

Coolant Heater

Thermo 300.102

Installation Instructions
for use with
The Detroit Diesel
Series 4000 Engine

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1. Introduction

1.1 Scope and Purpose

This manual is intended to support authorized Webasto trained distributors, dealers and personnel in the installation and servicing of Thermo 300 coolant heaters.

Webasto Thermosystems, Inc. does not recommend the installation and servicing of Webasto products by untrained, unauthorized personnel or end-users.

Installations and servicing of Webasto products by untrained, unauthorized personnel and end-users will release Webasto Thermosystems, Inc. and Webasto authorized distributors, dealers and personnel from responsibility for damage to Webasto product or collateral property and personal injury.

Any use, operation, installation, modification or application of the product not described in Webasto manuals, or subjecting the product to extreme or unusual conditions beyond the limits of specified performance characteristics is misuse of the product.

Failure to comply with all installation instructions is a misuse of Webasto product. The same applies for repairs without using genuine Webasto service parts. This will void the coolant heaters "Official Marks of Conformity."

1.2 Meaning of Warnings, Cautions, and Notes

Warnings, Cautions and Notes in this manual have the following meaning:

⚠WARNING
This heading is used to highlight that non-compliance with instructions or procedures may cause injuries or lethal accidents to personnel.

⚠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.

1.3 Additional Documentation to be Used

This manual contains all of the information and procedures necessary for the installation of the Thermo 300 heater.

The use of additional documentation is normally not required. Vehicle specific installation guides (when available) may be used as complimentary information only.

1.4 General Safety Regulations and Information

The general safety regulations for the prevention of accidents and relevant operating safety instructions must be observed at all times.

The specific safety regulations applicable to this manual are highlighted in the individual chapters by Warnings, Cautions and Notes.

1.4.1 General Safety Notes

The heater may only be installed in vehicles, with a minimum coolant capacity of 2.6 US Gal. (10 litres).

The heater must not be installed in the passenger compartments of the vehicle. Should the heater be installed in such a compartment, the installation box must be sealed tight against the vehicle interior. There must be sufficient ventilation of the installation box from the exterior in order not to exceed a maximum temperature of 140 °F (60 °C) in the installation box. Excessive temperatures may cause malfunctions.

⚠WARNING
Due to the danger of poisoning and suffocation, the heater must not be operated in enclosed areas, such as garages or workshops, without an exhaust venting system, not even if the start-up is activated by the timer or remote start device.

At filling stations and fuel depots the heater must be switched off as there is a potential danger of explosions.

Where flammable fumes or dust may build up (e.g. in the vicinity of fuel, coal, wood, cereal grain deposits or similar situations) the heater must be switched off to prevent explosions.

In the vicinity of the coolant heater, a temperature of 185 °F (85 °C) must not be exceeded under any circumstances (e.g. during body paint work). A violation of this temperature limit may cause permanent damage to the electronics.

When checking the coolant level, proceed in accordance with the vehicle manufacturer's instructions.

The coolant in the heating circuit of the heater must contain a minimum of 10% of a quality brand glycol based anti-freeze.

Extracting combustion air from the vehicle interior is not permissible under any circumstance.

The exhaust line outlet is to be positioned below the vehicle floor, to the nearest possible location of the vehicle's left side. Exhaust pipes must be routed so that exhaust fumes will not penetrate into the vehicle's interior.

The function of any parts vital for vehicle operation must not be impaired. Condensation accumulation in the exhaust line must be directly drained. A condensation drain hole may be provided as required.

Electrical lines, switch gear, and control gear of the heater must be located in the vehicle so that their proper function cannot be impaired under normal operating conditions.

The coolant heater may only be operated within the specified operating voltage range designated by type.

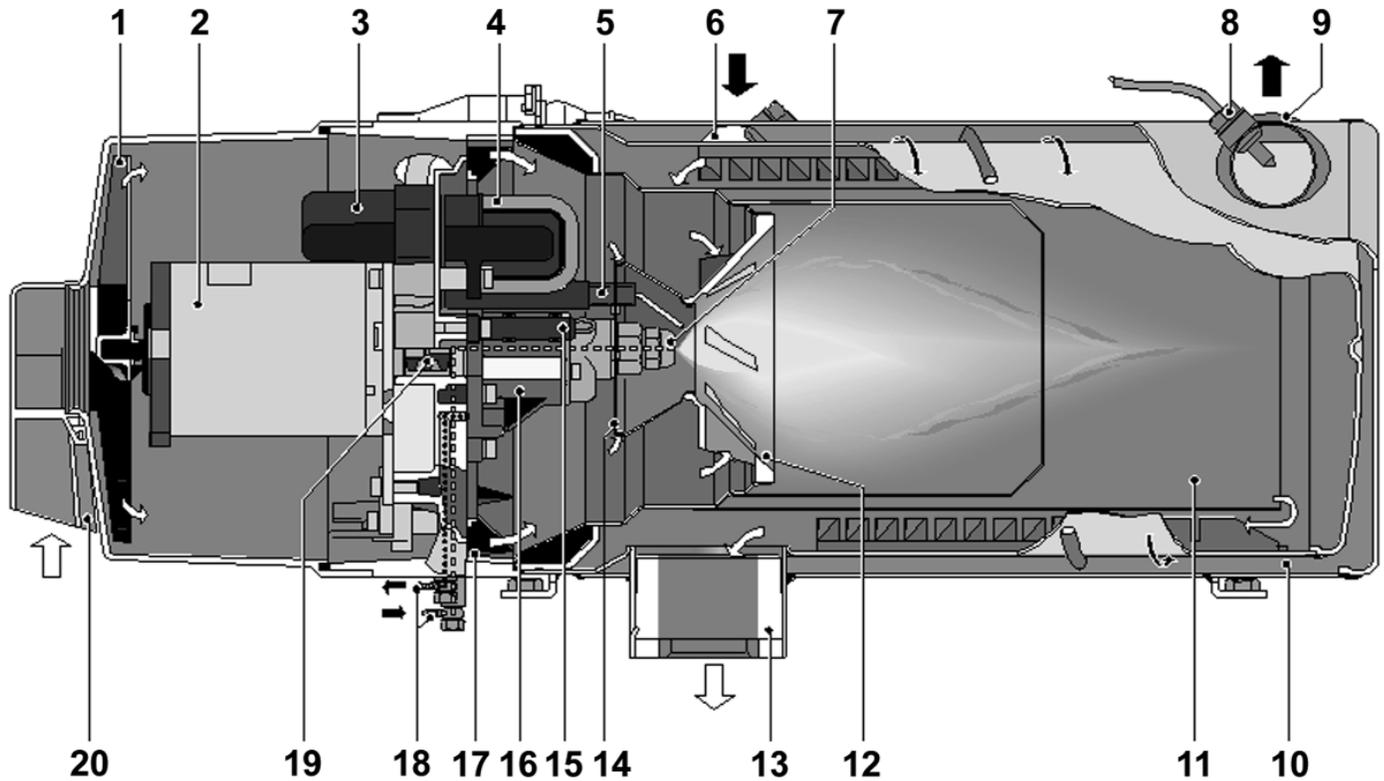
The coolant heater may only be operated with the specified fuel (Diesel 1, Diesel 2, Arctic grade, Kerosene and certain military spec. fuels).

For the routing of fuel lines, the following important regulations must be adhered to:

- Fuel lines are to be installed in such a way that they remain unaffected by torsional stresses created by vehicle and engine movement. They must be protected against mechanical damage. Fuel lines must be securely fastened to the vehicle every 12 inches (30 cm.) or less along the total length from heater to fuel tank. Fuel-carrying parts are to be protected against excessive heat and are to be installed so that any dripping or evaporating fuel can neither accumulate nor be ignited by hot components or electrical equipment.
- In buses, fuel lines are not to be located in the passenger area or in the driver's compartment. Fuel supply must not be by means of gravity or pressurization of the fuel tank.
- The fuel tank must either be equipped with a vent cap or be ventilated in another way (ventilation line).
- The operational state of the heater, i.e. an indication "On" or "Off", must be clearly visible to the operator.

