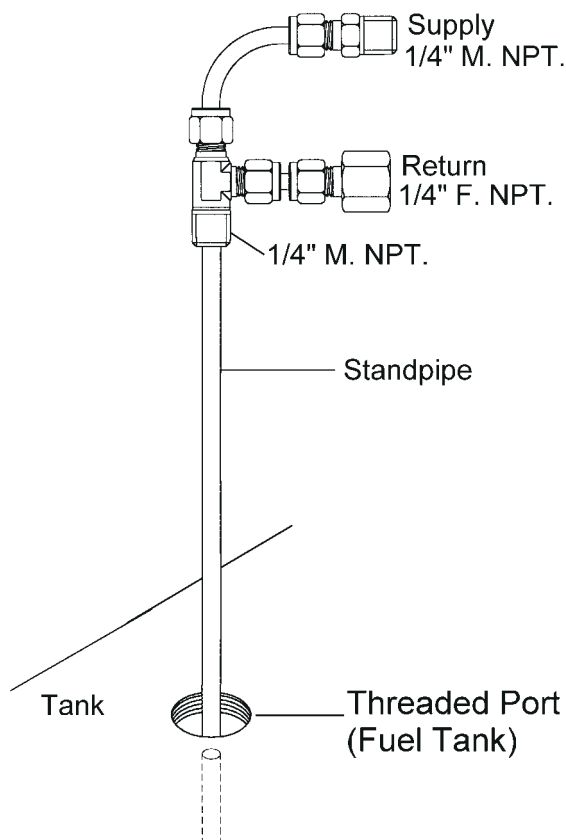


Fig. 405: Fuel Standpipe Installation

1. Cut fuel standpipe to length, approx. 2" off fuel tank bottom.
2. Install the fuel standpipe.

#### **NOTE**

After fuel standpipe has been cut to length, remove any burrs.

- use 1/4" or 1/2" spare port on fuel tank (if available) and install fuel standpipe securely in fuel tank, use pipe thread sealant on all pipe threads.
3. Route and secure fuel lines from heater to fuel tank. Route according to applicable regulations. Use grommets to protect fuel lines whenever routed through holes.
  4. Connect fuel lines to fuel standpipe and heater using 1/4" (6 mm) I.D. fuel line. Steel braided fuel lines are recommended for installations where the heater is located in the engine compartment.

**CAUTION**

Fuel line must be secured every 12" and kept away from hot exhaust and moving parts (drive shaft, wheels, etc.).

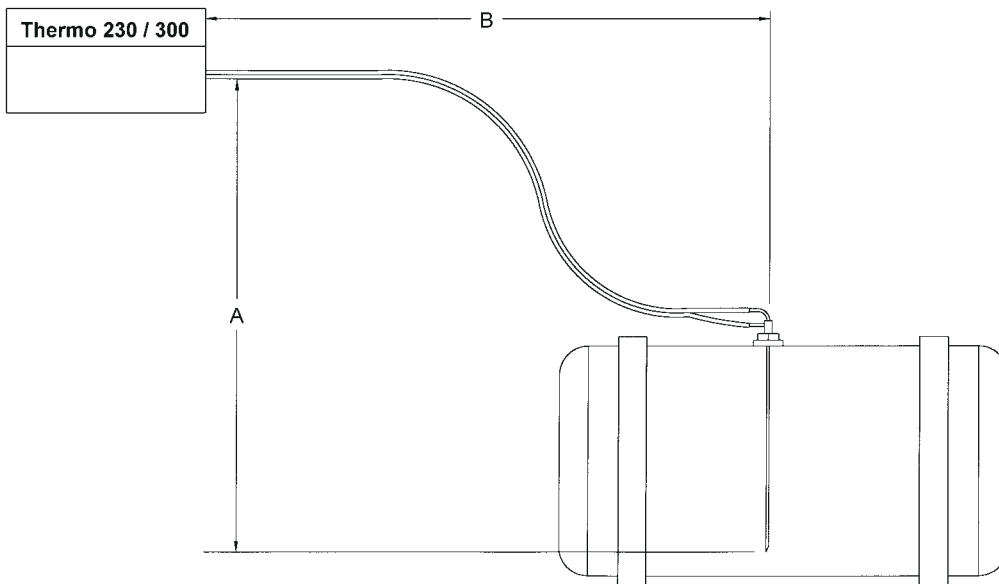


Fig. 406: Fuel Line Parameters

A = Suction height 6'6" (2,0 m)

A+B = Suction length and height not to exceed 33' (10 m)

#### 4.7.3 Fuel Filter

The heater must be equipped with a fuel filter. Fuel filters require changing at least annually and in cases of dirty fuel more often.

The fuel filter assembly should be mounted near the heater.

After installation, before the heater is fired for the first time, the fuel system and filter will require priming. In most cases, this will be achieved by turning on the heater and allowing it to self prime. In some cases the fuel filter may require filling with CLEAN diesel fuel before installation to assist system priming.

**NOTE**

Change the fuel filter at least annually.

**CAUTION**

To prevent fuel nozzle failure, always use CLEAN fuel from a known CLEAN source for priming fuel systems and filters.

### 4.8 Wiring Connections

#### 4.8.1 General Information

The control unit is equipped with low voltage protection, therefore it is imperative to keep vehicle batteries in good condition. Thermo 230/300 heaters are available in 24 volt configurations only.

**NOTE**  
The Webasto heating system will not perform to your satisfaction with weak batteries.

**CAUTION**  
If welding is done on the vehicle, the main battery cables must be disconnected from the battery to protect the electronic control unit.

#### 4.8.2 Timer and Switch Connections

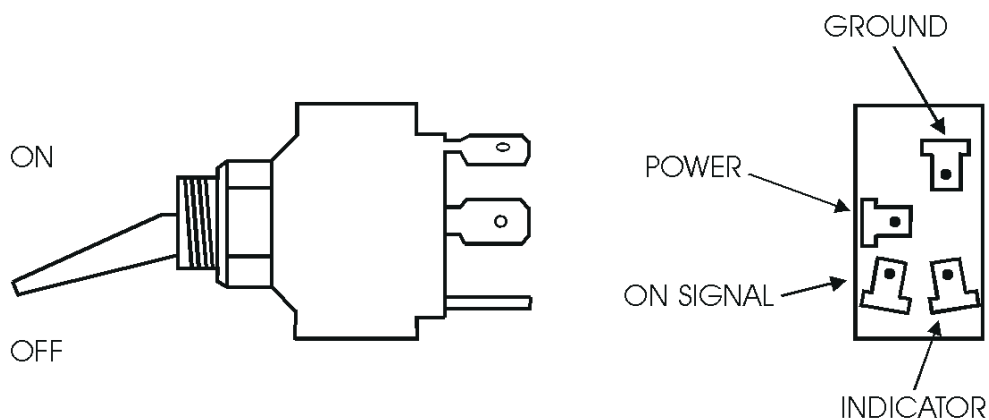


Fig. 407: On/Off Switch

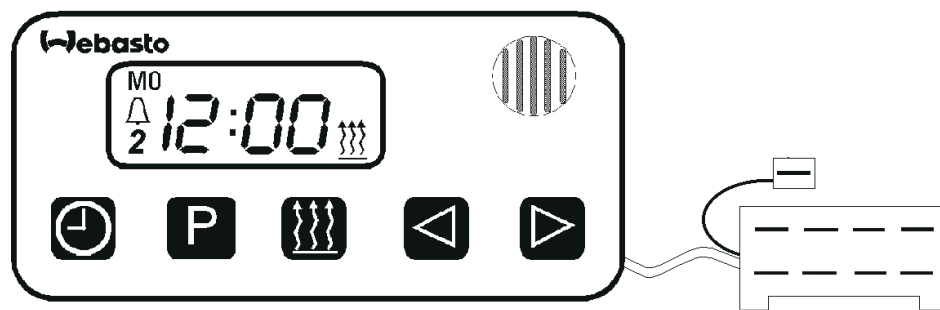


Fig. 408: 7-Day Digital Timer Model 1531

#### 4.8.3 Timer or Switch Installation

1. Select a suitable location in the vehicle for the timer or On/Off switch.
2. Connect the harness to the timer, or switch.

