

D9W (Water Heater)

Installation Troubleshooting & Parts Manual
Boxed & Universal versions



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Heater Model

25 1996 05 - 12 volt

25 1997 05 - 24 volt

25 1815 05 - 12 volt

25 1816 05 - 24 volt

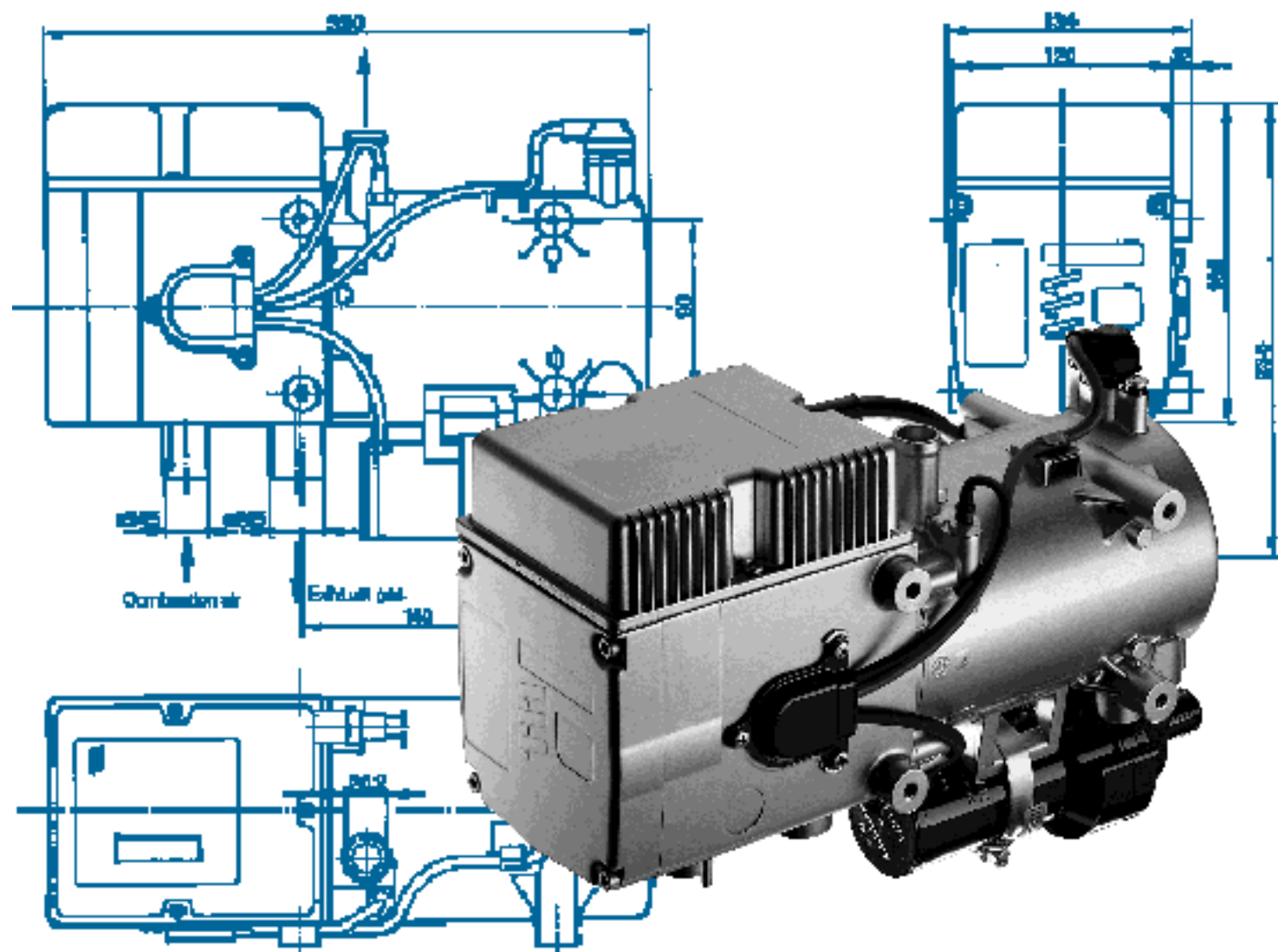
Release dates:

Sept 97 - present

Oct 97 - present

Not released in N.A.

July 95 - Oct 97



Permissible installation positions

October 1998

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Special Notes

Note: Highlight areas requiring special attention or clarification.

Caution: Indicates that personal injury or damage to equipment may occur unless specific guidelines are followed.



Warning: Indicates that serious or fatal injury may result if specific guidelines are not followed.

This publication was correct at the time of print. However, Espar has a policy of continuous improvement and reserves the right to amend any specifications without prior notice.

**Warning To Installer**

- Correct installation of this heater is necessary to ensure safe and proper operation. Read and understand this manual before attempting to install the heater. **Failure to follow all these instructions could cause serious or fatal injury**

**Warning - Explosion Hazard**

- Heater must be turned off while re-fueling.
- Do not install heater in enclosed areas where combustible fumes may be present.
- Do not install heaters in engine compartments of gasoline powered boats.

**Warning - Fire Hazard**

- Install the exhaust system so it will maintain a minimum distance of 50mm(2") from any flammable or heat sensitive material.
- Ensure that the fuel system is intact and there are no leaks.

**Warning - Asphyxiation Hazard**

- Route the heater exhaust so that exhaust fumes cannot enter any passenger compartments.
- If running exhaust components through an enclosed compartment, ensure that it is vented to the outside.

**Warning - Safety Hazard on Coolant Heaters Used With Improper Antifreeze Mixtures**

- The use of Espar coolant heaters requires that the coolant in the system to be heated contain a proper mixture of water and antifreeze to prevent coolant from freezing or slushing.
- If the coolant becomes slushy or frozen, the heater's coolant pump cannot move the coolant causing a blockage of the circulating system. Once this occurs, pressure will build up rapidly in the heater and the coolant hose will either burst or blow off at the connection point to the heater.
- This situation could cause engine damage and/or personal injury. Extreme care should be taken to ensure a proper mixture of water and antifreeze is used in the coolant system.
- Refer to the engine manufacturer's or coolant manufacturer's recommendations for your specific requirements.

Caution: *During electrical welding work on the vehicle disconnect the power to the heater in order to protect the control unit.*

Note: All measurements contained in this manual contain metric and approximate SAE equivalents in brackets eg 25mm (1")

Direct questions to Espar Heater Systems

USA
CDA

1-800-387-4800
1-800-668-5676

Introduction

Espar's D9W Coolant Heater

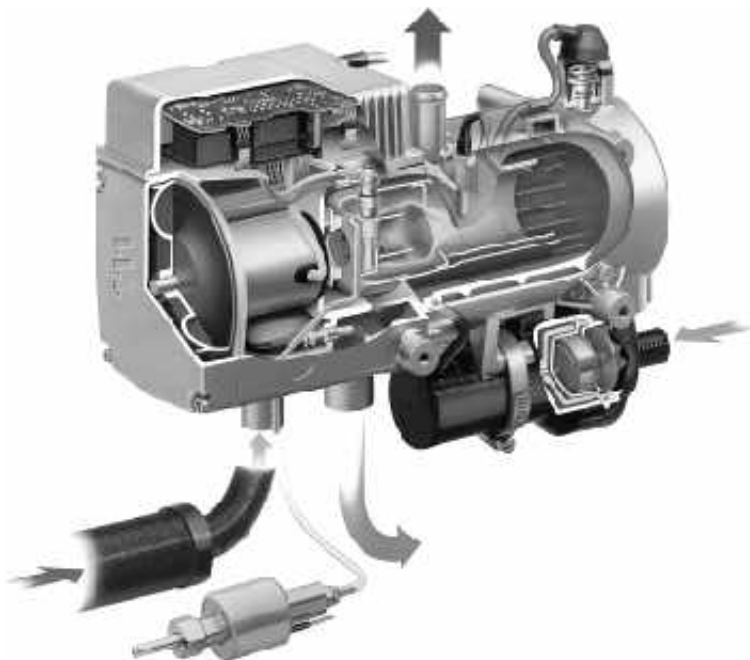
Quality engineered to provide a dependable means of heating, the Espar D9W is a diesel fired coolant heater capable of between 1.5 kW to 9.5 kW (5,100 to 32,400 BTU/hr). The heater can be purchased either in a weather resistant box to protect it and provide for ease of installation or in a universal form.

This light weight and compact water heater offers an affordable heating solution to many applications. The D9W is ideal for pre heating the engines of mid sized trucks, off-road equipment, buses and boats.

The heater simply pumps coolant from the engine, heats it and returns it to the engine. When used to provide sleeper heat, the coolant is pumped through the heat exchanger prior to returning to the heater. It features automatic heat regulation while being fuel and power efficient. Since the heater runs on diesel fuel and 12 or 24 volt power, it is able to perform this completely independently of the vehicle engine. A temperature regulating switch in the unit regulates the coolant temperature between a low of 68°C (154°F) and a high of 85°C (185°F) by automatically cycling the heater.

The D9W can be operated from the vehicle cab by an on/off switch, a preselect timer or a combination of both.

A flame sensor, temperature regulating sensor and overheat sensor are among the safety features which make the D9W a safe and dependable heating system.



D9W Hydronic Specifications

Heat output (±10%)

9.5 kW (32,400 BTU/hr) - **Boost**
 7.5 kW (25,600 BTU/hr) - **High**
 3.2 kW (10,900 BTU/hr) - **Medium**
 1.5 kW (5,100 BTU/hr) - **Low**

Current draw (±10%)

12Volt		24Volt
10.4	- Boost -	5.2 amps
6.3	- High -	3.2 amps
3.5	- Medium -	1.8 amps
2.9	- Low -	1.5 amps

Fuel consumption (±10%)

1.2 l/hr (0.32 USgal/hr) **Boost**
 0.9 l/hr (0.24 USgal/hr) **High**
 0.40 l/hr (0.11 USgal/hr) **Medium**
 0.18 l/hr (0.05 USgal/hr) **Low**

Operating Voltage Range

Minimum Voltage
 Maximum Voltage

10 V (20V on 24 volt systems)
 15 V (30 V on 24 volt systems)

Coolant pump flow (±10%)

1400 Litre/hr
 370 U.S. Gal/hr

Coolant Temperature Range (±5%)

60-85°C (140-185°F)

Overheat coolant temperature shutdown (±5%)

115°C (240°F)

Weight

6.5 kg. (14.3 lbs.)