2. General Description

2.1 General Description



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

Fig. 2-1: Major Components of the Thermo 300 Coolant Heater

The Webasto Thermo 300 heater has been designed for use on large displacement diesel engines where a high degree of operational flexibility is desired.

Additionally, the Thermo 300 heaters supplied to Detroit Diesel Corporation have been optimized to meet the specific requirements of the Series 4000 Detroit Diesel engine.

The Webasto Thermo 300 heater is designed to:

1. Preheat Engine block of liquid cooled engines to help 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 charge-air cooling system in cold weather when an engine is running at light loads or idling while helping to eliminate white smoke and fuel accumulation in the vehicle exhaust system.

3. Functional Description

Activation and deactivation is by means of a

- switch
- timer

dependent on the type of installation.

For monitoring operation an operating indicator light is provided.

Switch off initiates the rundown procedure (see "Switch off").

The heaters may be

- operated with power save for reduced fuel consumption (see circuit diagram)
- equipped or retrofitted with nozzle preheating for extreme low temperatures.

3.1 Switching On

Upon switching on, an operating indicator light will illuminate.

Combustion air fan, fuel pump and circulation pump start operation. (If fitted and temperature is $< 0\text{ }^{\circ}\text{C}$ ($< 32\text{ }^{\circ}\text{F}$) nozzle preheating is also activated).

After approximately 12 seconds a high voltage ignition spark is generated at the electrode tips. Approximately 1 second later the solenoid valve in the fuel pump opens and the nozzle sprays fuel into the combustion chamber to be ignited by the spark at the electrode tips. A photo control device detects a flame in the combustion chamber and deactivates the ignition system (Combustion process is self-sustaining).

3.2 Heating Operation

After reaching operating temperature the control unit takes over to provide controlled operation by activation and deactivation of the burner in order to maintain a nearly constant temperature of the heat exchanger.

A rise in temperature above the upper switching point makes the solenoid valve in the fuel pump shut off the fuel supply and initiates the rundown procedure. The flame extinguishes, the combustion air fan and the circulation pump continuing their operation. After approximately 90 seconds rundown is completed with deactivation of the combustion air fan.

The circulation pump remains in operation during the control idle period. The operating indicator light is on.

3.3 Switch Off

Switching off the heater stops combustion. The operating indicator light goes out and the rundown procedure commences.

The combustion air fan and circulation pump are deactivated after approximately 90 to 120 seconds.

Reactivation of the heater during rundown is permitted.

3.4 Power Save

With the power save feature on, the control temperatures of the heating circuit are kept low.

This results in a reduced heat radiation loss when limited heating performance is required (e.g. in heat hold operation) and reduces fuel consumption.

4. Technical Data

4.1 General Information

Where no threshold values are specified, technical data are understood to include standard tolerances for heater units of ± 10% at ambient temperature of + 20 °C (+ 68 °F) and at nominal voltage.

Electrical components:

Control unit, fan and circulation pump motors, solenoid valve, igniter box, heater cartridge, nozzle pre-heater and timer are 24V components. Temperature limiter, flame sensor, temperature sensor and switches are voltage independent components.

NOTE:
The allocation of circulation pumps to heater units must be in accordance with coolant resistances.

4.2 Thermo 300 Heater Data

| Heater | Thermo 300 | |
|--|---|--|
| Type | DW 300. | |
| Mark of conformity | ~ S229 | |
| Heater design principle | High pressure fuel atomizing nozzle | |
| Heat output | kW/h (BTU/h) | 30 (104,000) |
| Fuel | Diesel #1, Diesel #2, Arctic grade and Kerosene | |
| Fuel consumption | kg/h (US. Gal/h) | 3.3 (1.2) |
| Rated nominal voltage | V | 24 |
| Operating voltage | V | 20 ... 28 |
| Nominal power consumption (without circulation pump) | W | 110 |
| Permissible operating ambient temperature range (heater, control unit, circulation pump) | °C (°F) | - 40 ... + 60 (- 40 ... + 140) |
| Permissible storage temperature | °C (°F) | + 85 max. (+ 185) |
| Permissible operating pressure of coolant system | bar (psi) | 0.4 ... 2.0 (06 ... 29) |
| Heat exchanger capacity | l (US. Gal) | 1.8 (0.475) |
| Minimum capacity of circuit | l (US. Gal) | 10.00 (2.64) |
| CO ₂ in exhaust at nominal voltage | Vol.-% | 10 + 0.5 related to 500 m above S.L. |
| Dimensions of heater | length width height | 610 mm (24.01 in.) 246 mm (9.69 in.) 220 mm (8.66 in.) |
| Weight | kg (lb.) | 19 (41.88) |

Table 4-1: Thermo 300 Heater Data

4.2.1 Thermo 300.102 Heater Dimensions

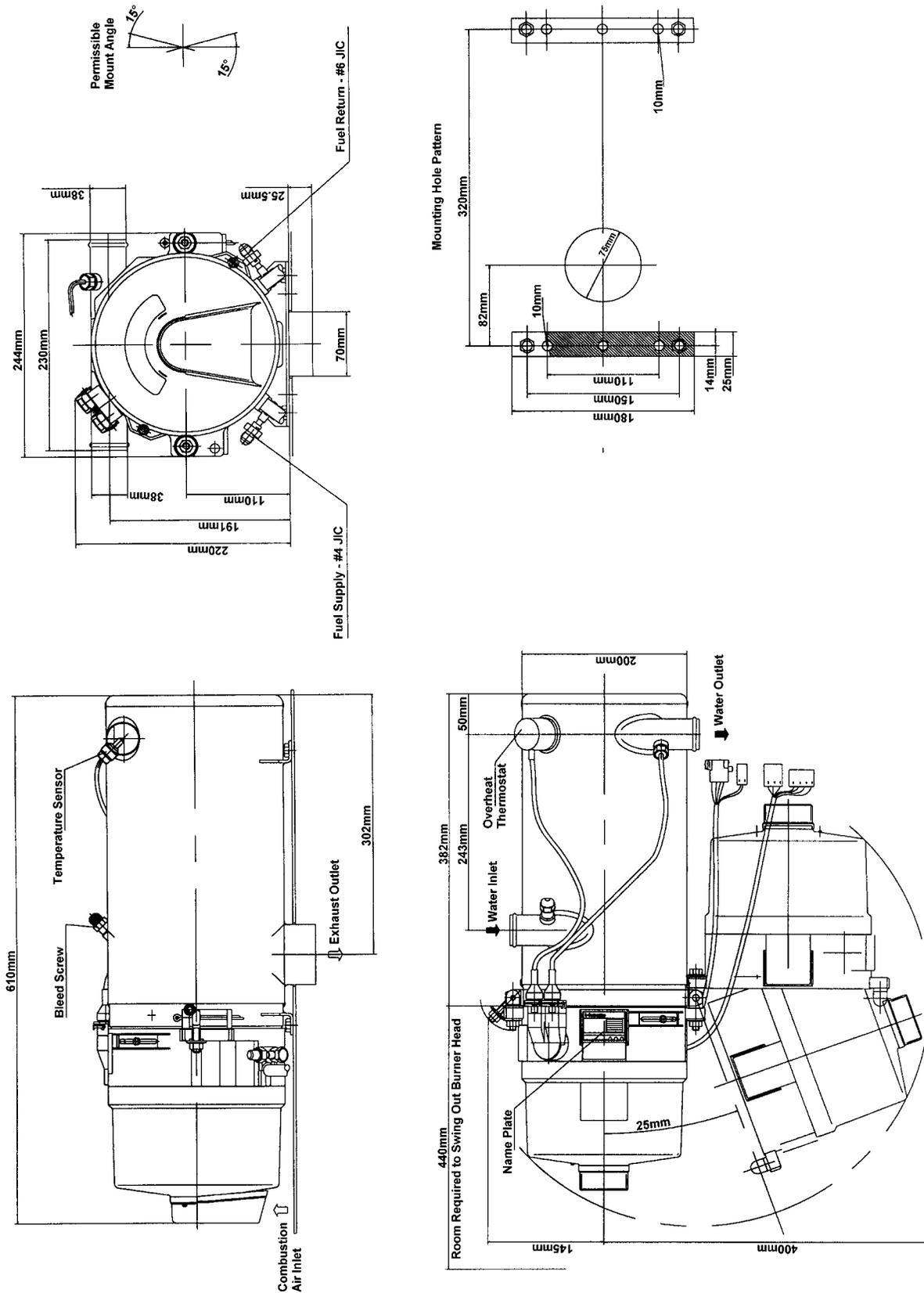


Fig. 4-1 Thermo 300.102 Heater Dimensions

4.3 U 4814 & U 4852 Coolant Pump Data

NOTE:
The allocation of circulation pumps to heater units must be in accordance with coolant resistances.