4.8.4 Wiring Diagram - with Switch

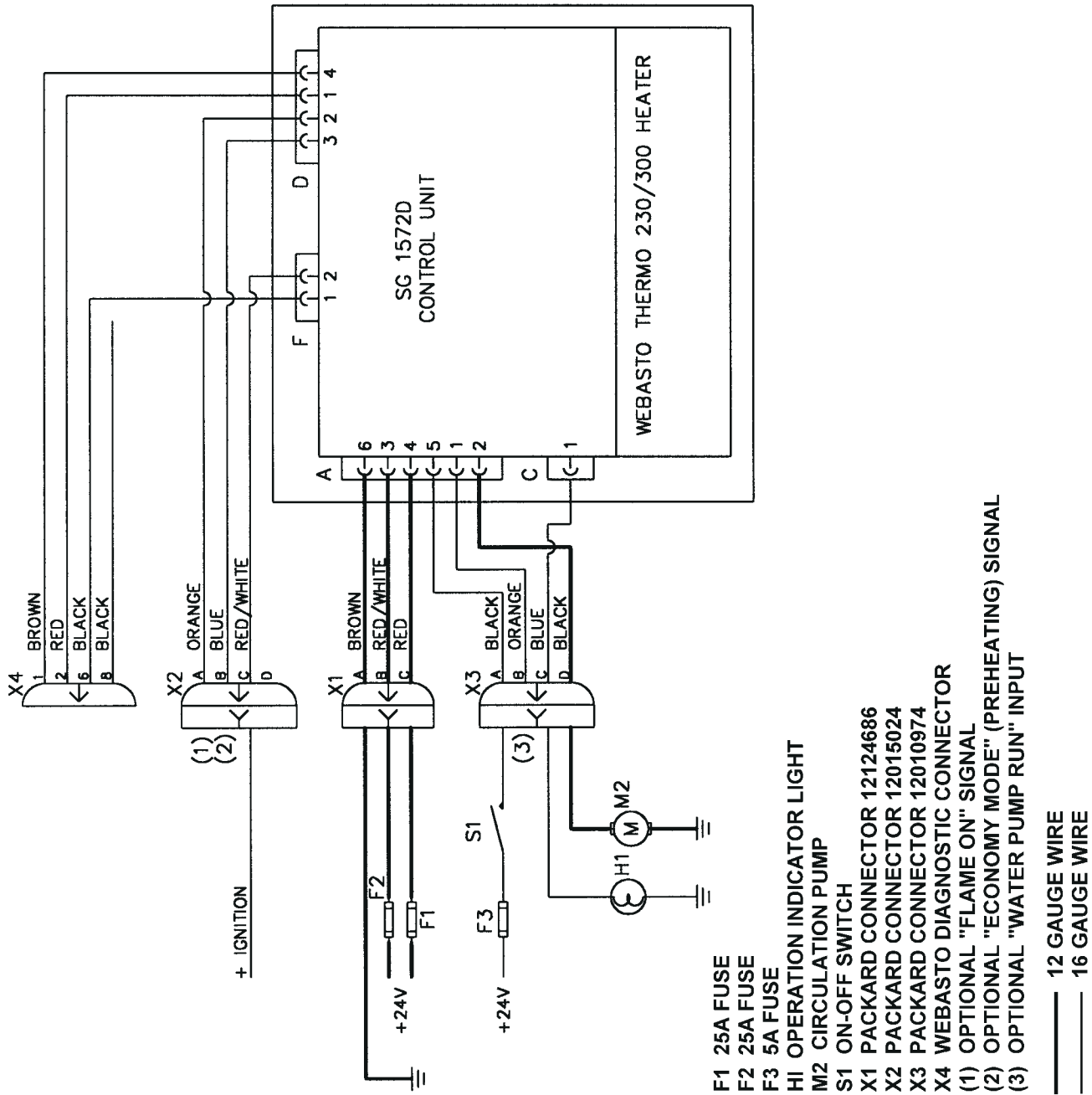


Fig. 409: Wiring Diagram with Switch



4.8.5 Wiring Diagram - with 7-Day Digital Timer Model 1531

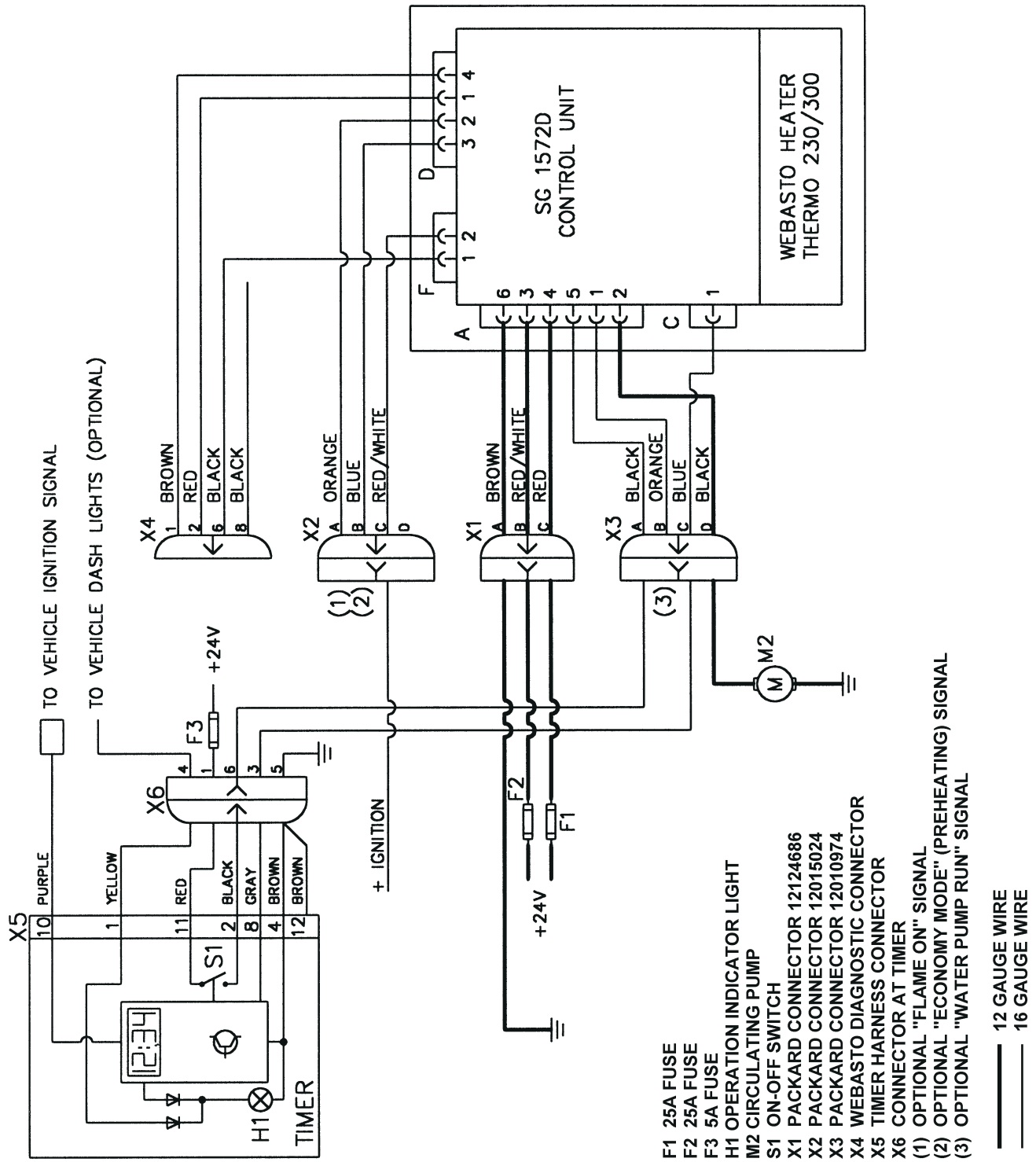


Fig. 410: Wiring Diagram with Timer Model 1531

**4.9 Initial Operation**

1. Check your installation for:
  - loose nuts and bolts.
  - exhaust pipe routing and clamp tightness.
  - loose hose clamps.
  - routing and securing of wiring and heater hoses.
  - kinked or pinched hoses.
  - battery connection and polarity.
2. Top off or refill cooling system with coolant as per engine manufacturers recommendations.
3. Open shut-off valves and driver's heater valve.
4. Set vehicle heater controls to maximum heat position.
5. Start the vehicle engine and run it at a fast idle for 10 minutes to purge air from the Webasto coolant heater and all of the heat exchangers. While the engine is running check:
  - hose connections for leaks.
  - coolant level in the expansion tank and add coolant as needed.
  - use bleeder valve on top of Webasto heat exchanger to purge out trapped air when necessary.
6. Switch on Webasto heater and check:
  - indicator light on.
  - circulating pump in operation.
  - heater fan motor in operation.
  - presence of combustion after approximately 25 seconds.
7. Shut off the engine.
8. Allow heater to run until coolant is hot and heater cycles off. During this period, monitor system for any coolant or fuel leaks.
9. Temperature differential between water inlet and outlet should not exceed 10° C (18° F) during heating operation.
10. Switch "OFF" Webasto heater.
11. Re-tighten hose clamps to 45 in/lb. (5 Nm) and inspect installation for leaks.
14. Install any panels and access covers removed during installation.

**NOTE**

Installation with long fuel lines may need a second start attempt to initially prime the fuel system. Cycle ON/OFF switch or timer to reset control unit.

**NOTE**

Coolant temperature must be below 158°F (70°C) to start up.

15. Complete the warranty card and send to Webasto Thermosystems (There is an area on the last page of this manual for recording information which is useful when calling for technical support).
16. Install the compartment cover if equipped. Installation is now complete.

**NOTE**

The engine temperature gauge may read a lower temperature depending on the location of the temperature sensor on the engine.

**NOTE**

Necessary information to complete warranty card and ensure full warranty coverage can be found on name plate.

## 5. Maintenance of the Heater

### 5.1 Annual Maintenance

The Webasto heater requires a minimum of maintenance to operate. To keep your heater in service the following maintenance procedures should be performed annually before each heating season:

#### Enclosure Area

- clean the heater and enclosure area from any accumulated debris or dust with compressed air
- inspect all components for wear and damage

#### Electrical System

- check wiring harnesses for damage, fix or replace if required
- check condition of the batteries and connections.
- load test batteries and replace if necessary.

#### Exhaust System

- check the exhaust system carefully for restrictions or corroded areas. Replace exhaust pipe if necessary.

#### Fuel System

- change fuel filter and inspect fuel lines for wear and damage. Repair or replace if necessary.

#### Burner System

- swing open burner head, clean flame detector (photo eye), pull out combustion chamber and inspect and clean heat exchanger. Replace nozzle if necessary (annually). Re-install combustion chamber and close up burner head.

#### Operation Test

- Run your heating system for at least 15 minutes.
- Check water and fuel connections for leakage. Re-tighten clamps and fittings if necessary.

**NOTE**

For major repairs and spare parts, return to your authorized Webasto Thermosystems servicing Specialist.

**NOTE**

The heater will not function properly with weak batteries.

**NOTE**

Operate your Webasto at least once a month for 10 minutes.

## 6. Basic Troubleshooting

### 6.1 General Information

This section describes troubleshooting procedures for the Thermo 230/300 coolant heater.

Troubleshooting is normally limited to the isolation of defective components.

#### CAUTION

Troubleshooting requires profound knowledge about structure and theory of operation of the heater components and should only be performed by skilled personnel.

#### Before troubleshooting, check for and eliminate these defects:

- fuel supply (plugged fuel filter)
- corrosion on battery terminals
- blown fuses
- corrosion on electrical wiring, connections and fuses
- loose contacts, or improper crimping on connectors
- shut down initiated by temperature limiter thermostat (automatic reset)

#### NOTE

After any correction of a defect a functional test has to be performed in the vehicle.

#### NOTE

Coolant temperature must be below 158°F (70°C) to start up.