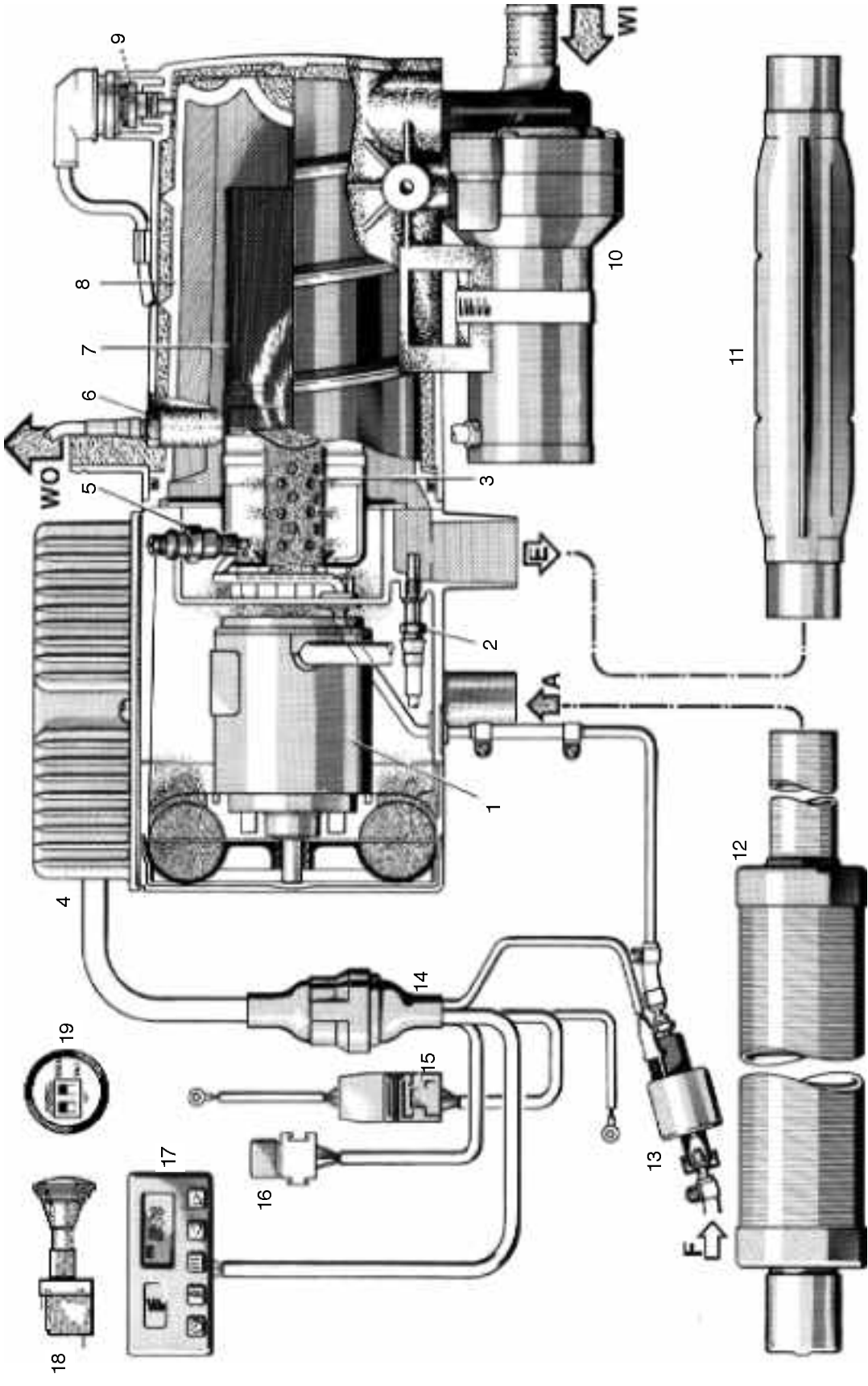
Controls available

On/Off switch, 99hr. timer or 7 day timer.

Note: The heater is equipped with a high voltage cutout as well a low voltage cutout.

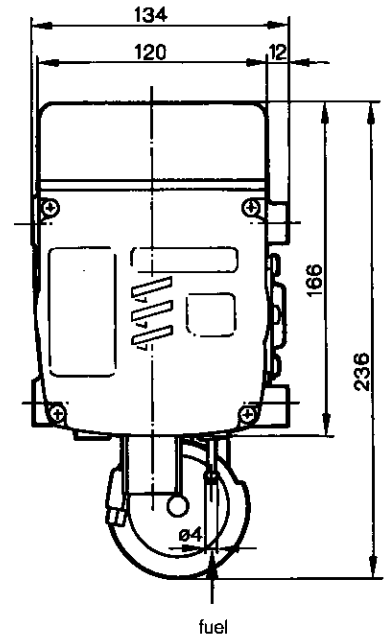
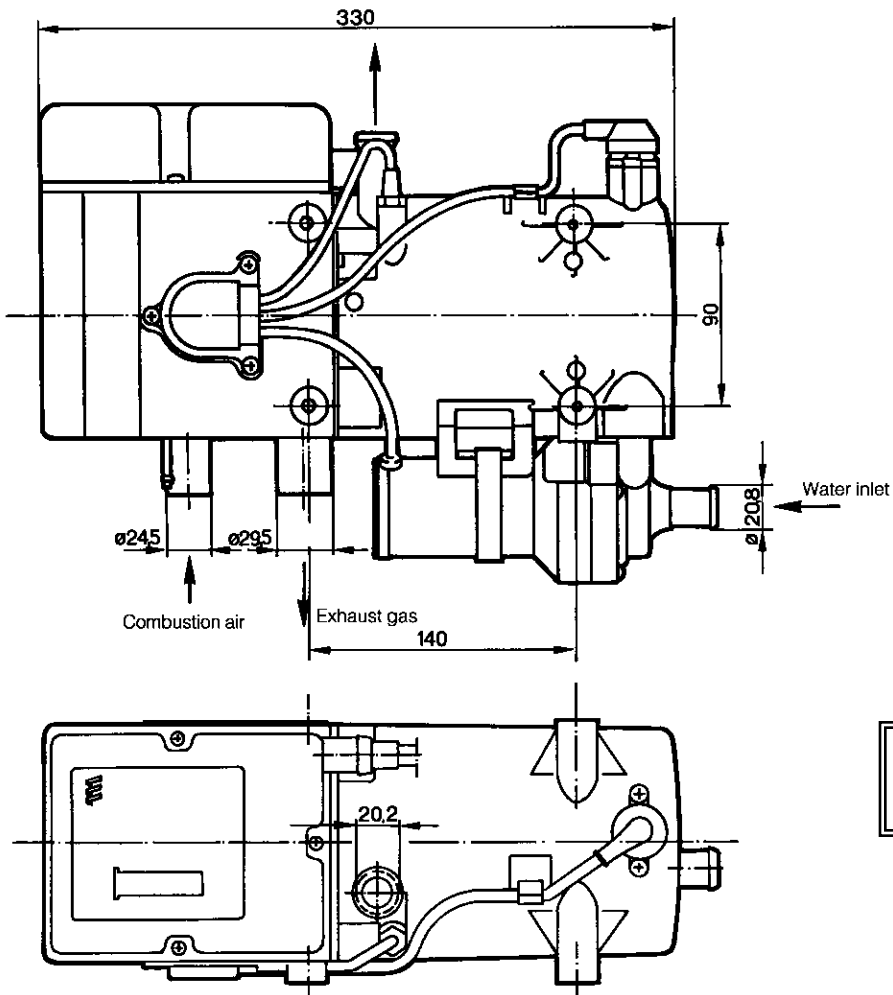