| Circulation pump | | U 4814 | U 4852 |
|----------------------------|-------------------|------------------------------|-----------------------------|
| Volume flow | l/h (US. Gal/min) | 5200 (22.9) against 0.15 bar | 6000 (26.4) against 0.4 bar |
| Nominal voltage | V | 24 | 24 |
| Operating voltage range | V | 20 ... 28 | 18 ... 32 |
| Nominal power consumption | W | 104 | 209 |
| Dimensions of coolant pump | length | 221 mm (8.7 in.) | 285 mm (11.22 in.) |
| | width | 100 mm (3.94 in.) | 115 mm (4.52 in.) |
| | height | 105 mm (4.14 in.) | 110 mm (4.33 in.) |
| Hose connection | O.D. | 38.0 mm (1.5 in.) | 38.0 mm (1.5 in.) |
| Weight | kg (lb.) | 2.1 | 2.7 |

Table 4-2: U 4814 & U 4852 Coolant Pump Data

4.3.1 Coolant Circulation Pump U4814 Dimensions

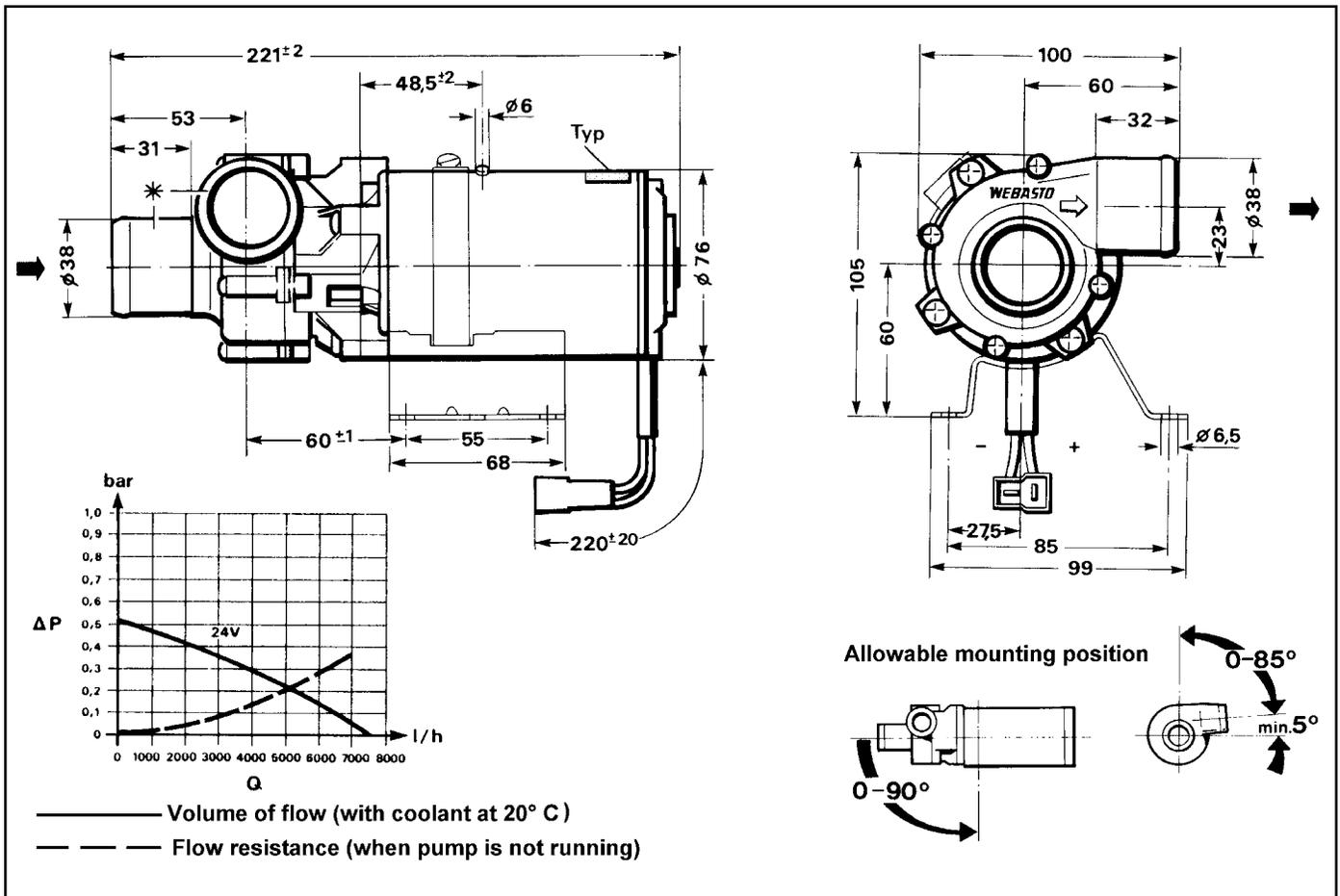


Fig. 4-2 Coolant Circulation Pump U4814 Dimensions

4.3.2 Coolant Circulation Pump U4852 Dimensions

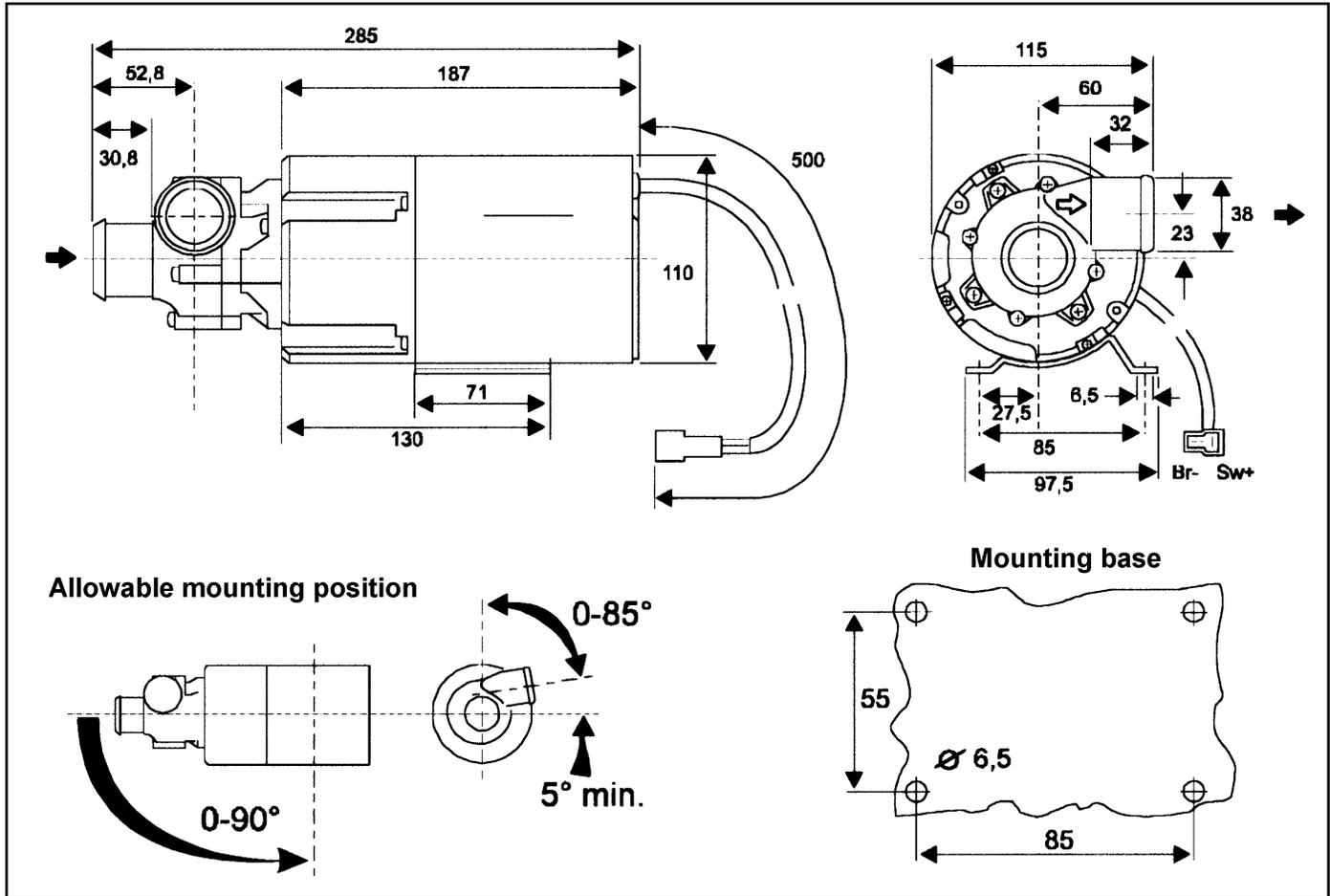


Fig. 4-3 Coolant Circulation Pump U4852 Dimensions

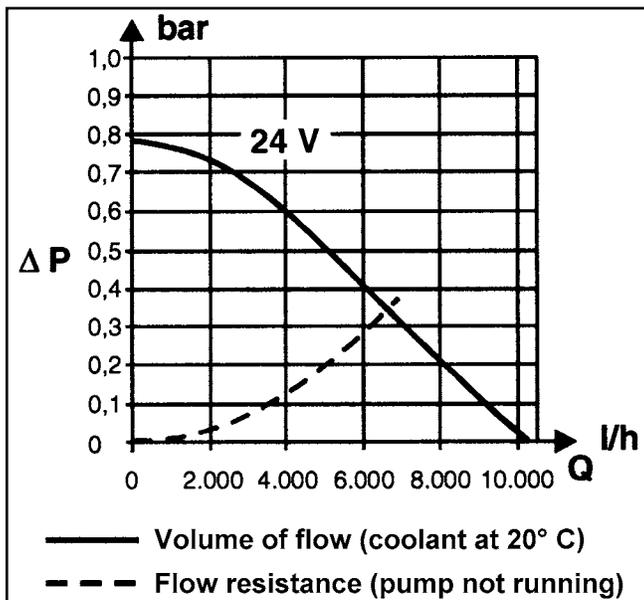


Fig. 4-4 Pump U4852 Operating Data

5. Installation

5.1 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.

NOTE:

This manual does not cover all possible installation variants. For special applications, use this manual as a guideline only. For further information concerning installations for special applications, contact Webasto Thermosystems directly at 1-800-555-4518.

5.2 Installation Location

⚠ WARNING

Due to the danger of poisoning and suffocation, the heater must not be installed in either the drivers compartment or in the passenger area of vehicles.

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 in² (20 cm²)]. 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 4-1, page 4-2.

5.3 Mounting the Heater and Enclosure

1. Locate spot to mount heater, refer to fig 5-4, page 5-6
2. Drill holes as needed for size refer to fig ?? page 4-5

5.5 Exhaust Pipe Connection**⚠WARNING**

Due to the danger of poisoning and suffocation, exhaust pipes are to be installed and routed in a manner that does not permit the possibility of exhaust gases entering the vehicle where people are present. Carefully read and understand all information pertaining to the installation of the exhaust system.

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. Always form sweeping corners and smooth transitions when forming bends in exhaust pipes.

1. Install exhaust deflector on heater exhaust outlet or install exhaust pipe.
2. Route the exhaust system so that the possibility of discharged exhaust gases 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.

⚠CAUTION

Route the exhaust system away from vehicle components that may be damaged by heat e.g., brake lines, electrical wiring, coolant hoses and fuel lines.

NOTE:

Webasto approved flexible exhaust tubing is available from your Webasto Thermosystems supplier under part number 479721.

5.6 Combustion Air Supply**⚠WARNING**

Due to the danger of poisoning and suffocation, never draw combustion air from inside the driver and passenger areas of the vehicle or from areas where hazardous fumes and gases can accumulate. Carefully read and understand all information pertaining to the installation of the combustion air intake system.

⚠CAUTION

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

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

Where the heater is installed in a sealed compartment, adequate ventilation for combustion air requirements [4 in² (20 cm²)] 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 88729A.

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 port of the heater.

For a straight connection, order a straight adapter under part number 101377 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. 101404) and an adapter ring (P.N. 82315A) 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.

NOTE:

Webasto approved flexible combustion air ducting is available from your Webasto Thermosystems supplier under part number 88729A.

5.7 Plumbing Into the Coolant System

5.7.1 General Information

⚠ WARNING

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

⚠ CAUTION

The coolant pump(s) must be operating and a continuous unobstructed coolant path provided during heater operation. Overheating of the heater will quickly develop if coolant flow is interrupted.

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.

Refer to "Supplemental Heating Schematic - Jacket Water and Intercooler Coolant Heaters" under section 5.7.2 for information regarding plumbing the coolant heater into the coolant system.

NOTE:

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

5.7.2 Supplemental Heating Schematic - Jacket Water and Intercooler Coolant Heaters (fig. 5-1)

⚠ CAUTION

The coolant pump(s) must be operating and a continuous unobstructed coolant path provided during heater operation. Overheating of the heater will quickly develop if coolant flow is interrupted.