### 6.2 Operational Failure Symptoms (reading the flash code)

A flash code will be generated on the indicator light of the control (on / off) switch in the event of an operational failure. In order to make a correct analysis it's necessary to understand the flash code event. The flash code event is only visible during the after run (cool down) period of operation.

During the flash code event you will see the following:

Five quick flashes followed by a slower sequence of flashes, the slower sequence of flashes is the actual fault code. The first five quick flashes are only an indication that a fault code has been registered and will be displayed. Count only the slower sequence of flashes to obtain the current fault code.

For example (flashes = □):

Fault code 7X (F 07): □□□□□ ... □ ... □ ... □ ... □ ... □ ... □ ... □

The flash code sequence will be repeated during the Thermo 230/300 after run (cool down) period and will remain visible once heater stops in the lock out mode. Once the heater is cycled "OFF" and "ON" the fault code will no longer be visible on the indicator light but will be stored in memory.

### 6.2.1 Reading a Fault Code with 1531 “Comfort” Timer Installed

Where the Thermo 230/300 installation includes the model 1531 “Comfort” Digital Timer, you will be able to read the current failure fault code directly from the timer display. The flame indicator symbol will “flash” the present fault code once and will then convert the fault code to an alphanumeric display message.

For example: fault code 10 (overheat) will be visible on the timer display as “F 10”.

Once the failure has been corrected, and the heater switch or timer is cycled “OFF” and “ON” and the heater successfully starts and runs with no further failures, the error code will disappear from the timer display.

**CAUTION**

Troubleshooting requires profound knowledge about structure and theory of operation of the heater components and may only be performed by skilled personnel.

**NOTE**

After any correction of a defect a functional test has to be performed in the vehicle.

### 6.2.2 Storing a Fault Code in Memory

Once the Thermo 230/300 completes the after run (cool down) period initiated by a failure event, the current flash code will be downloaded (stored) in memory.

The Thermo 230/300 can store up to ten fault codes.

Once the memory is “full”, any additional fault code will replace the earliest code stored thereby continually updating the fault codes stored in memory with the four most recent faults.

### 6.3 Operational Failure Symptoms via Fault/Flash Code

The following table lists the possible faults which can be read by flashing code or read directly off of an appropriate timer or with the PC diagnostics kit.

Failure Symptom	Probable Cause	Check and Correct
<b>1X Flash (F 01)</b> No combustion after completion of start up sequence.	- Fuel system  - Combustion air  - Electronic ignition	- Fuel level - Type of fuel being used - Fuel filter - Fuel line connections (air bubbles in fuel lines) - fuel nozzle plugged - Air intake or exhaust, restricted or plugged - incorrect electrode gap
<b>2X Flashes (F 02)</b> Flame out during burner operation no restart possible	- Fuel supply (shortage of fuel)	- Restriction in the fuel system - Fuel filter - Fuel line connections (air bubbles in fuel lines) - Type of fuel being used
<b>3X Flashes (F 03)</b> Low voltage for more than 20 seconds	- Electrical system	- Load test batteries - Corrosion at connections - Loose connections
<b>4X Flashes (F 04)</b> Flame detector recognizes false flame signal during pre-start or shut-down cycle	- Defective flame detector	- Replace flame detector
<b>5X Flashes (F 05)</b> Flame detector	- Wiring - Defective flame detector	- Damaged wiring, open or short circuit - Replace flame detector
<b>6X Flashes (F 06)</b> Temperature sensor	- Wiring - Defective temperature sensor	- Damaged wiring, open or short circuit - Replace temperature detector
<b>7X Flashes (F 07)</b> Fuel solenoid valve	- Wiring  - Defective solenoid valve	- Damaged or corroded wiring, open or short circuit - Replace solenoid valve
<b>8X Flashes (F 08)</b> Combustion air fan motor	- Wiring - Wrong RPM - Defective combustion air fan motor	- Damaged wiring, open or short circuit - Replace combustion air fan - Replace combustion air fan
<b>9X Flashes (F 09)</b> Circulation pump motor	- Wiring - Defective circulation pump motor	- Damaged wiring, open or short circuit - Replace circulation pump motor
<b>10X Flashes (F 10)</b> Temperature limiter	- Overheat condition - Coolant flow  - Wiring  - Defective temperature limiter	- Reset temperature limiter - Coolant level or flow restriction - Air trapped in coolant circuit - Damaged or corroded wiring, open or short circuit - Replace temperature limiter
<b>11X Flashes (F 11)</b> Electronic ignition coil	- Wiring - Defective electronic ignition coil	- Damaged wiring, open or short circuit - Replace electronic ignition coil
<b>12X Flashes (F 12)</b> Heater lock out	3 repeated faults/flame-outs or 5 repeated start attempts	Reinitialize control unit by switching heater on and disconnecting power.