Heater Components



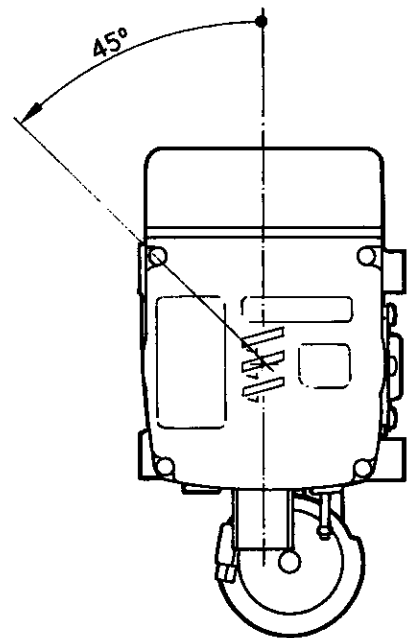
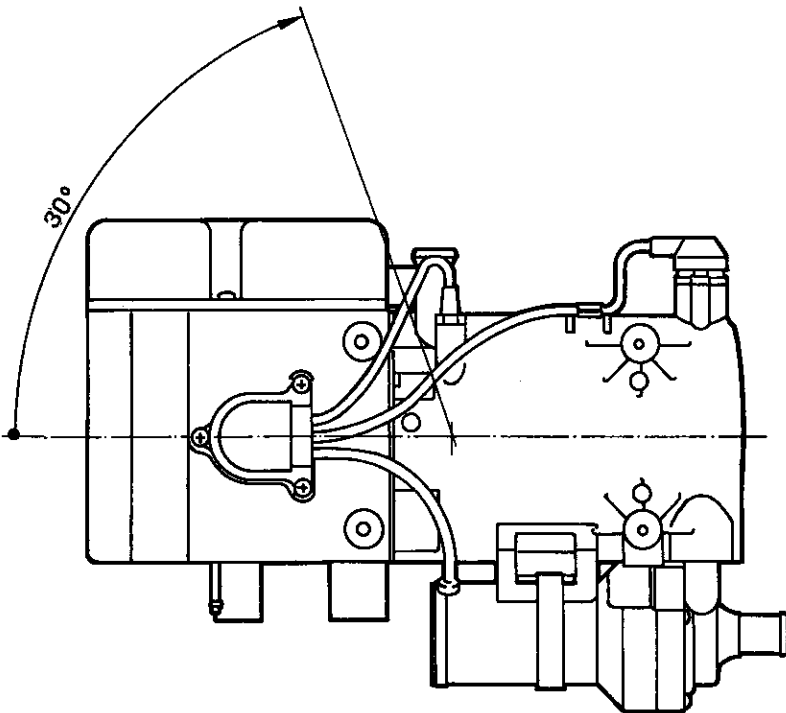
- | | | | | |
|----|---------------------------------------|----|---|------------------|
| 1 | Burner Motor | A | = | Combustion air |
| 2 | Flame sensor | E | = | Exhaust |
| 3 | Combustion chamber | F | = | Fuel supply line |
| 4 | control unit | WO | = | Water Outlet |
| 5 | Glow plug | WI | = | Water Inlet |
| 6 | Temperature sensor | | | |
| 7 | Flame tube | | | |
| 8 | Heat exchanger | | | |
| 9 | Overheat sensor | | | |
| 10 | Water pump | | | |
| 11 | Exhaust muffler | | | |
| 12 | Combustion air muffler | | | |
| 13 | Fuel metering pump | | | |
| 14 | Wiring harness | | | |
| 15 | Fuse holder | | | |
| 16 | Relay for switching on vehicle blower | | | |
| 17 | 7 day timer | | | |
| 18 | Push/Pull switch | | | |
| 19 | 99 hr timer | | | |

Principal Dimensions



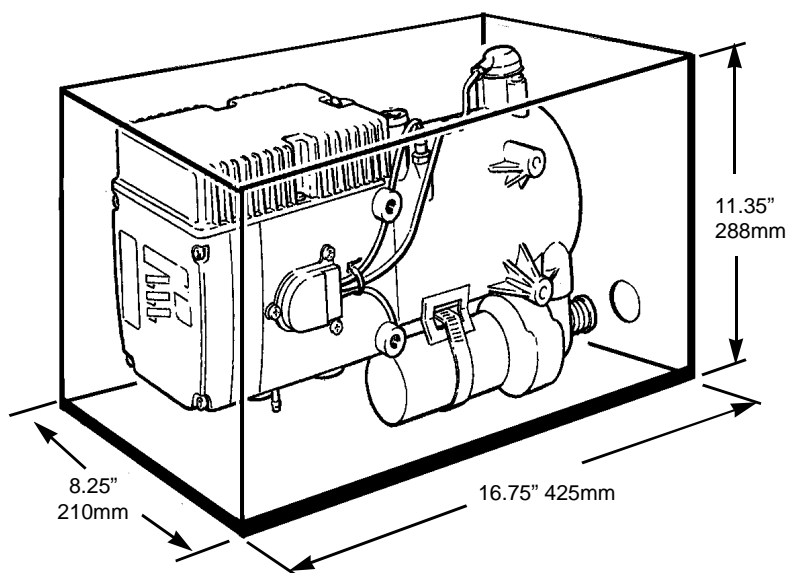
* All measurements in millimeters
25.4mm = 1"

Permissible installation positions





Principal Dimensions- Boxed Version



Installation Procedures

Heater Location

Mount the heater in a protected area such as a storage compartment or engine compartment. When mounting the heater, adhere to the following conditions:

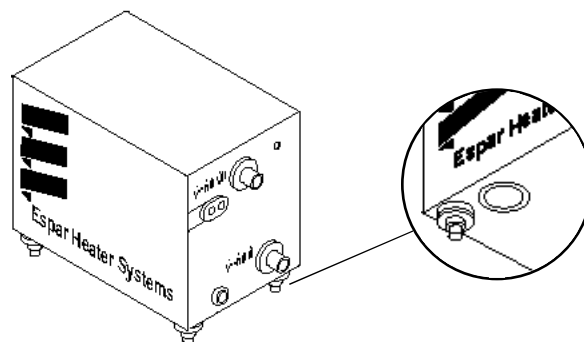
- Situate the heater below the normal coolant level of the engine.
- Guard against excessive road spray.
- Keep coolant hoses, fuel lines and electrical wiring as short as possible

Heater Mounting

Mount the heater using the four (4) shock mounts provided and one of the following mounting methods:

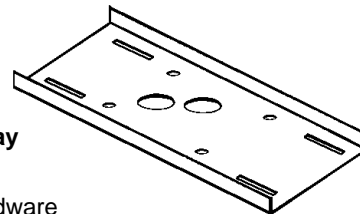
- Use the **Cross Frame Mounting Tray** to mount the heater behind the cab and on top of the frame rails.
- Use the **Side Mount Bracket** to mount the heater on the side of the frame rail.
- Use a spare step box or battery box.
- Use the saddle bracket and hardware provided

Caution: Guard the heater against excessive road spray to avoid internal corrosion



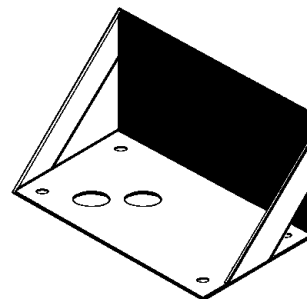
Cross Frame Mounting Tray

P/N: CA0 10 028
CA0 10 022 with hardware



Side Mount Bracket

P/N: CA0 10 057



Heater Plumbing

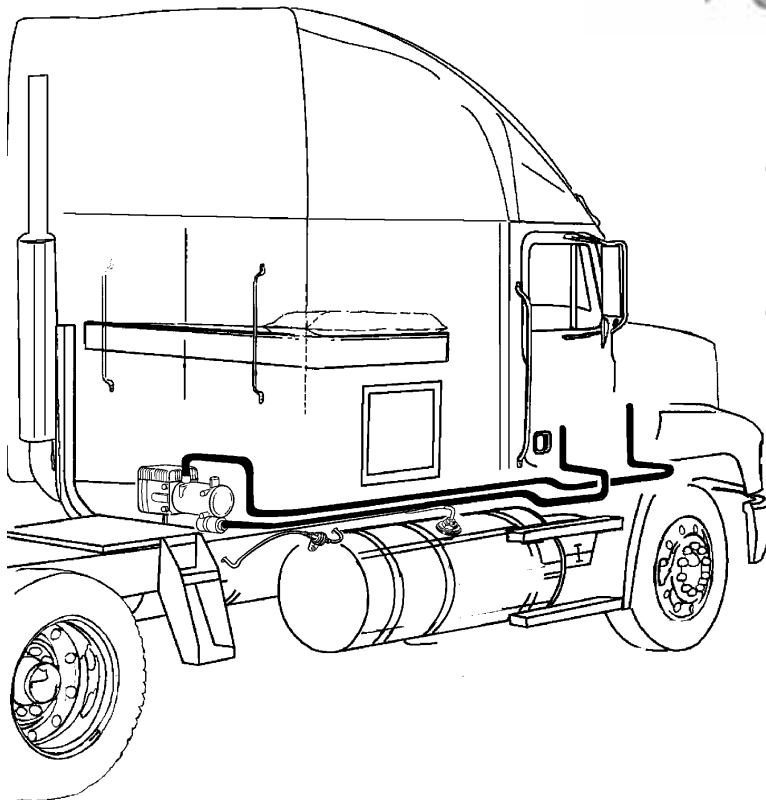
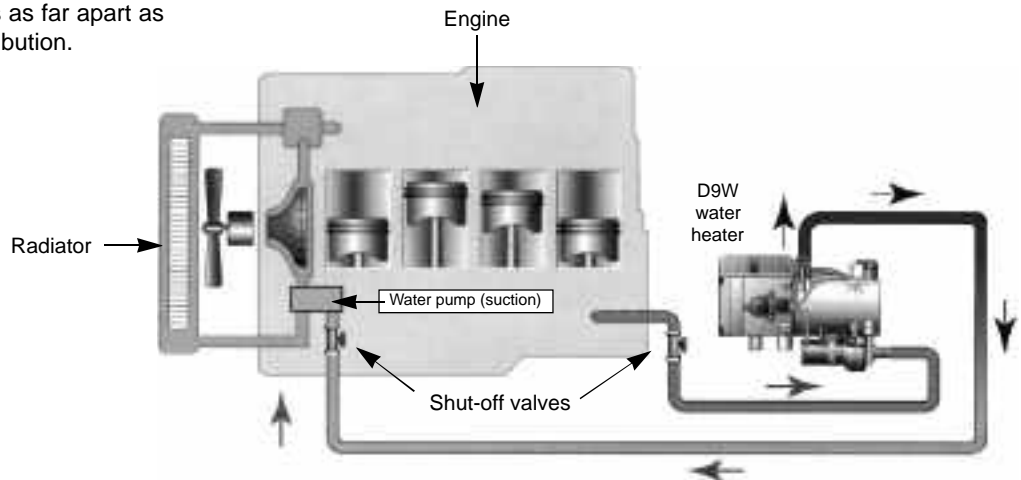
The heater is incorporated into the engine's cooling system for engine preheating

Engine Plumbing

Follow these guidelines and refer to the engine plumbing diagram shown below.