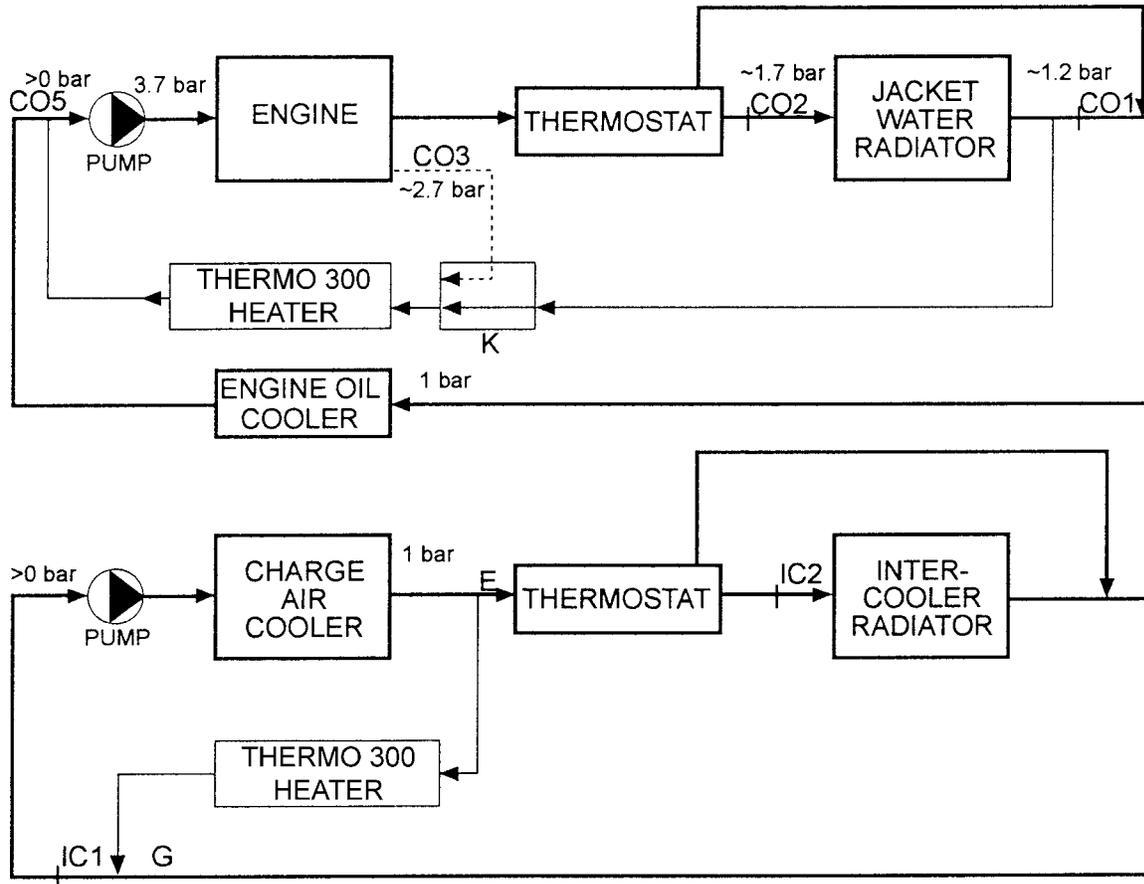


Fig. 5-1: Supplemental Heating Schematic

- CO2: OEM Connection - Engine Outlet to Jacket Water Radiator
- B: Supply to Jacket Supplemental Heater - Connect to OEM Plumbing
- CO1: OEM Connection - Engine Inlet from Jacket Water Radiator
- CO5: Return from Jacket Supplemental Heater - Connect to Engine (30 mm)
- E: Supply to Intercooler Supplemental Heater - Connect to Engine (1 in. NPT)
- IC2: OEM Connection - Engine Outlet to Intercooler Radiator
- G: Return from Intercooler Supplemental Heater - Connect to OEM Plumbing
- IC1: OEM Connection - Engine Inlet from Intercooler Radiator
- CO3: Supply to Jacket Supplemental Heater - Preheating Mode - Connect to Engine (2 X 20 mm)
- K: Ball valve or Solenoid Activated Valve - Required if both Supplemental Heating and Preheating Modes are Desired

Dashed Lines = Preheat Mode
 Bold Lines = Engine Coolant Circuit
 Thin Lines = Supplemental Heating Mode

* All pressures listed without radiator pressure cap @ 1900 RPM - pressure with radiator cap on will be 1 bar higher.

5.7.3 Supply and Return Plumbing Connection Points (Charge Air Cooler)

⚠ WARNING

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

NOTE:

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

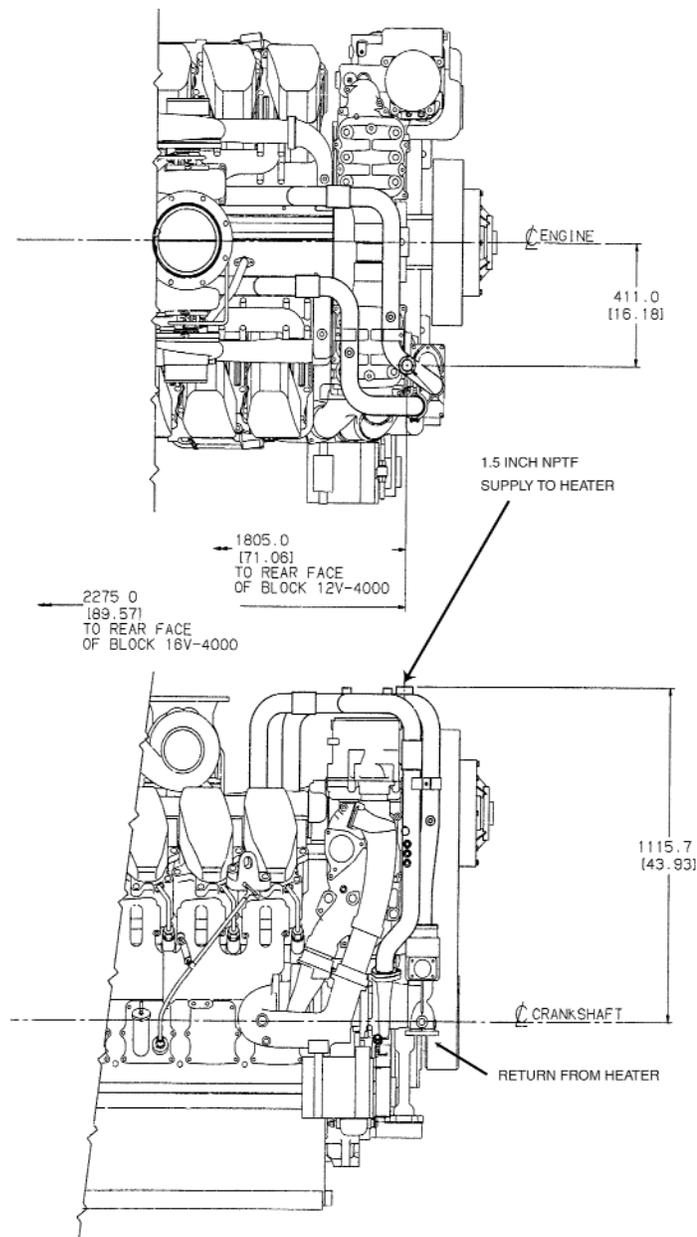


Fig. 5-3: Engine

5.7.4 Example of a Heater Installation

Thermo 300 in Enclosure

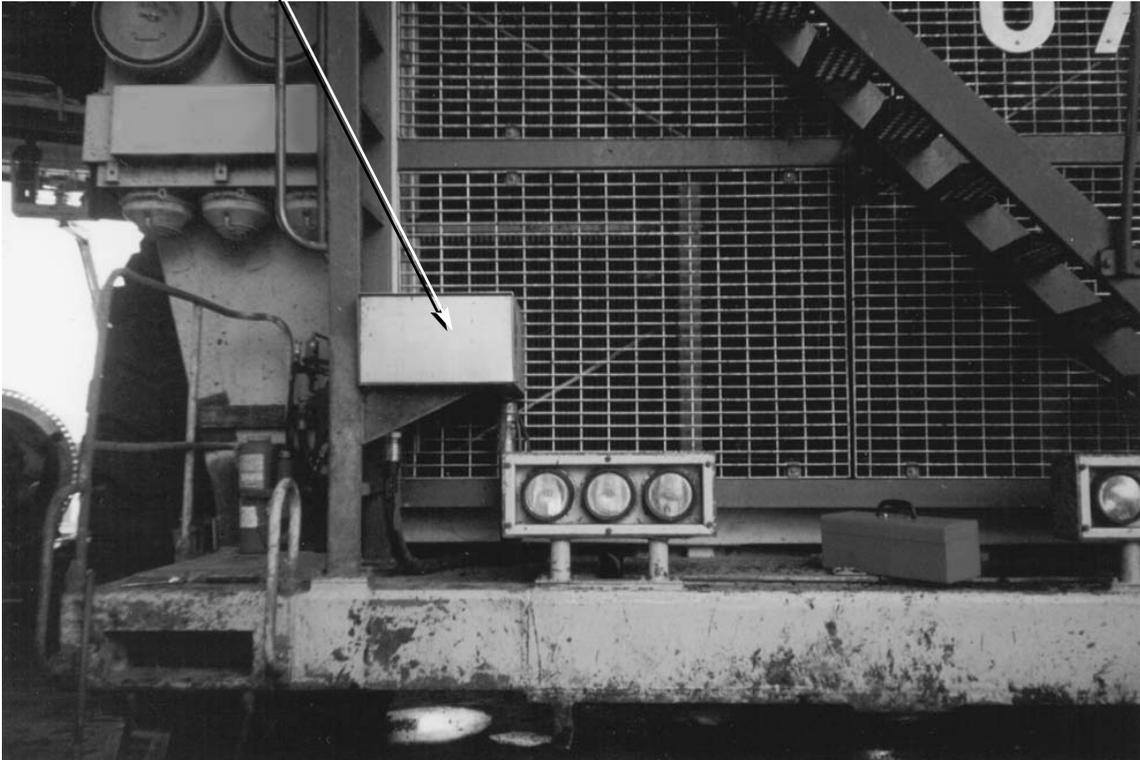


Fig. 5-4: Example of Heater Installation

5.8 Fuel System

5.8.1 General Information

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 5-5. 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.