Table 601: Operational Failure Symptoms (Control Unit SG 1572 D)

### 6.4 Reading and Removing Fault Codes Stored in Memory with the Webasto PC Diagnostics Kit and Adapter

It is possible to read and remove (reset) stored fault codes from the Thermo 230/300 memory.

This is achieved through the use of a diagnostic interface kit connected to the Thermo 230/300 and an IBM compatible computer having the necessary software installed.

The PC Diagnostic Interface Kit comes with software and instructions for use with Webasto heaters equipped with internal diagnostics capabilities such as the Thermo 230/300.

Order PC Diagnostics Kit under part number 925 42A and adapter under part number 208 65A.

#### **System requirements:**

- IBM compatible PC with 80286 processor or higher
- DOS version 3.0 or higher including \*MS Windows (\*Not required)
- at least 1 MB RAM
- hard disk with at least 3 MB space available
- 3 1/2 inch, 1.44 MB floppy disk drive for installation of program files
- VGA graphics board with 640 x 480 pixel resolution and at least 16 colors
- unused serial port
- monitor, keyboard (mouse or other pointing device recommended)

In addition to working with stored fault codes, the PC Diagnostics Kit allows you to do several other functions such as reading values while the heater is in operation or testing individual components. Printing out of fault codes is also available (User supplied printer required).

For further capabilities and detailed instructions for use with the Thermo 230/300 heater, see instruction manual supplied with the PC Diagnostics Kit.

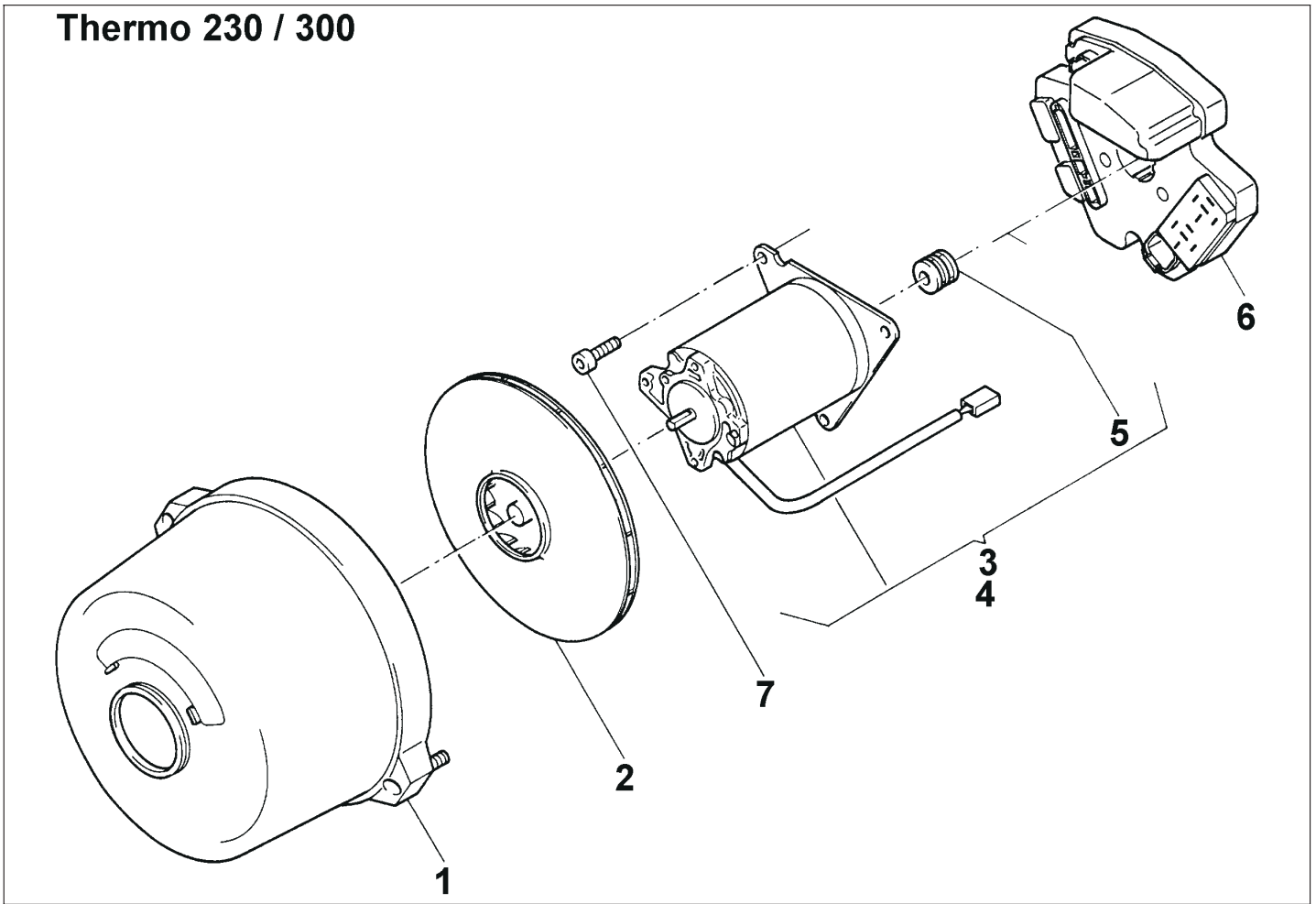
#### **CAUTION**

Diagnostics equipment is intended for use by Webasto trained personnel at authorized Webasto Distributor, Dealer and End User service facilities.



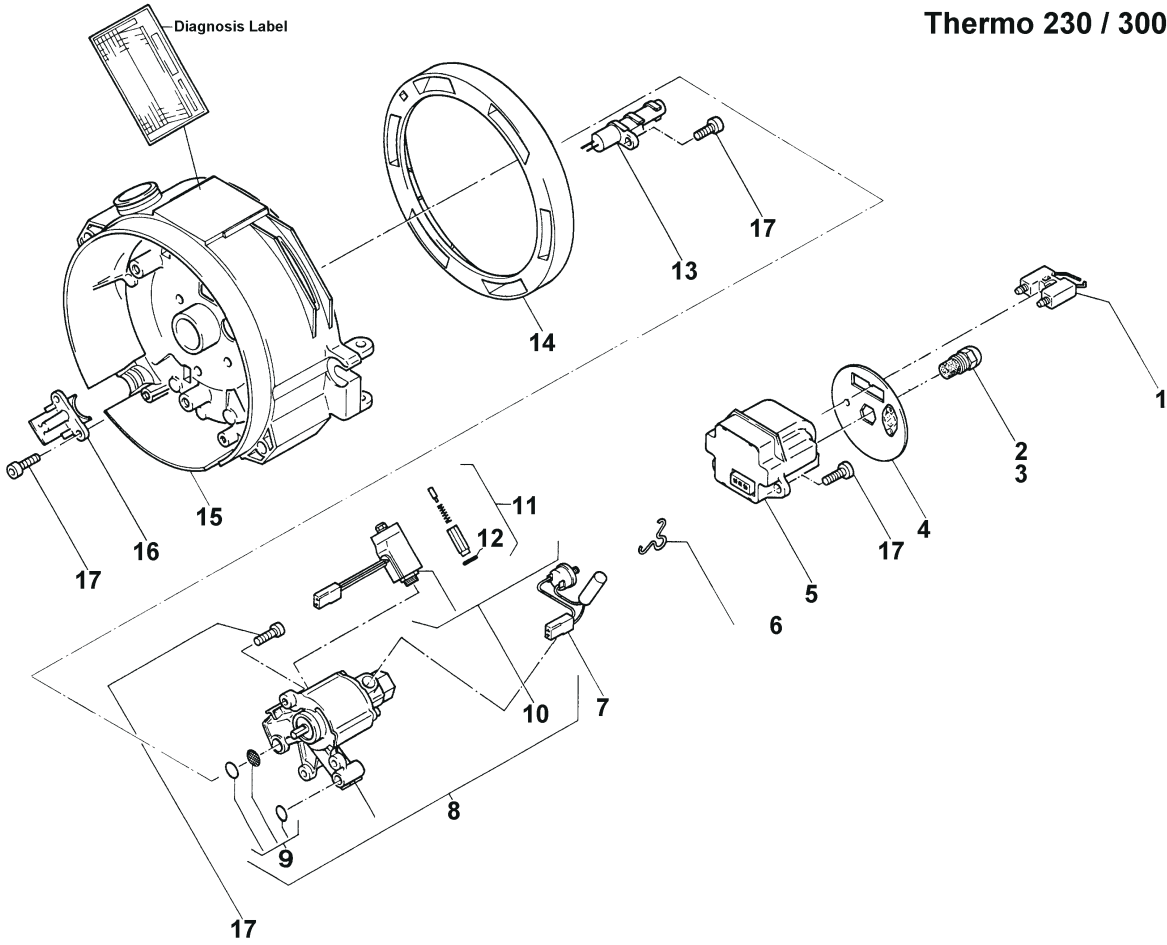
# SECTION 7 – THERMO 230/300 SPARE PARTS LISTING