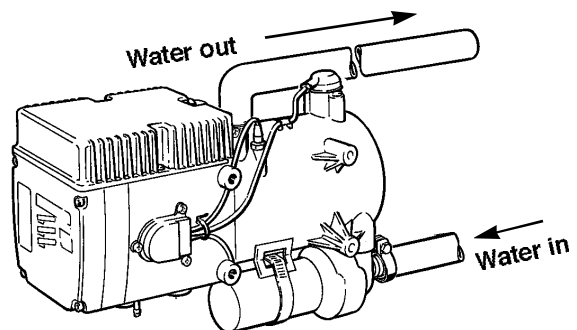
- Install hose fittings into the engine block for pick-up and return lines.
- Use existing holes in the engine block (ie. remove blanking plugs when possible).
- Use shut off valves to ensure the system can be isolated from the engine when not in use. Alternatively "T" piece connectors in existing coolant hoses can be used if no blanking plugs are available
- Provide 20mm (3/4") hose barbs for hose connections.
- Use 20mm (3/4") hoses to ensure adequate coolant flow.
- Keep the pick up and return points as far apart as possible to ensure good heat distribution.

- Take the coolant from a low point on the engine to reduce aeration in the system.
- Ensure proper direction of coolant flow by taking coolant from a high pressure point in the engine and returning it to a low pressure point. (ie. pickup from back of block and return to the suction side of the engine's water pump).
- Ensure adequate flow rate through the heater by comparing the incoming and outgoing coolant temperatures while the heater is running. If the rise in temperature exceeds 10°C (18°F), coolant flow must be increased by modifying the plumbing.
- Ensure the heater and water pump are installed as low as possible to allow the purging of air.
- If a bunk heat exchanger is incorporated into the system, proper plumbing layouts must be followed.



Caution: The coolant must contain a minimum of 10% antifreeze at all times as a protection against corrosion. Fresh water will corrode internal heater parts.

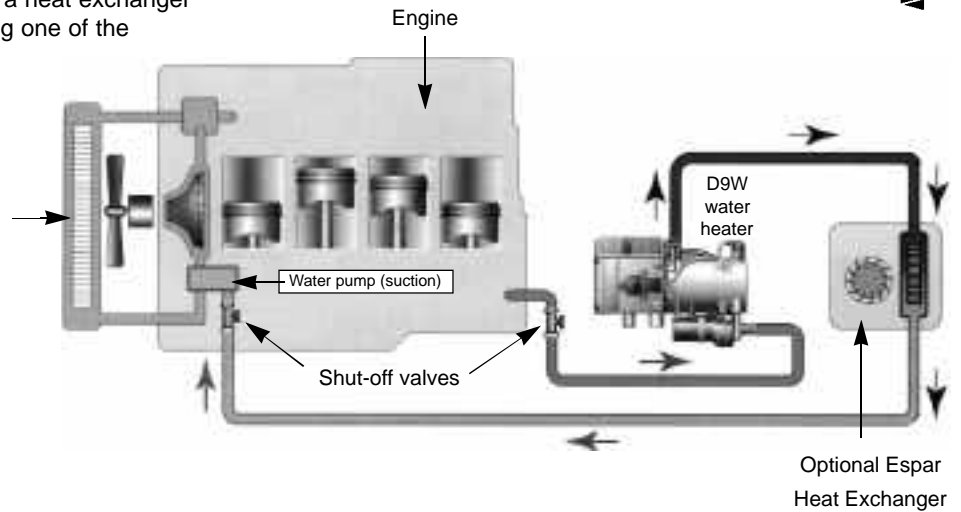
Caution: If your bunk heater exchanger has a flow control valve integrated into it, provisions must be made to ensure that flow through the Espar heater cannot be blocked.



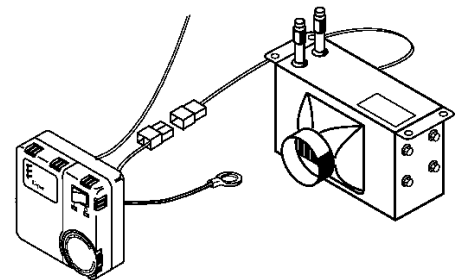
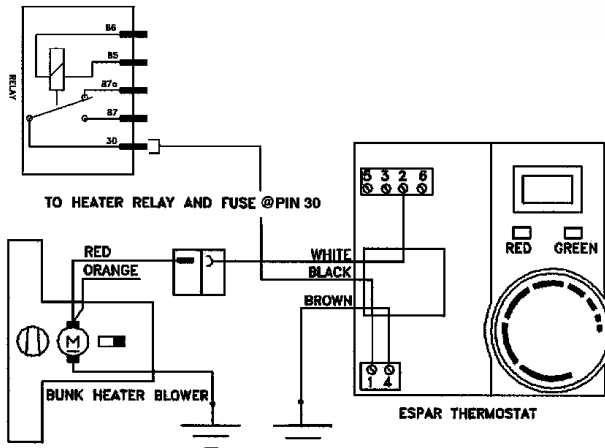


When being used to provide bunk heat with a heat exchanger the D9W should be plumbed and wired using one of the following methods.

1 D9W plumbed with an Espar heat exchanger.



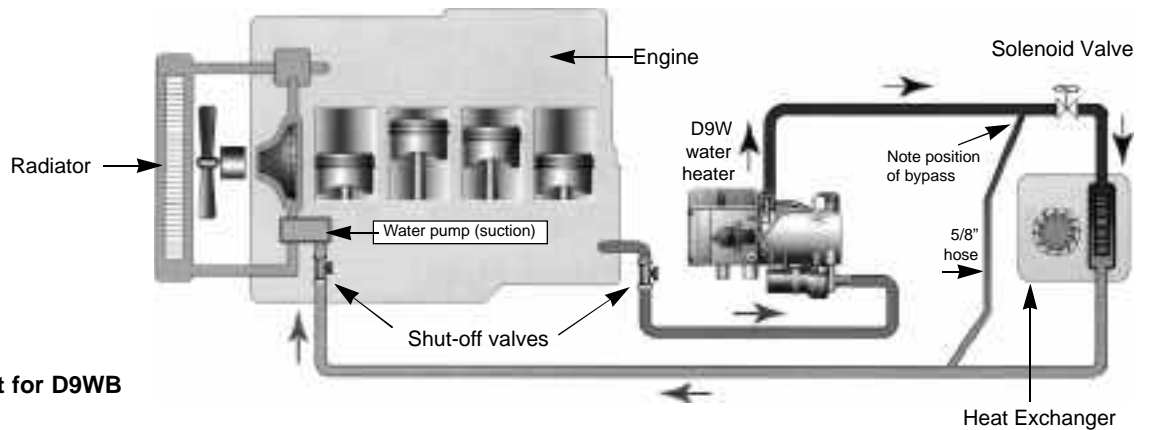
Thermostat/Heat Exchanger for D9WB



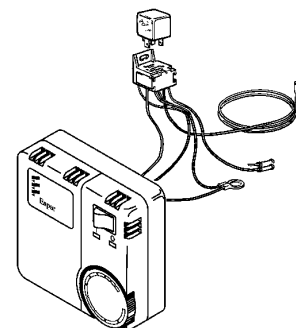
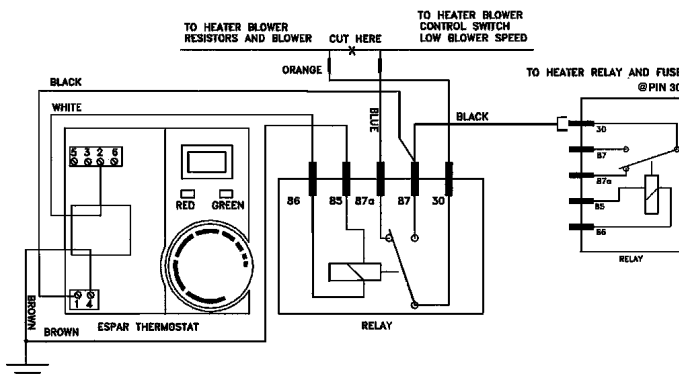
P/N: CA 1807 81

2 D9W plumbed with an OEM heat exchanger.

Note: Bypass must be used to ensure that coolant flow can't be completely stopped.



Thermostat/Bunk Relay kit for D9WB



P/N: CA 010 097

Fuel System

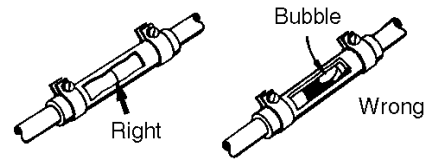
The D9WB is most commonly provided with the fuel metering pump mounted inside the box. This is to reduce installation time and to protect the pump from corrosion. If specifications cannot be met the pump must be mounted externally. See illustration for connections and specifications. All parts necessary to do the installation are included in the kit as shown

Note: Fuel line limits must not be exceeded. Ensure that the following conditions are met.