5.8.2 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.

⚠ CAUTION

Whenever the fuel tank is situated higher than the Webasto heater, the top of the fuel tank must not be more than 500 mm (20 in.) above the heater.

NOTE:

The Thermo 300 heater is equipped with a self priming fuel pump. Priming the fuel system or fuel filters is generally not necessary.

On Haulage Trucks

Use an open port NEAR the bottom of that fuel tank, at least 2” above bottom.

On Mining, Drill Rigs, Marine, and other Off-highway applications that have large fule tanks use a spare port that is at least 2” from the bottom of the tank.

If the fuel tank is small enough to be able to use the standpipe follow the directions listed below for installation guide.

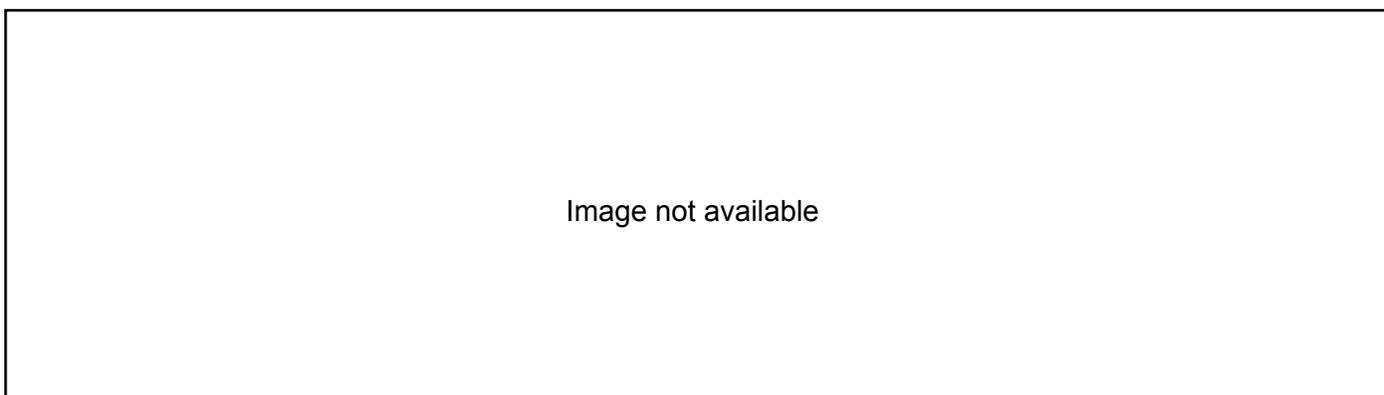


Fig. 5-5: Fuel Standpipe Installation

1. Cut fuel standpipe to length, approx. 2” off fuel tank bottom.

NOTE:

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

2. Install the fuel standpipe.
 - 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 305 mm (12 in.) and kept away from hot exhaust components and moving parts (drive shafts, wheels, etc.).

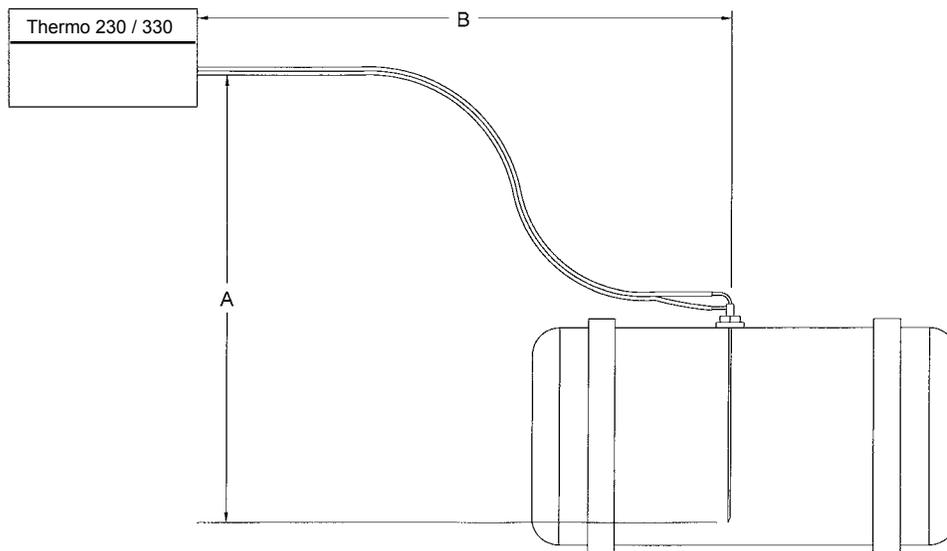


Fig. 5-6: Fuel Line Parameters

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

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

Maximum fuel system residual pressure not to exceed 0.3 bar (4.35 psi.)

5.8.3 Fuel Filter

The heater must be equipped with a fuel filter. The fuel filter assembly should be mounted close to the heater.

Fuel filters require changing at least annually and in cases of dirty fuel more often.

NOTE:

Change fuel filters at least annually and more often in cases of sub-standard fuels or in severe conditions.

⚠ CAUTION

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

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.

5.9 Wiring Connections

5.9.1 General Information

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

⚠ CAUTION

Whenever welding is to be performed on the vehicle, the main battery cables must be disconnected from the battery to protect the electronic control unit.

NOTE:

The Thermo 300 heater will not perform to your satisfaction with weak batteries.