## Thermo 230 / 300



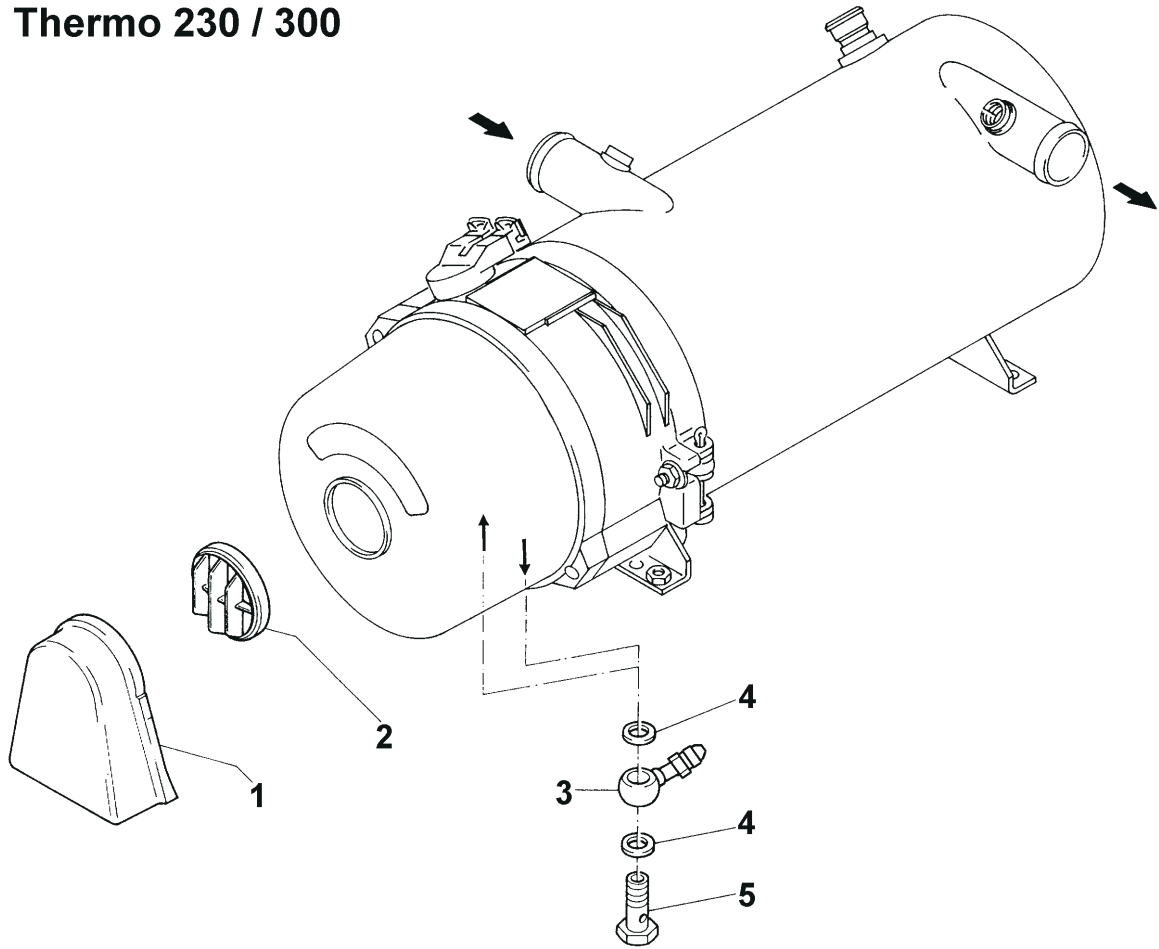
ITEM	QUANTITY	PART NO.	DESCRIPTION	REMARKS
No Fig.	X	636 47A	Thermo 230.036 Heater - Complete	Replacement heater
No Fig.	X	636 50A	Thermo 300.066 Heater - Complete	Replacement heater
1	1	206 49B	Hood	
2	1	206 41B	Fan	
3	1	208 32B	Motor	For Thermo 230
4	1	206 64A	Motor	For Thermo 300
5	1	206 54A	Drive Coupling	
6	1	884 57B	Control Unit - SG 1572 D	Full diagnostic features
7	3	907 70A	Allen Socket Screw - M5 x 16	

# Thermo 230 / 300



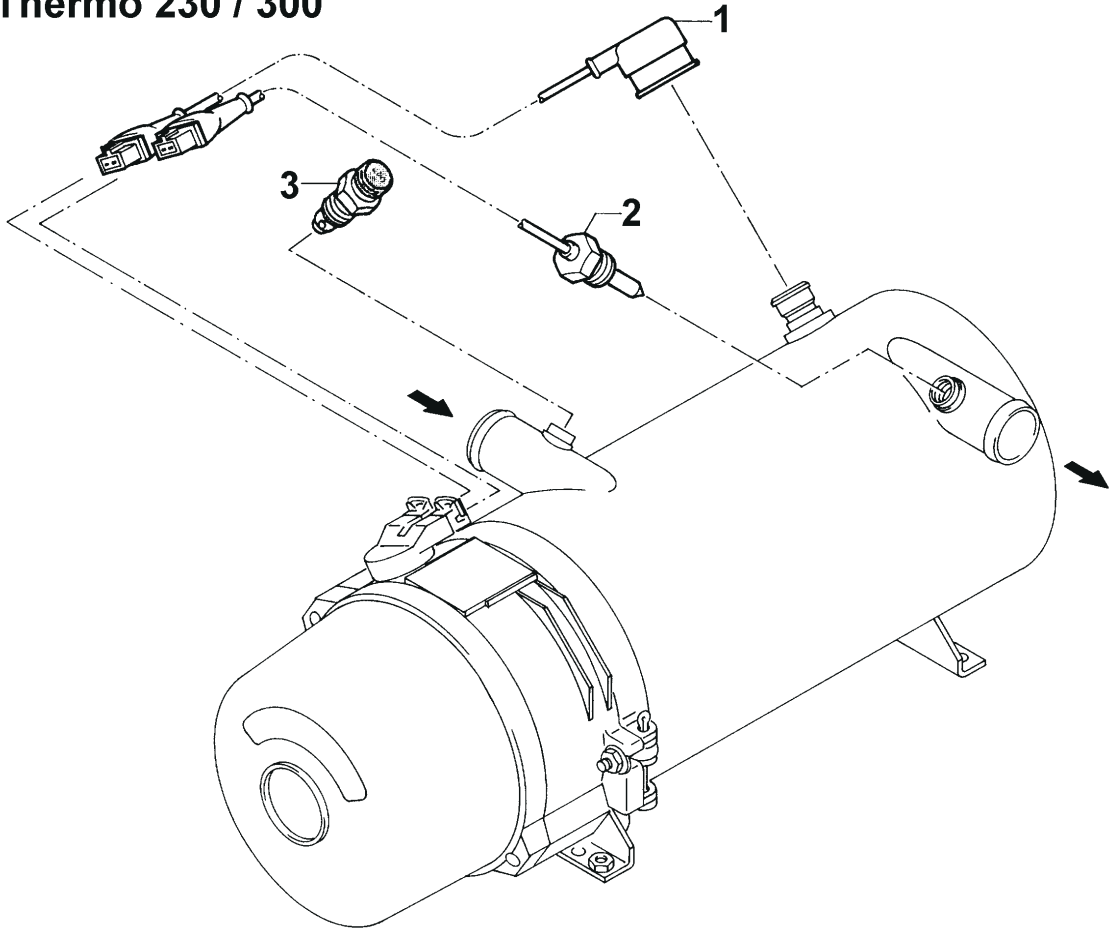
ITEM	QUANTITY	PART NO.	DESCRIPTION	REMARKS
1	1	148 46B	Ignition Electrodes	
2	1	470 716	Fuel Nozzle	For Thermo 230
3	1	470 724	Fuel Nozzle	For Thermo 300
4	1	838 88A	Photo Disc	
5	1	148 45C	Ignition Coil	
6	1	197 23B	Retaining Clip - Nozzle Pre-heater	
7	1	839 33A	Pre-heat Cartridge with Thermostat	
8	1	203 38C	Fuel Pump Assembly	
9	1	199 77A	Fuel Pump Seal and Screen Kit	
10	1	293 13A	Solenoid Valve	
11	1	386 650	Solenoid Repair Kit	
12	1	260 487	O-ring	
13	1	230 37A	Flame Detector (Photo Cell)	
14	1	208 20B	Air Quantity Adjustment Ring	
15	1	822 06A	Housing	Aluminum
16	1	205 12B	Strain Relief	
17	8	907 70A	Allen Socket Screw - M5 x 16	