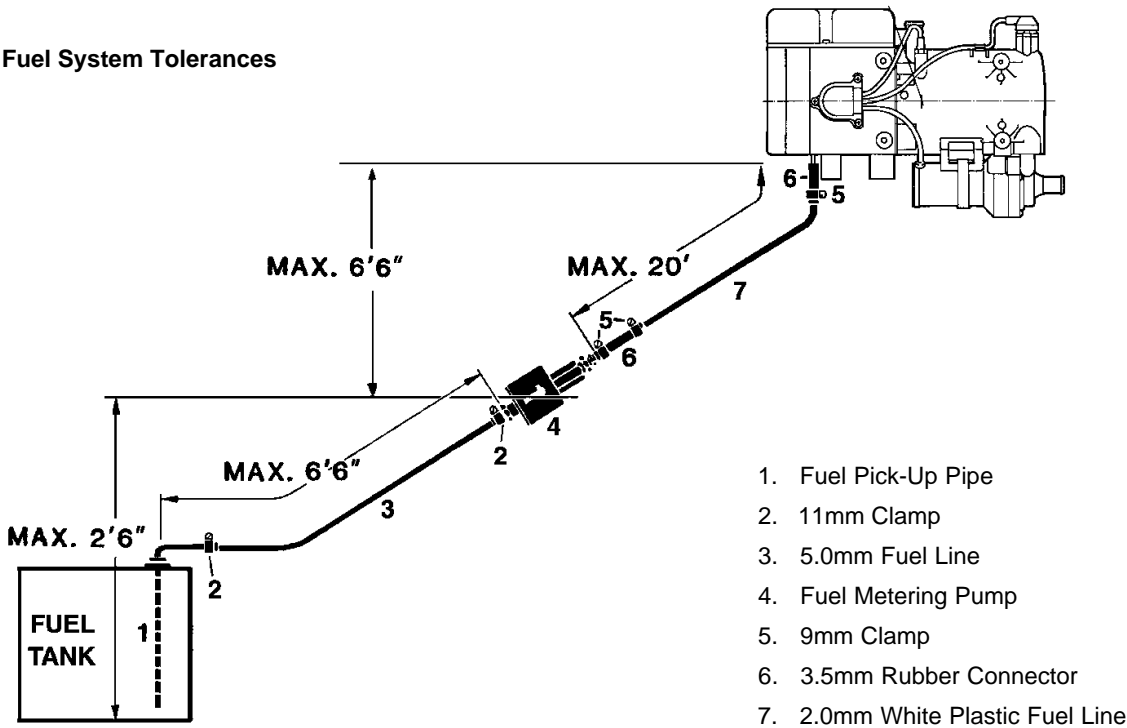
Bottom of the fuel metering pump must be within a height of 2'6" of the bottom of the fuel pick-up pipe.

Fuel metering pump must be within a total distance of 6'6" from the fuel pick-up pipe.

Note: Butt joints and clamps on all connections.

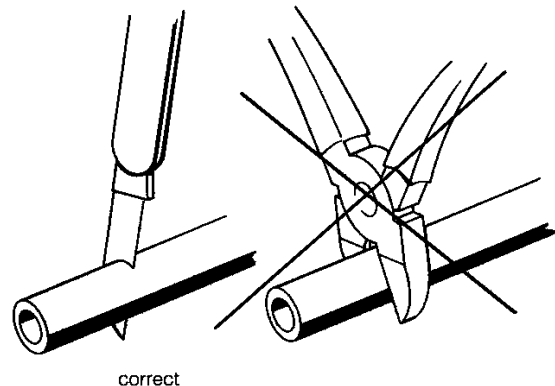


Fuel System Tolerances



Fuel Line

- Route fuel lines from the fuel pick-up pipe to the heater.
- Use fuel lines provided.
- Other sizes or types of fuel lines may inhibit proper fuel flow.
- Make proper butt joints using clamps and connector pieces as shown
- Use a sharp utility knife to cut plastic fuel lines to avoid burrs.



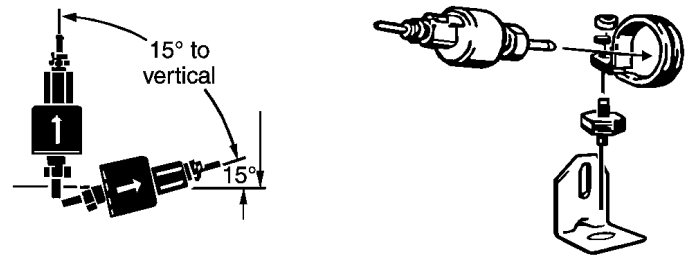


Fuel Metering Pump Installation

If the pump needs to be mounted externally follow these guidelines:

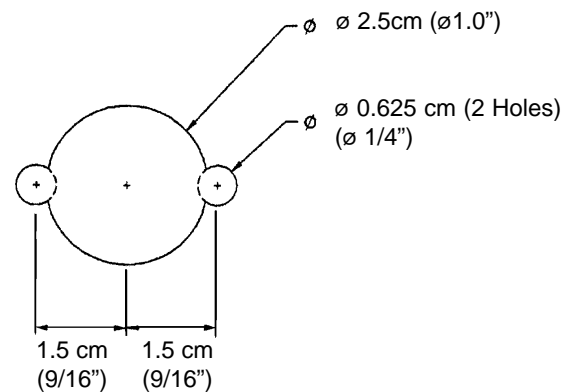
- Choose a protected mounting location close to the fuel pick-up pipe and heater.
- Using the bracket and rubber mount provided, install pump as shown.

Note: Proper mounting angle of the pump is necessary to allow any air or vapor in the fuel lines to pass through the pump rather than cause a blockage.

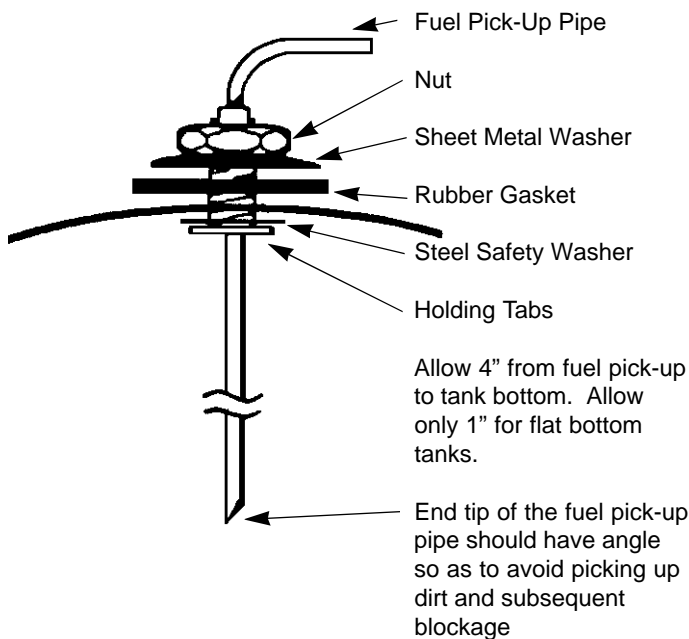


Fuel Pick-Up Pipe Installation (Standard Pick-Up)

- Choose a protected mounting location close to the pump and heater. A spare fuel sender gauge plate provides an ideal mounting location.
- Drill the mounting holes as shown.
- Cut the fuel pick-up pipe to length.
- Mount the fuel pick-up pipe as shown
- Lower the fuel pick-up pipe (with reinforcing washer) into the tank using the slot created by the two 0.6cm (1/4") holes.
- Lift the assembly into position through the 2.5cm (1") hole.
- Assemble the rubber washer, metal cup washer and nut.

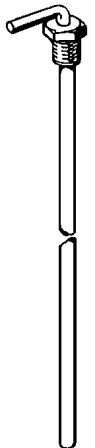


Note: Drill the two (1/4") holes first.



(Optional Pick-Up Pipe with NPT fitting)

- Remove an existing plug from the top of the fuel tank.
- Cut the fuel pick-up pipe to length.
- Secure the fuel pick-up pipe into position using the combined NPT compression fitting as shown



Note: NPT fittings are available in various sizes (Refer to parts section).

Electrical Connections

Caution: To avoid potential short circuit damage during installation, Make connection to the positive terminal at battery after all electrical connections are complete.

Note: All harnesses should be cut to length. All exposed electrical connections should be coated with protective grease.

A) Power Harness.....

Note: Wire must be inserted into fuse holder prior to terminating

- 2 core harness (red, brown).
- Connect red wire to fuse link and terminal.
- Attach ring terminal to vehicle battery (+).
- Connect brown wire to vehicle battery (-) using ring terminal provided.
- Insert 20 amp fuse

B) Switch Harness.....

- 4 core harness (red/yellow, brown, yellow, blue/white)
- Run to location of switch. Make terminal connections at switch. Espar has 3 available switches. See switch instructions for more information.

C) Fuel Metering Pump Harness.....

- 2 core harness (green, green).
- Fuel Metering Pump Harness is pre-connected when box is provided with pump pre-mounted.
- If mounted externally, connect wires to fuel metering pump using single terminals and rubber protective boots provided with the heater-(no polarity required).
- Connect fuel metering pump harness using two single connectors.

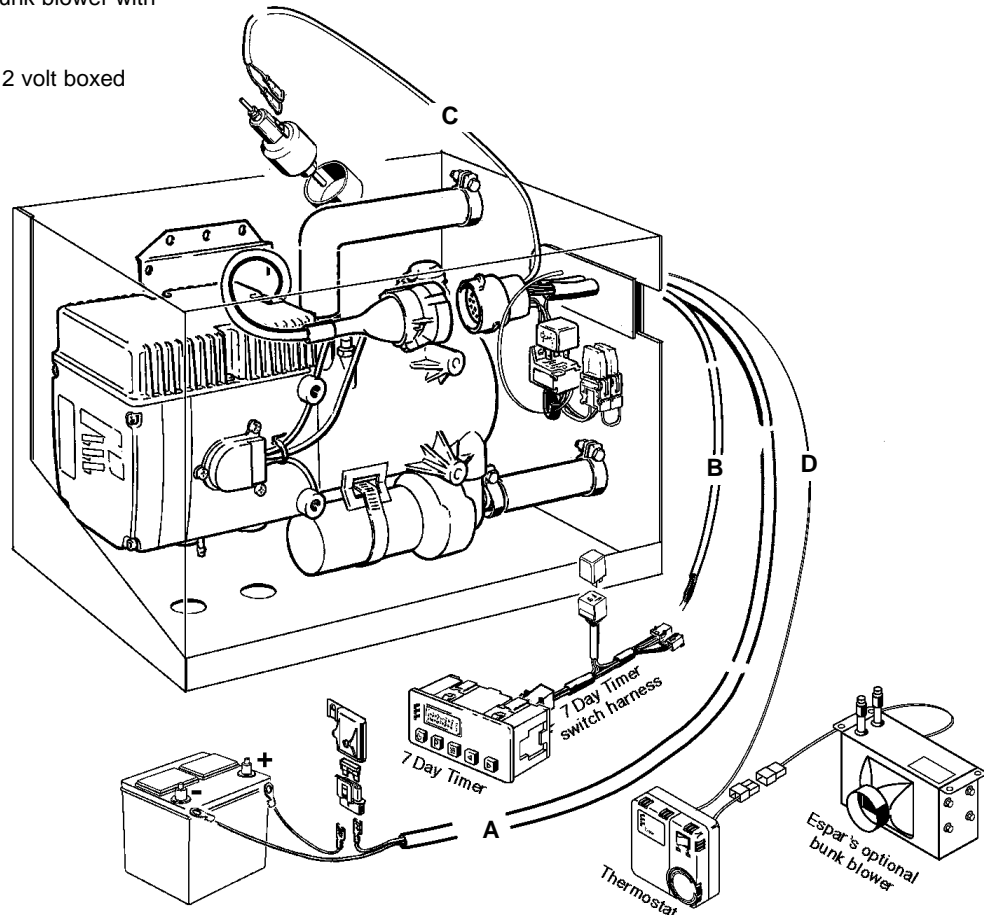
D) Bunk Heat Exchanger (optional).....