5.9.2 Timer and Switch Connections

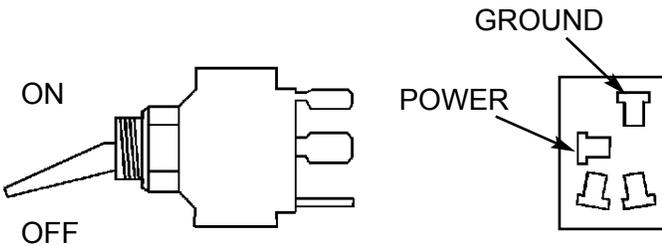


Fig. 5-7: On/Off Switch

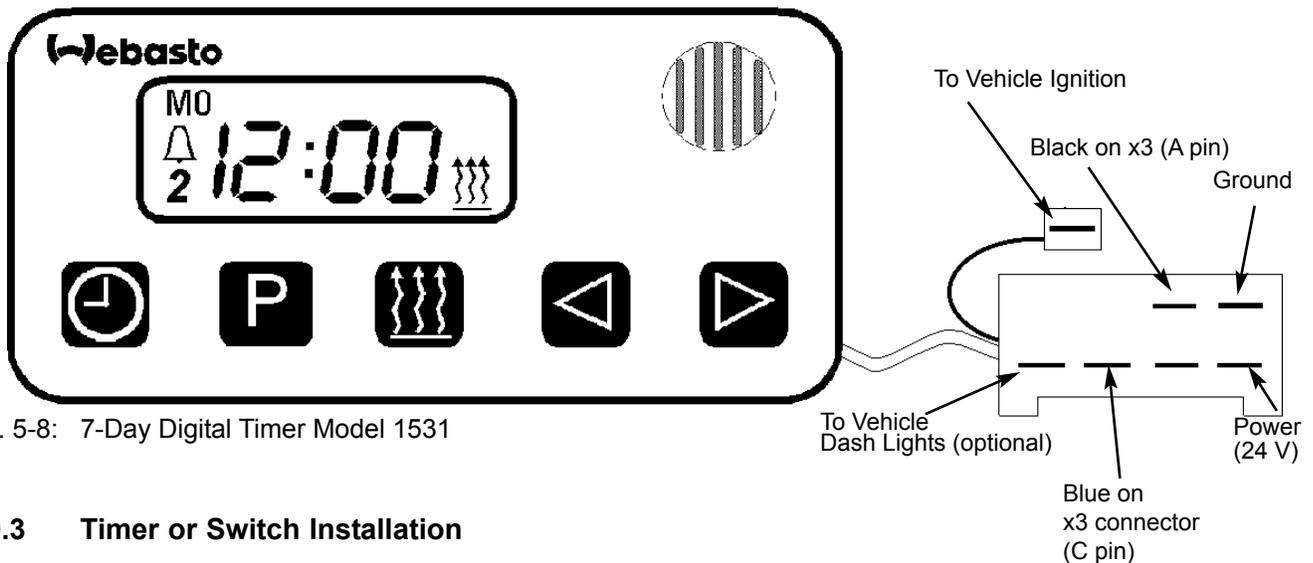


Fig. 5-8: 7-Day Digital Timer Model 1531

5.9.3 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.

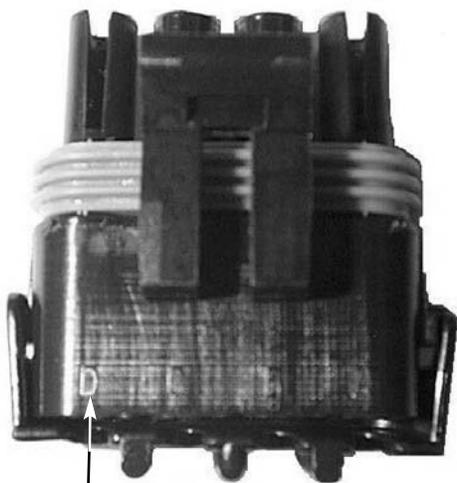
5.9.4 Coolant Pump Connections

Use Eyelet (901.038) supplied with coolant pump harness kit for ground.

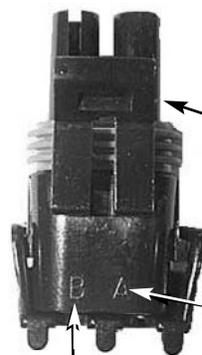


Run 12 Gauge wire from eyelet to Pin B on connector #905455 for the ground.

Run 12 Gauge wire from Pin A on the same connector into Pin D on the flat 4 pin connector of the electrical connector kit.