# Thermo 230 / 300



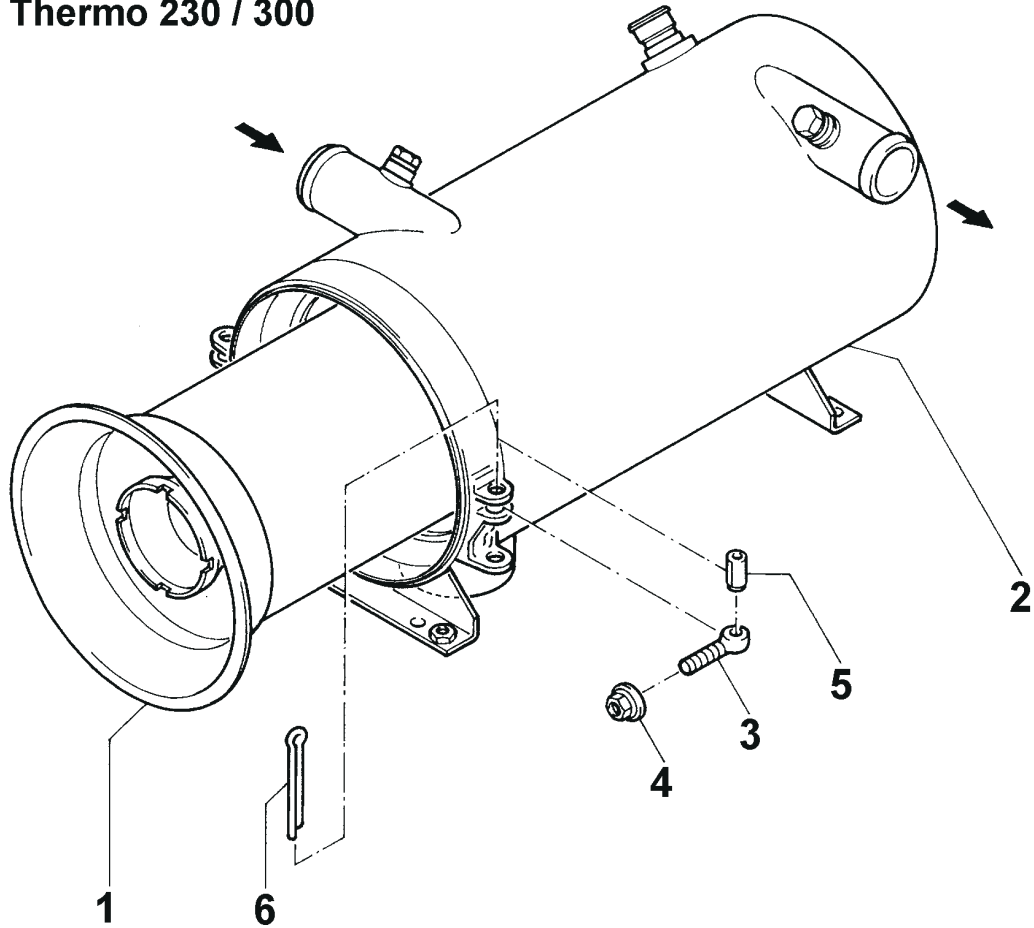
ITEM	QUANTITY	PART NO.	DESCRIPTION	REMARKS
1	1	208 18B	Splash Guard	
2	1	208 19A	Grill	Optional to splash Guard item 1
3	1	922 22A	Supply Line Fitting - #4 JIC (37° Flare)	
3	1	922 21A	Return Line Fitting - #6 JIC (37° Flare)	
4	4	151 157	Copper Washer - 10 x 14	
5	2	150 754	Banjo Bolt	
no fig.	1	638 27B	Harness	
no fig.	1	638 28B	Harness	

# Thermo 230 / 300



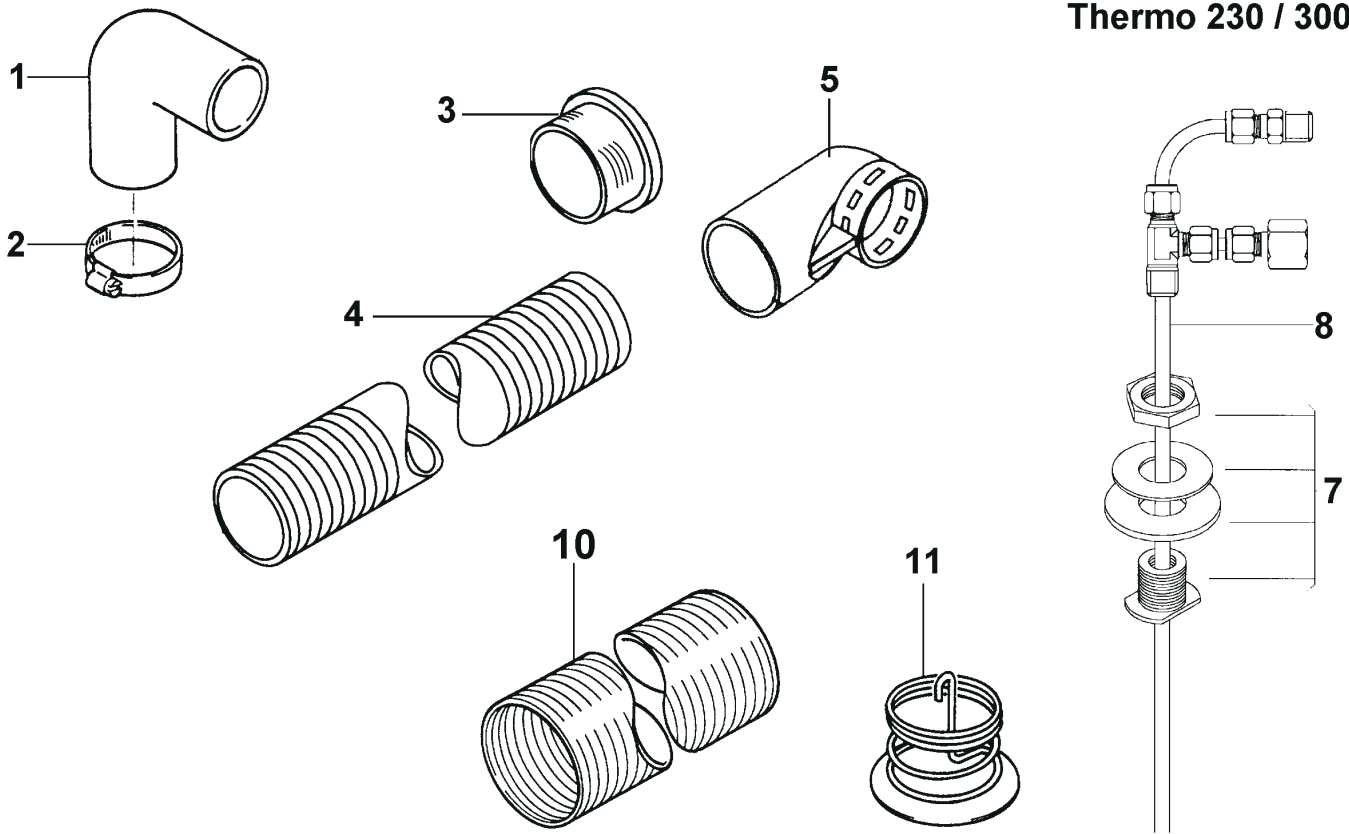
ITEM	QUANTITY	PART NO.	DESCRIPTION	REMARKS
1	1	636 49A	Overheat Protection Thermostat	
2	1	149 41A	Temperature Sensor	Mounted in water outlet pipe
3	1	213 27A	Bleed Valve	Mounted in water inlet pipe