- single black wire from thermostat.
- connect as described in Heat Exchanger plumbing section. (pg.9)

Shown is a D9WB, 12 volt with Standard- Power, Switch Fuel Metering Pump harnesses and Bunk blower relay. Other optional parts shown are the 7 day timer and Espar bunk blower with thermostat.

The bunk blower relay option is provided in 12 volt boxed version or with universal harnesses only.

Other timers or switch options are available





Exhaust Connection

A 30 mm flexible tube exhaust pipe with a length no more than 1M long is required for the exhaust. An exhaust clamp is needed to secure the exhaust to the heater. Connect the exhaust as follows:

- Connect the exhaust pipe to the exhaust port on the heater and attach with clamp provided. Feed the exhaust pipe through the silicone (white) gasket on the bottom of the box.
- Run exhaust to an open area to the rear or side of the vehicle so that fumes can not build up and enter the passenger compartment or the heater combustion air intake.
- Install exhaust pipe with a slight slope or drill a small hole in the lowest point to allow water to run off. Any restriction in exhaust will cause operational problems.
- Route the exhaust pipe from the heater using holders provided

Caution: Run exhaust so that it cannot be plugged by dirt, water or snow. Ensure the outlet does not face into the vehicle slip stream.

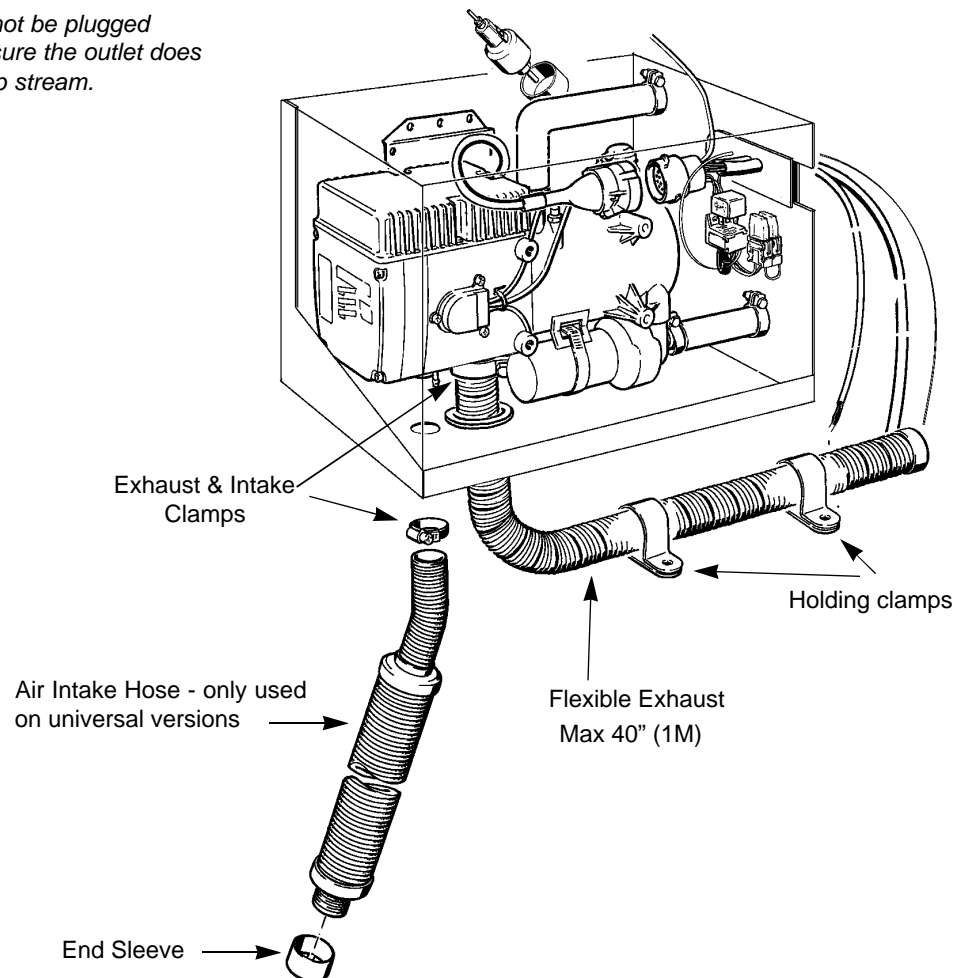
Intake Connection

Universal versions only:

Combustion air must be drawn in from the outside. The combustion air opening must be kept free at all times.

- Connect the air intake pipe to the intake port on the heater and secure with clamp provided.

Caution: Do not install the intake opening facing the vehicle slipstream. Ensure that the opening cannot become clogged with dirt or snow and that any water entering the intake can drain away.



Asphyxiation Hazard



Warning: Route exhaust beyond the skirt of the cab and outside of the frame area. Failure to comply with this warning could result in Asphyxiation.

Fire Hazard



Warning: The exhaust is hot, keep a minimum of 5cm (2") clearance from any heat sensitive material. Route exhaust so that the exhaust fumes cannot enter the passenger compartment.

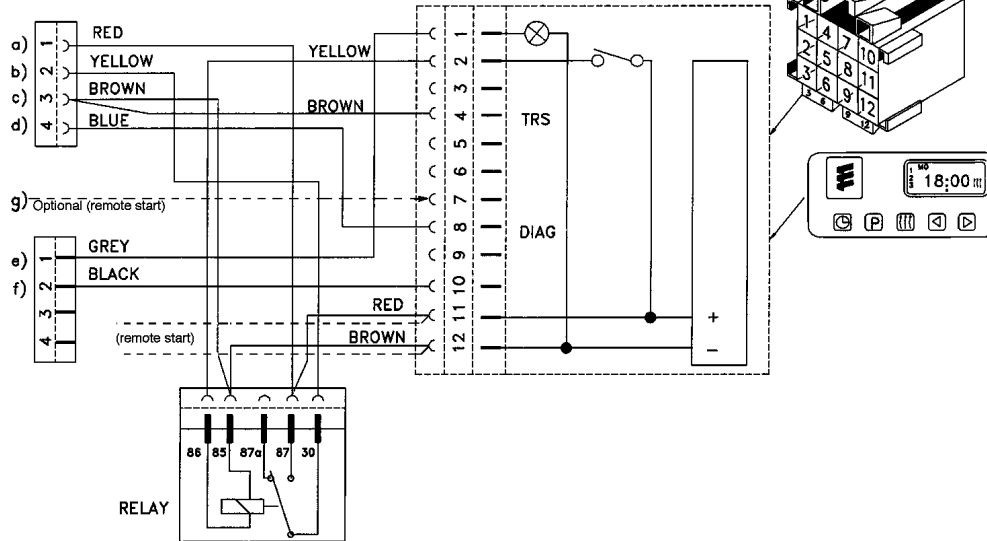
Operating Switches

A Push/Pull switch, optional 99 Hour Digital Timer or a 7 Day Timer are available for the heater. All three are discussed on the following pages. Connect the operating switch as follows.

7 Day Timer

The 7 Day Timer has been designed to provide a simple means to control the operation of the heater system and to include the capability for diagnostics. This timer connects to the diagnostic circuit of the heater. The timer then displays any heater fault codes in three digit number form automatically. The timer allows for pre-selection of turn on time, up to 7 days in advance, as well as an option for run times up to 2 hours before automatically turning off. In addition, there is an on/off switch for manual operation. By default the timer is pre-set by Espar to operate for two hours. Refer to instructions provided with timer for setting options.

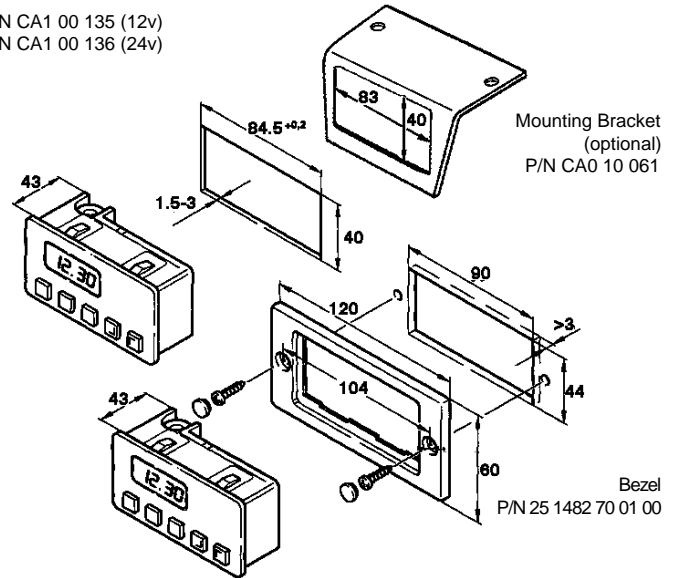
- Mount bezel into dash and insert timer or use Espar's optional mounting bracket and secure to dash.
- Use hardware supplied for connections.
- Connect the switch harness to the connector at the heater and run harness to switch location. (Harness should be neatly routed and secured under dashboard).
- Cut harness to length and terminate wires. Attach using connectors provided.
- Refer to timer instructions for other wiring options.