Pin D
Coolant Pump Power to Pin A on connector P/N #905.455



Connector P/N 905.455

Pin A, Coolant Pump Power from Pin D

Ground for Coolant pump

5.9.5 Wiring Diagram - with Switch

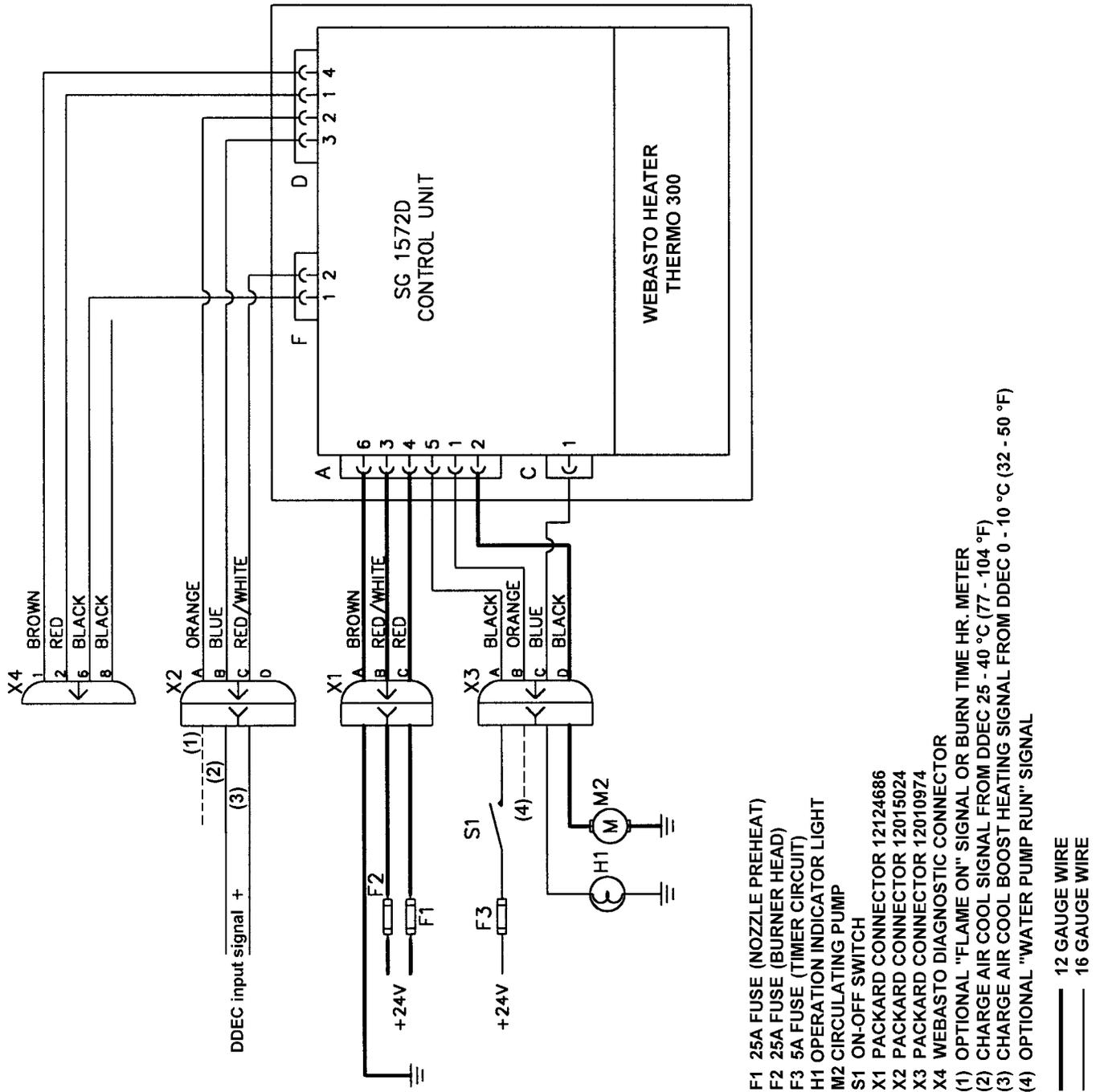


Fig. 5-9: Wiring Diagram with Switch

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

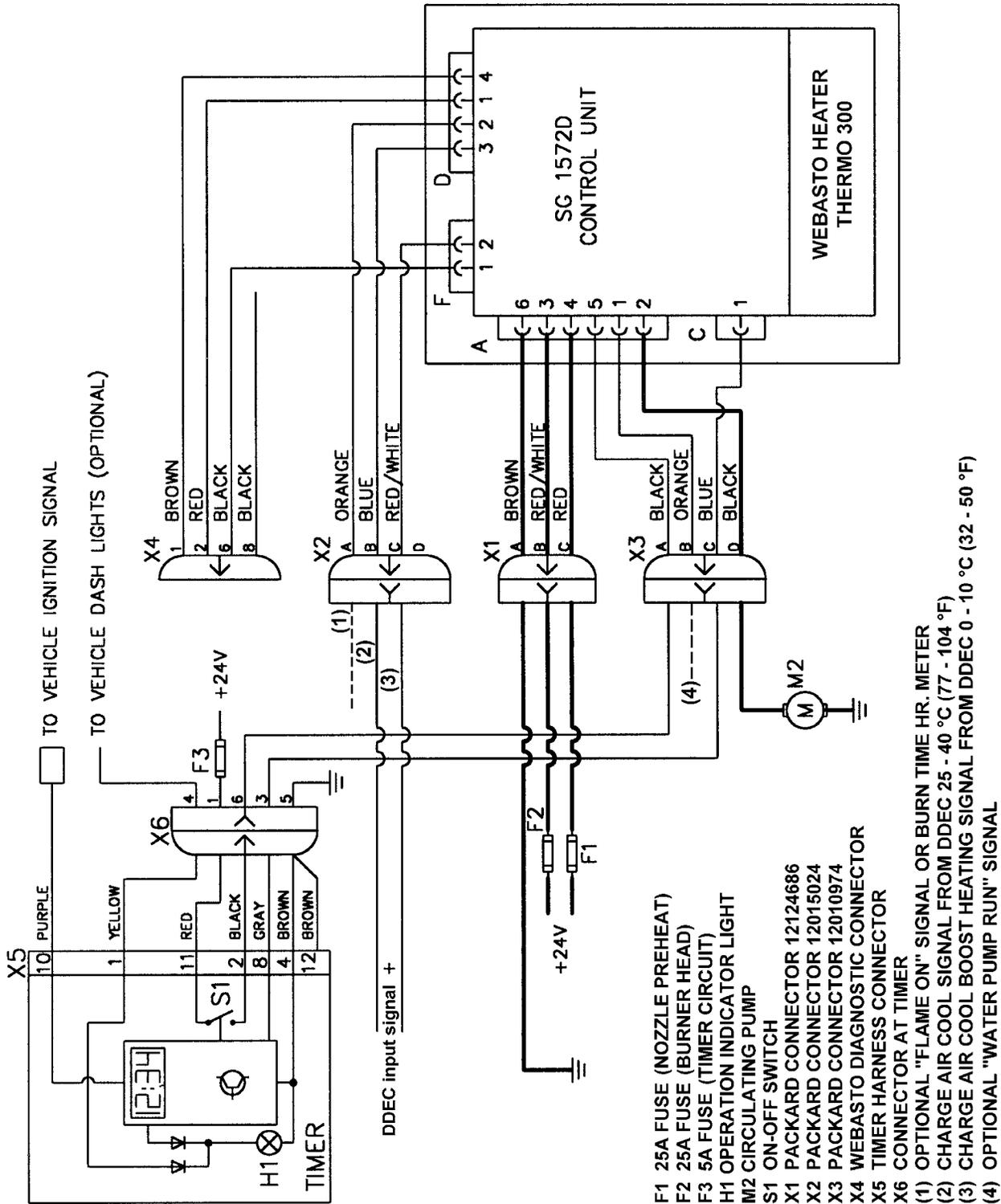


Fig. 5-10: Wiring Diagram with Timer Model 1531

5.10 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 coolant circuits. 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.

NOTE:

Installation with long fuel lines may require 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 70 °C (158 °F) to start up heater.

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.

NOTE:

The engine temperature gauge may read a lower temperature than actual coolant temperature at heater outlet. This difference depends on the location of the temperature sensor on the engine in relation to coolant flow.

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.

15. Complete the warranty card and mail to Webasto Thermosystems.
16. Install the heater or engine compartment cover if equipped. Installation is now complete.

NOTE:

Necessary information to complete warranty registration card and ensure full warranty coverage can be found on the name plate on top of the burner head.

6. Basic Troubleshooting

⚠ CAUTION

Troubleshooting requires profound knowledge about structure and theory of operation of the heater and components. Troubleshooting and fault correction should only be performed by Webasto trained, skilled personnel unless otherwise stated in this manual.

6.1 General Information

This section describes troubleshooting procedures for the Thermo 300 coolant heater. Troubleshooting is normally limited to the isolation of defective components.

Before troubleshooting, check for and eliminate the following defects:

- fuel supply (plugged fuel filter, kinked fuel line)
- 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 the correction of a malfunction, a functional test must always be performed with the heater installed in its operational position in the vehicle.

NOTE:

Coolant temperature must be below 70 °C (158 °F) before heater will start.

6.2 Operational Malfunction 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 malfunction. In order to make a correct analysis it is 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 malfunction code. The first five quick flashes are only an indication that a malfunction code has been registered and will be displayed. Count only the slower sequence of flashes to obtain the current malfunction code.

For example (flashes = □):

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

The flash code sequence will be repeated during the Thermo 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 malfunction flash code will no longer be visible on the indicator light but will be stored in memory.

6.2.1 Reading a Malfunction Code with the Digital Timer Model 1531 Installed

Where the Thermo 300 installation includes the Digital Timer model 1531, you will be able to read the current malfunction code directly from the timer display. The flame indicator symbol will "flash" the present malfunction code once and will then convert the malfunction code to an alphanumeric display message. For example: code 10 (overheat) will be visible on the timer display as "F 10". Once the malfunction has been corrected, and the heater

switch or timer is cycled “Off” and “On” and the heater successfully starts and runs with no further malfunctions, the malfunction code will disappear from the timer display.