# Thermo 230 / 300



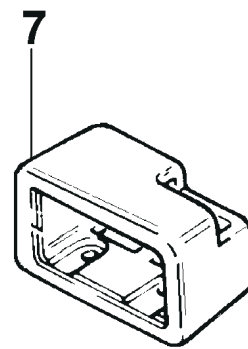
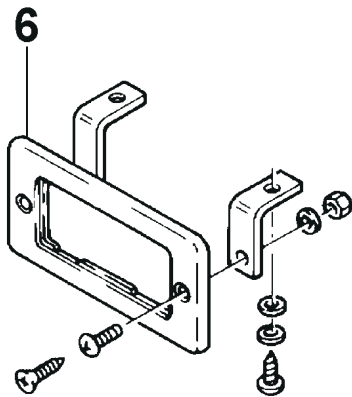
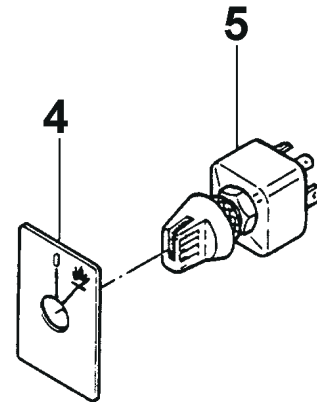
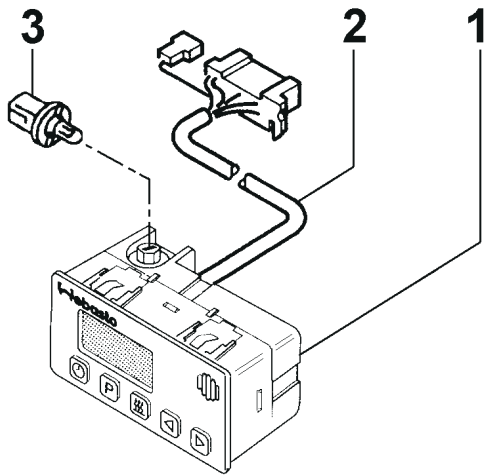
ITEM	QUANTITY	PART NO.	DESCRIPTION	REMARKS
1	1	443 25A	Combustion Chamber	
2	1	820 73E	Heat Exchanger	
3	2	150 47A	Eye Bolt - 8 x 40	
4	2	208 26A	Nut with Washer - M8	
5	2	156 74A	Roll Pin - 8 x 16	
6	1	131 60A	Cotter Pin	

## Thermo 230 / 300

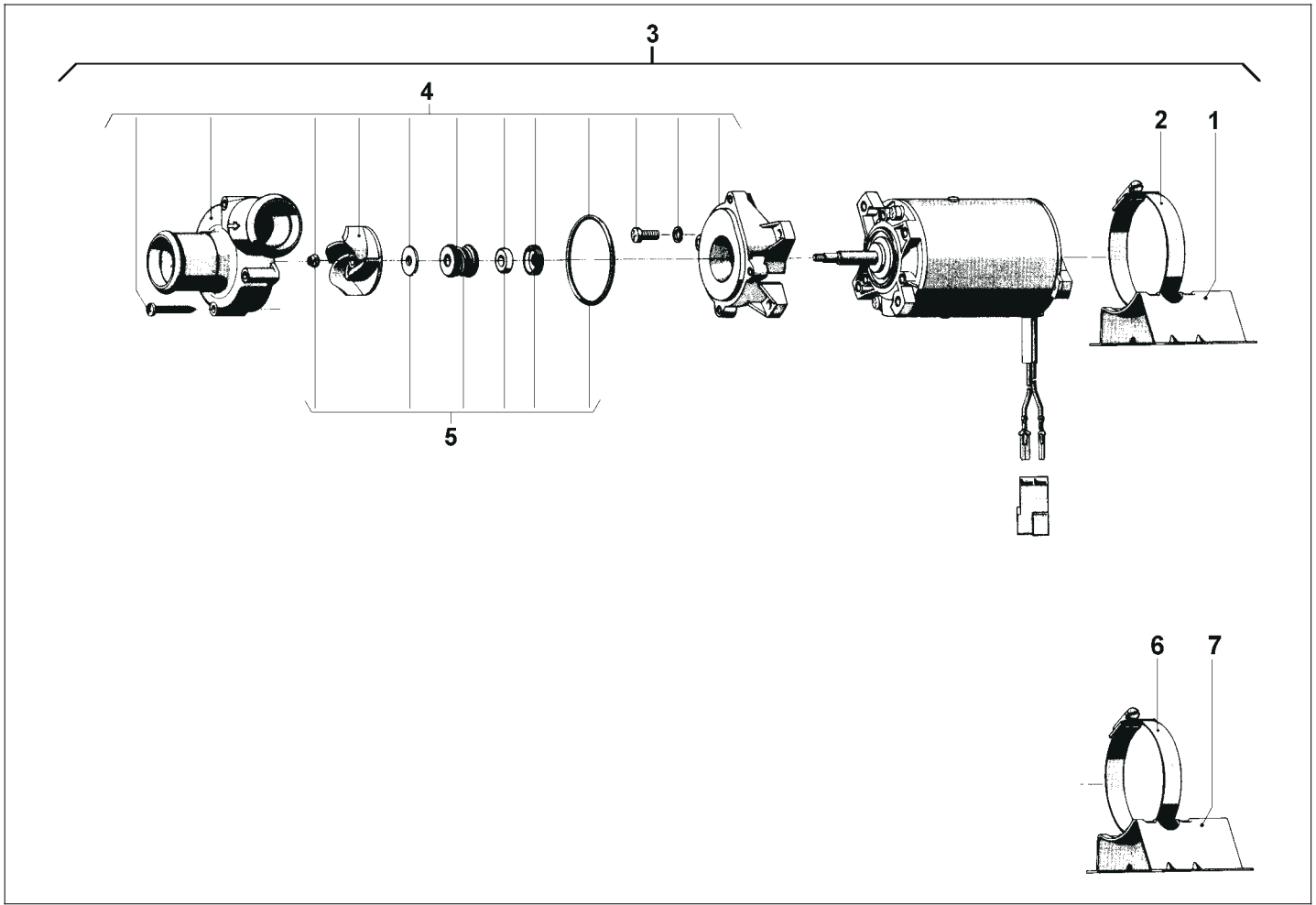


ITEM	QUANTITY	PART NO.	DESCRIPTION	REMARKS
1	X	211 524	90° Rubber Elbow - 1 1/2" ID.	For coolant connection
2	X	902 428	Hose Clamp - 34-57mm	
3	1	101 377	Connector	For combustion air tubing item 4
4	X	887 29A	Combustion Air Tubing	Per meter
5	1	101 404	90° Snap-on Elbow	Requires adapter (P.N. 823 15A)
no fig.	1	823 15A	Adapter Fitting	Required with 90° Snap-on Elbow item 5
7	1	906 807	Fuel Tank Boss Assembly	Use when threaded port is not available
8	1	905 030	Fuel Standpipe	
10	X	479 721	Stainless Steel Flexible Exhaust Tubing 70mm ID.	Per meter
11	1	849 70A	Exhaust Deflector	Clips onto heater