- a) Power from battery “+”
- b) Switch control to the heater
- c) Power from battery “-”
- d) Diagnostic from heater
- e) To the vehicle dimmer switch for light display
- f) To vehicle ignition accessories for continuous operation of heater
- g) Remote starter (optional)

Note: If installing a remote starter, refer to remote starter instructions before terminating wires

P/N CA1 00 135 (12v)
P/N CA1 00 136 (24v)



Note: The timer display is automatically illuminated while the heater is operating. Connecting the grey wire to the vehicle dimmer switch will allow the timer display to illuminate with the vehicles dash lights.

Note: An alternative to connecting the black wire to the vehicle ignition accessories “On” circuit may also be considered for some applications where extended run times are desired. Connecting the black wire with the red wire will enable the heater to run continuously whether the heater is switched on manually or through the preset function.



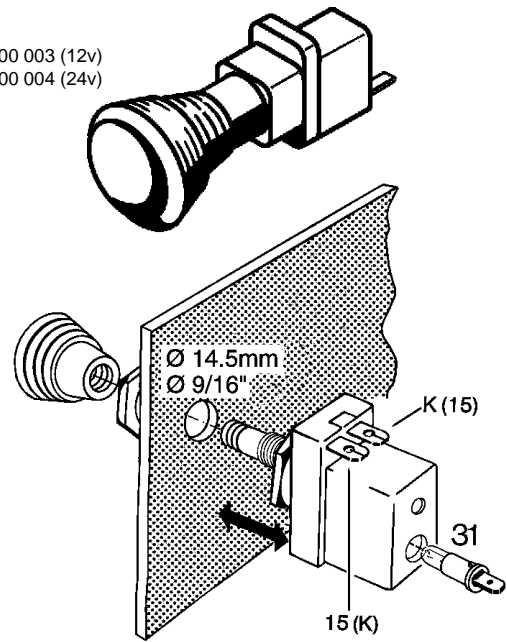
Push/Pull Switch

- Mount switch in a location where it is easily accessible
- Mount using hardware supplied
- Connect the switch harness to the connector at the heater and run the harness to the switch location
- Cut harness to length at the switch and install terminals
- Connect wiring as described below

Note: Wired described the switch light glows when pulled out and is off when pushed in.

Brown- 31	Power from battery “-”
Red- K(15)	Power from battery “+”
Yellow-15(K)	Switch control to the heater
Blue/White	Diagnostic from heater (disregard - tape end and tie off to the side)

P/N CA1 00 003 (12v)
P/N CA1 00 004 (24v)



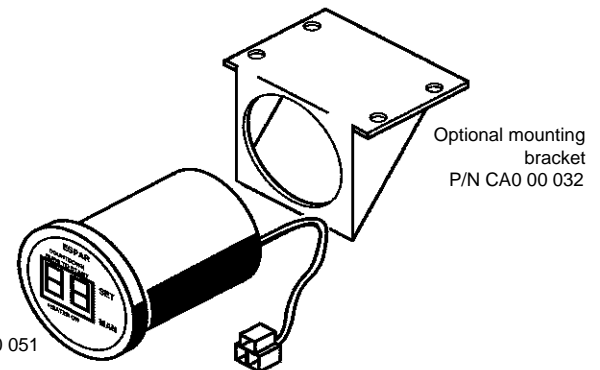
99 Hour Digital Timer

This timer is pre-set by Espar to operate the heater for one (1) hour only. See installation and operating instructions provided with timer if other run times are desired.

- Mount the timer using a (2") hole in the dash or use the optional mounting bracket.
- Mount timer using hardware supplied.
- Connect the switch harness to the connector at the heater and run the harness to the switch location.
- Cut harness to length and install terminals.
- Install connector provided and attach.

Red -Red
Yellow -Yellow
Brown -Brown

P/N CA1 00 051

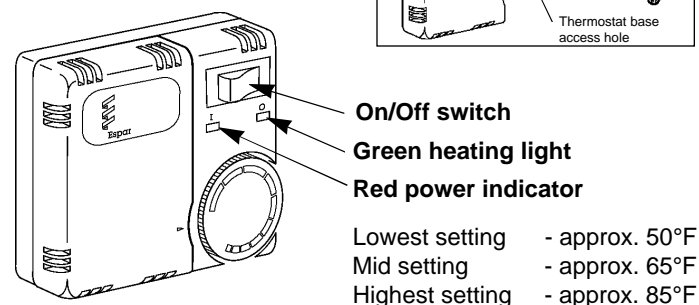


Optional Thermostat for Bunk Heat Exchanger

This thermostat is used to control the fan motor of the heat exchanger (OEM or optional Espar Heat Exchanger) inside the truck's sleeper, thereby allowing for interior cab heating. See operators guide for operations.

- Mount the thermostat in a location where it is easily accessible and it's temperature sensor is representative of the area being heated. Avoid mounting near heater outlets, windows, doors, electrical appliances or in areas receiving direct sunlight.
- Route the switch harness from the heater to the thermostat mounting location.
- Mount using the mounting slots in it's base.
- Connect wiring as shown on page 9

P/N 301 00 135 (12v)
P/N 301 00 134 (24v)



Heater Operation

Pre-Start Procedures

Upon completion of installation prepare the heater as follows:

- Check all fuel, electrical and plumbing connections.
- Refill the engine coolant.
- Bleed air from the coolant system by running the engine and refilling the antifreeze as needed. Resecure heater hose
- Run engine to further bleed the system
- Top up engine coolant.

Start Up

Once switched on the following sequence occurs:

- Control unit does a systems check (flame sensor, temperature, safety thermal cutout fuse and various other control unit checks).
- Water pump starts circulating coolant fluid.
- Combustion air blower starts
- Glow pin begins to preheat 20-50 secs.
- After about 20-50 seconds the Fuel Metering Pump starts delivering fuel and the combustion air blower ramps up gradually.
- Once ignition takes place the flame sensor alerts the control unit and the control unit shuts off the glow pin (ignition time: 1.5 - 2 minutes)

Note: If the heater fails to start the first time it will automatically attempt a second start. If unsuccessful the heater will shut down completely.

Note: On initial start up the heater may require several start attempts to self prime the fuel system.

Running

Once ignition is successful the following operations take place:

- Heater runs in full heat mode and the temperature is monitored at the heat exchanger.
- Once the coolant reaches 72°C (162°F) the heater will start to cycle up and down between levels (High,Medium,Low).
- If the coolant temperature continues to rise, the heater will automatically switch off. This occurs when temperature reaches 85°C (185°F)
- The water pump will continue to circulate coolant to allow the heater to monitor engine temperature
- The heater will automatically re-start once coolant temperature reaches 68°C (154°F)
- The heater continues to run as described above until it is switched off, either manually, automatically by a timer or heater malfunction shutdown.

Note: If the heater should flame out while in running mode, it will automatically attempt one restart. If successful it will continue to run, if not it will turn itself off.

Note: During operation the heater continually senses the input voltage from the batteries, if the input voltage drops to approximately 10V (20V on a 24 volt system) or rises above 15V (30V on a 24 volt system) the heater will automatically shut down.

Switching Off

- When the heater is switched off, manually or automatically, it starts a controlled cool down cycle
- The fuel metering pump stops delivering fuel and the flame is extinguished
- The combustion air blower and water pump continue to run for 130 seconds to cool down
- The heater shuts off.

Safety Equipment

The control unit, overheat sensor and flame sensor continually monitor heater functions and will shut down the heater in case of a malfunction.

- The control unit ensures electrical circuits (fuel pump, combustion air blower etc.) are complete prior to starting the heater.
- If the heater fails to ignite within 90 seconds of the fuel pump being started, the starting procedure will be repeated. If the heater again fails to ignite after 90 seconds of fuel being pumped, a “no start safety shutdown” follows.
- If the heater flames out during operation, the heater automatically attempts to restart. If the heater fails to ignite within 10 seconds of fuel delivery, or ignites but flames out again within 3 minutes, “flame out” shutdown follows. After troubleshooting the problem, the heater can be started again by switching the heater off and then back on.
- Overheating due to lack of water, a restriction or a poorly bled coolant system results in an “overheat shut down”.
- If at any time the voltage drops below 10V (20V on a 24 volt system), or rises above 15V (30V on a 24 volt system), a “high/low voltage” shutdown follows (after a 20 second delay).



Warning:






The heater must be switched off while any fuel tank on the vehicle is being filled.

The heater must not be operated in garages or enclosed areas.