6.2.2 Malfunction Codes Stored in Memory

Once the Thermo 300 completes the after run (cool down) period initiated by a malfunction, the current flash code will be downloaded (stored) in memory. The Thermo 300 can store up to ten malfunction codes. Once the memory is “Full”, any additional malfunction code will replace the earliest code stored thereby continually updating the malfunction codes stored in memory with the ten most recent malfunctions.

6.3 Operational Malfunction Symptoms via Flash/ Malfunction Code

The following table lists the possible malfunctions 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 |
|---|---|---|
| 1X Flash (F 01) 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 |
| 2X Flashes (F 02) Flame out during burner operation and 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 (waxing) |
| 3X Flashes (F 03) Low voltage for more than 20 seconds | - Electrical system | - Load test batteries - Corrosion at connections - Loose connections |
| 4X Flashes (F 04) Flame detector recognizes false flame signal during pre-start or shut-down cycle | - Defective flame detector | - Replace flame detector |
| 5X Flashes (F 05) Flame detector | - Wiring - Defective flame detector | - Damaged wiring, open or short circuit - Replace flame detector |
| 6X Flashes (F 06) Temperature sensor | - Wiring - Defective temperature sensor | - Damaged wiring, open or short circuit - Replace temperature sensor |
| 7X Flashes (F 07) Fuel solenoid valve | - Wiring - Defective solenoid valve | - Damaged or corroded wiring - Open or short circuit - Replace solenoid valve |
| 8X Flashes (F 08) 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 |
| 9X Flashes (F 09) Circulation pump motor | - Wiring - Defective circulation pump motor | - Damaged wiring, open or short circuit - Replace circulation pump motor |
| 10X Flashes (F 10) 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 |
| 11X Flashes (F 11) Electronic ignition coil | - Wiring - Defective electronic ignition coil | - Damaged wiring, open or short circuit - Replace electronic ignition coil |
| 12X Flashes (F 12) Heater lock-out | 3 repeated faults/flame-outs or 5 repeated start attempts | Re-initialize control unit by switching heater on, disconnecting and connecting power connection. |

Table 6-1: Operational Failure Symptoms (Control Unit SG 1572 D)

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

⚠ CAUTION

*Diagnostics equipment is intended for use by Webasto trained personnel at authorized Webasto distributor, dealer and end user service facilities. Troubleshooting requires profound knowledge about structure and theory of operation of the heater and components.
Troubleshooting and fault correction should only be performed by Webasto trained, skilled personnel unless otherwise stated in this manual.*

It is possible to read and remove (reset) stored malfunction codes from the Thermo 300 memory. This is achieved through the use of a diagnostic interface kit connected to the Thermo 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 300.

Order PC Diagnostics Kit under part number 92542E and adapter under part number 20865A.

System requirements:

- IBM compatible PC with 80286 processor or higher
- DOS version 3.0 or higher including *MS Windows (*Not required)
- Requires a minimum of 1 MB RAM
- Requires a 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
- One unused serial port
- One monitor and keyboard (mouse or other pointing device recommended)

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

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