## Thermo 230 / 300



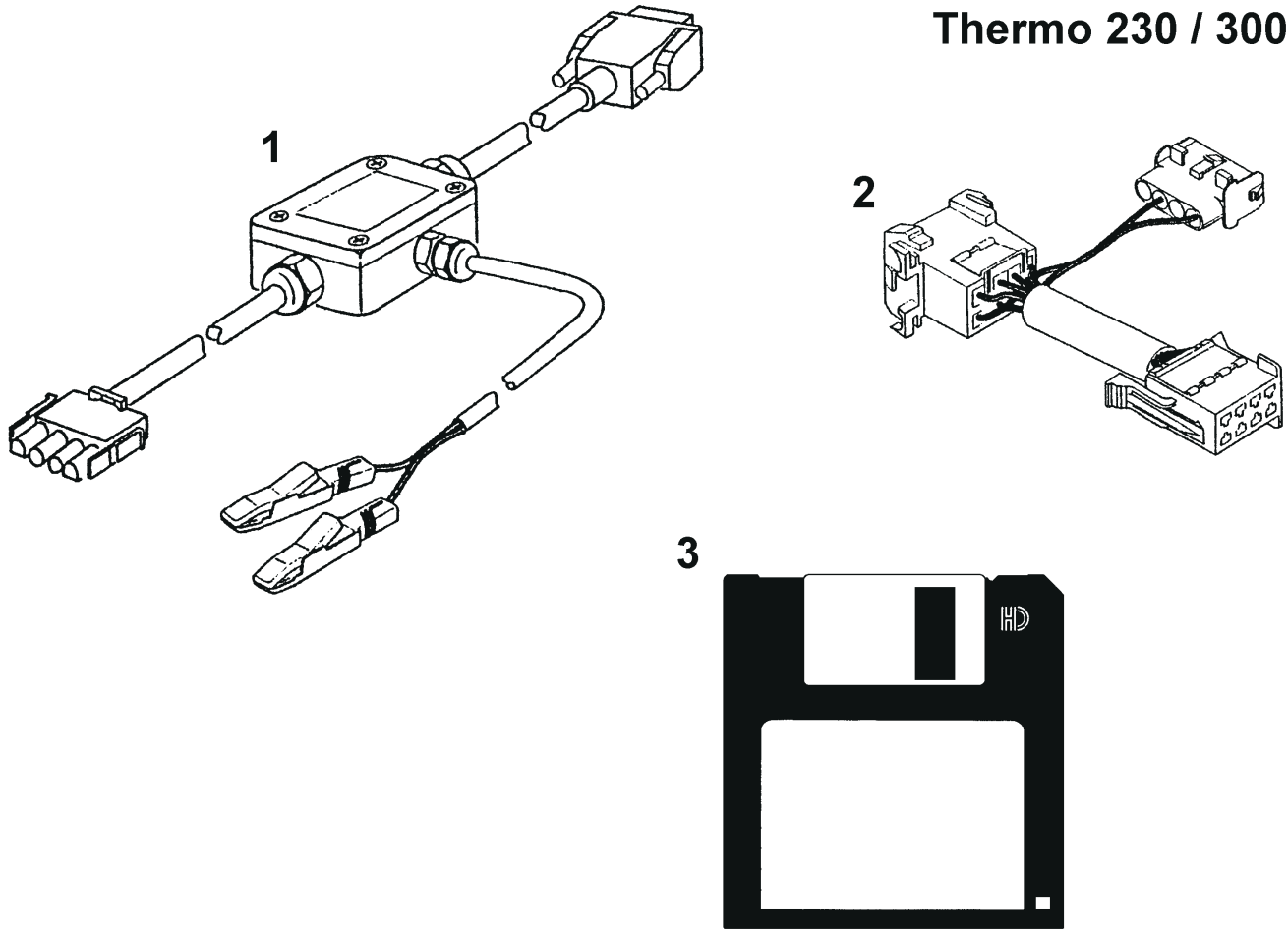
ITEM	QUANTITY	PART NO.	DESCRIPTION	REMARKS
1	1	881 95A	24V - 7 Day Digital Timer Model 1531	3 programmable timer settings and alarm feature.
2	1	884 36A	Harness	For 1531 Digital Timer
3	1	284 47A	24V - Replacement Bulb	For digital timer model 1531
4	1	116 389	Label - ON/OFF	
5	1	103 877	ON/OFF Switch with Light	
6	1	474 63A	Timer Mounting Frame	
7	1	475 866	Timer Mount Housing	
no fig.	1	905 798	Timer Kit - Includes Timer (1), Mounting Frame (6) and Harness (2)	



ITEM	QUANTITY	PART NO.	DESCRIPTION	REMARKS
1	1	372 69A	Mounting Base	For U 4814 only
2	1	139 661	Mount Clamp	For U 4814 only
3	1	431 52A	24V - Coolant Pump - U 4814	
4	1	427 46A	Pump Parts	For U 4814 and U 4851
5	1	427 47A	Seal Kit	For U 4814 and U 4851
6	1	233 641	Mounting Base	For U 4851 only
7	1	139 629	Mount Clamp	For U 4851 only
no fig.	1	903 97A	Coolant Pump - U 4851	



## Thermo 230 / 300



ITEM	QUANTITY	PART NO.	DESCRIPTION	REMARKS
1	1	925 42A	PC Download Diagnostic Kit (IBM)	Includes software
2	1	208 65A	Adapter Harness for Thermo 230/300 Heaters	Order separately
3	1	647 15B	Software on 3.5 Floppy Disk (IBM)	Version 1.15 for item 1 (Upgrade from version 1.14)

**8. WARRANTY POLICY \***

Webasto Thermosystems Inc. and Webasto Thermosystems (Canada) Ltd., (herein after referred to as "Webasto") warrants their products and related component parts against defects in materials and workmanship for 24 months effective from installation date or vehicle registration date for O.E.M. installations. The warranty period may not however, exceed 36 months from the original date of delivery by Webasto.

During the warranty period the EXCLUSIVE REMEDY will be for Webasto to repair or replace those parts which are demonstrated to be defective in material or workmanship.

In the event of a defect covered by this warranty, only Webasto authorized distributors/dealers are permitted to perform warranty work. Call Webasto @ 1-800-Heater-1 (1-800-432-8371) or, in Canada @ 1-800-667-8900 for your closest Webasto authorized dealer.

**Please complete and return the Webasto warranty  
registration card immediately upon installation  
or registration of new vehicle.**

Webasto specifically excludes and limits from warranty the following:

- **Normal wear of service parts including:** *Fuel nozzles, filters and fuses.*
- **Improper installation,** *which is not in accordance with valid supplied installation instructions.*
- **Deterioration,** *due to normal wear and tear, corrosion, abuse, damage, accident, improper storage or operation.*
- **Modification,** *of a product by alteration, use of non genuine parts or repair by unauthorized personnel.*
- **Economic loss,** *for expenses related to travel, vehicle disassembly, personal injury or other incidental or consequential damages.*

\* See official warranty for complete details

Heater Information:

Serial No.: \_\_\_\_\_

Purchased From: \_\_\_\_\_

Date Purchased: \_\_\_\_\_

Date Installed: \_\_\_\_\_

Installer: \_\_\_\_\_

Your Notes:

**Webasto Thermosystems Inc.**

**North America**

3333 John Conley Drive

Lapeer, MI 48446

Phone (810) 245-2400

Toll-free (800) HEATER-1

Fax (810) 664-7720

Technical Assistance Hotline

USA: (800) 555-4518

Canada: (800) 667-8900