Operational Flow Chart

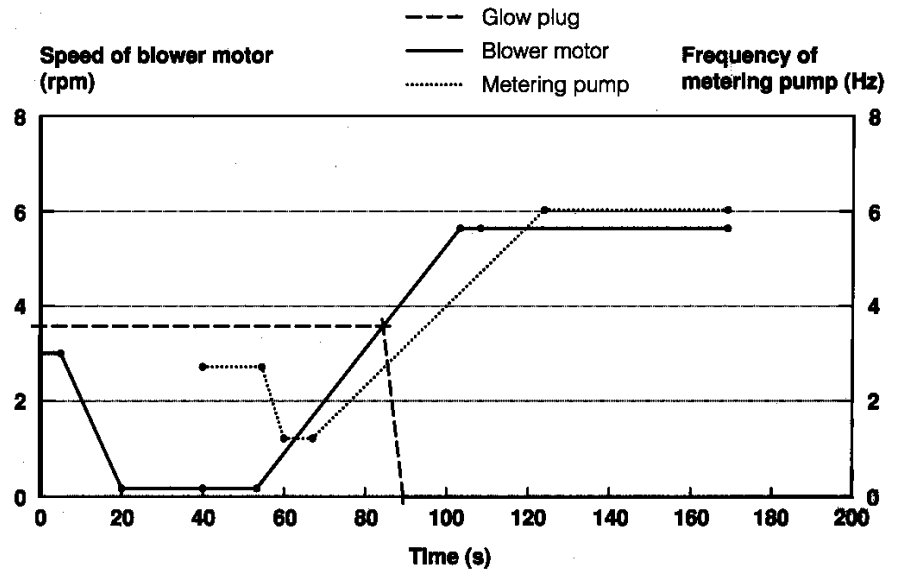
Operating Mode	STARTING PHASE					RUNNING PHASE	SHUT DOWN PHASE		
	System Check	Pre-heat	Ignition Attempt	Pre-heat 2nd. attempt	Ignition Attempt 2nd. attempt		After Glow	Cool Down	Off or Stand by
 Water Pump	Off	On	On	On	On	On	On	On	Off On: if in stand by
 Blower	Off	On	On	On	On	On	On	On	Off
 Glow Plug	Off	On	On	On	On	Off	On	Off	Off
 Fuel Pump	Off	Off	On	Off	On	On	Off	Off	Off
 Time	1- 3 sec.	50 sec.	Up to 90 sec.	50 sec. If Required	Up to 90 sec.	4 speed Operation until switched off manually or automatically			
							30 sec.	3 min.	

Note: During the controlled heating cycle, if the coolant temperature exceeds 85°C (185°F) the heater will cycle off. Heater will automatically restart in high mode once coolant temperature reaches 68°C (154°F)

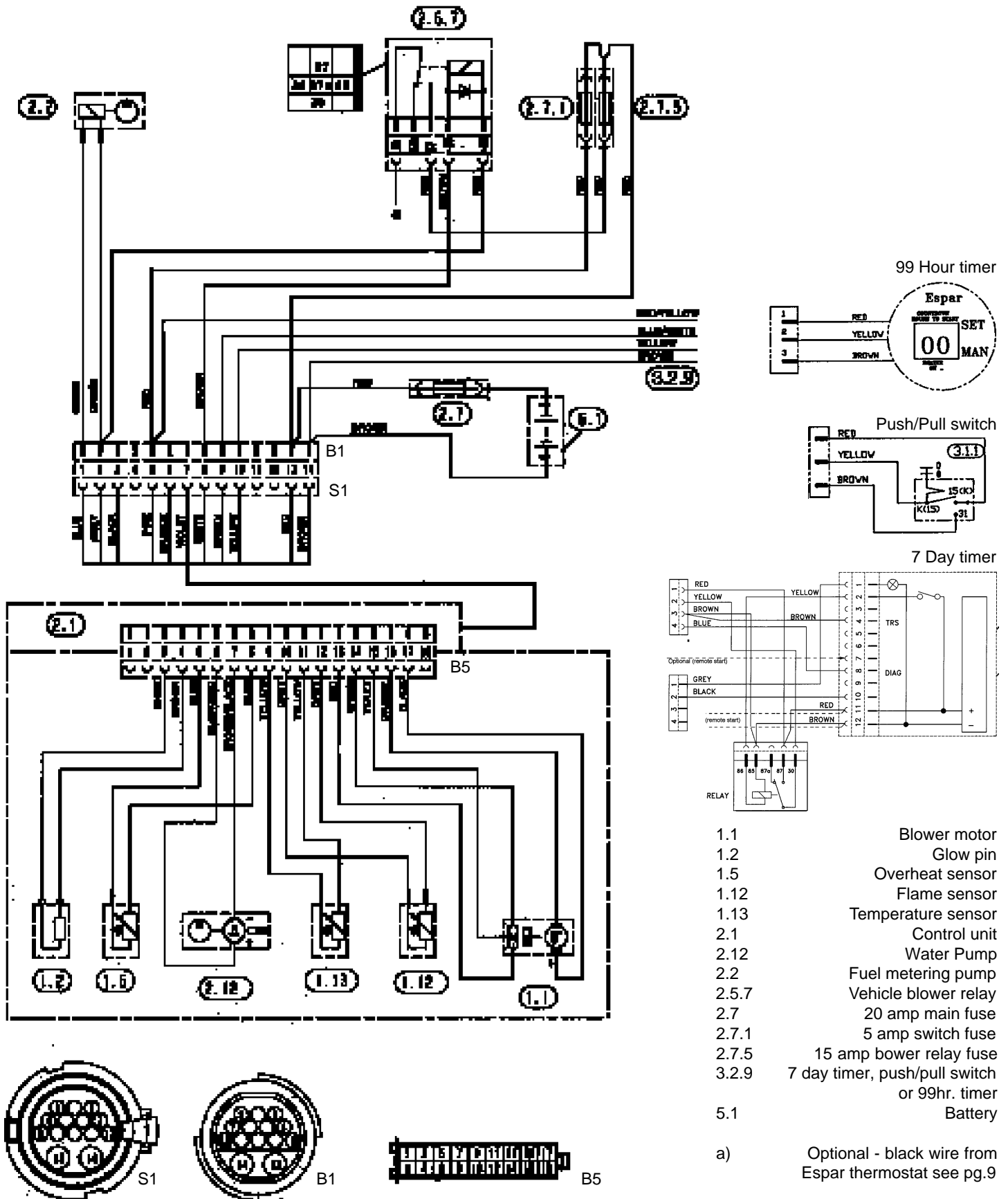
Control temperatures Speed of blower motor

Vehicle Blower On	55°C	Power - 7300 rpm
Power - High	72°C	High - 5600 rpm
High - Medium	78°C	Medium - 3000 rpm
Medium - Low	79°C	Low - 1800 rpm
Low - Off	85°C	
Off - Medium	68°C	
Medium - High	68°C	
Low - Medium	73°C	
High - Power	60°C	

Start up sequence

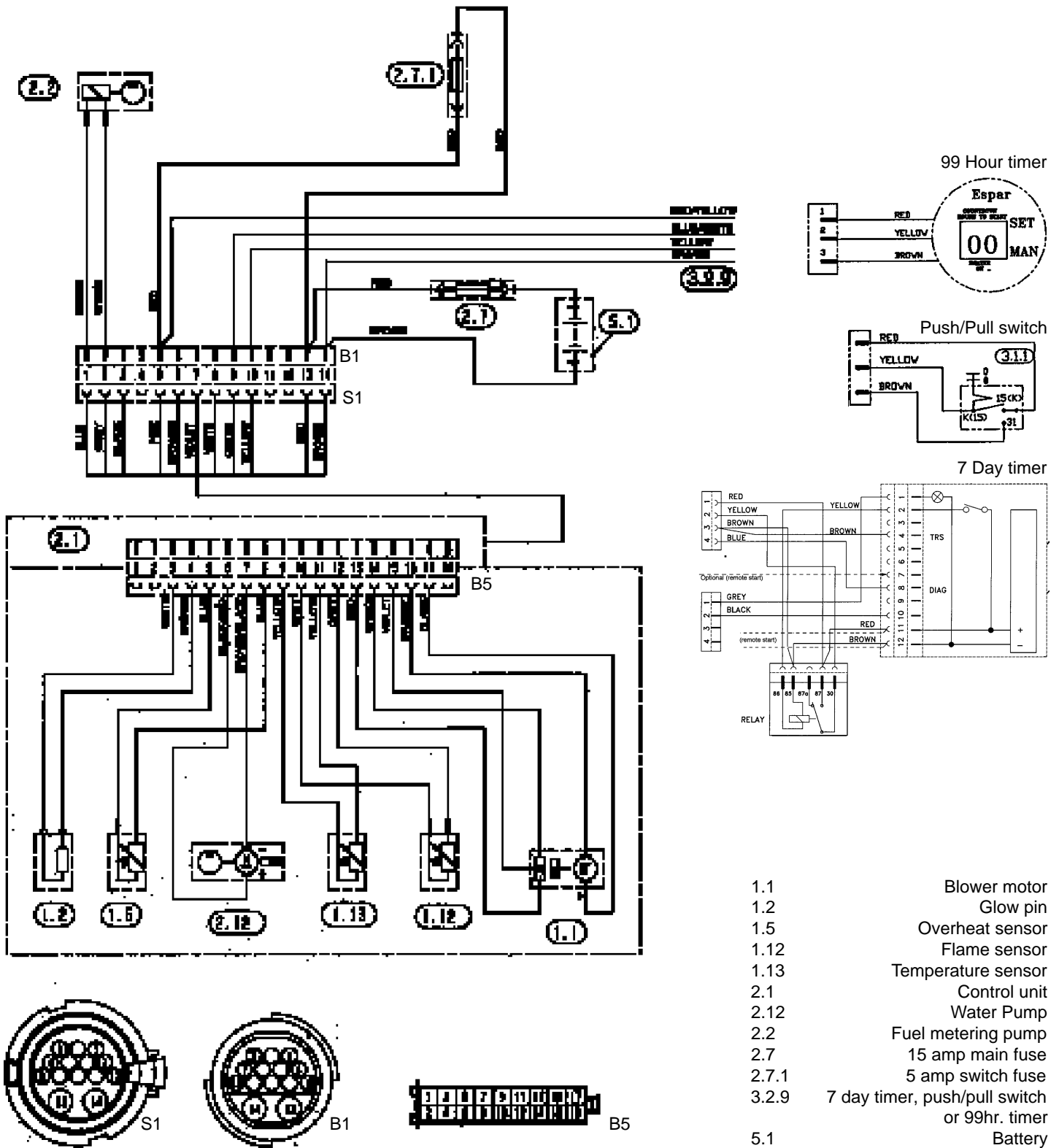


D9W Wiring Diagram - 12 Volt
with vehicle blower control

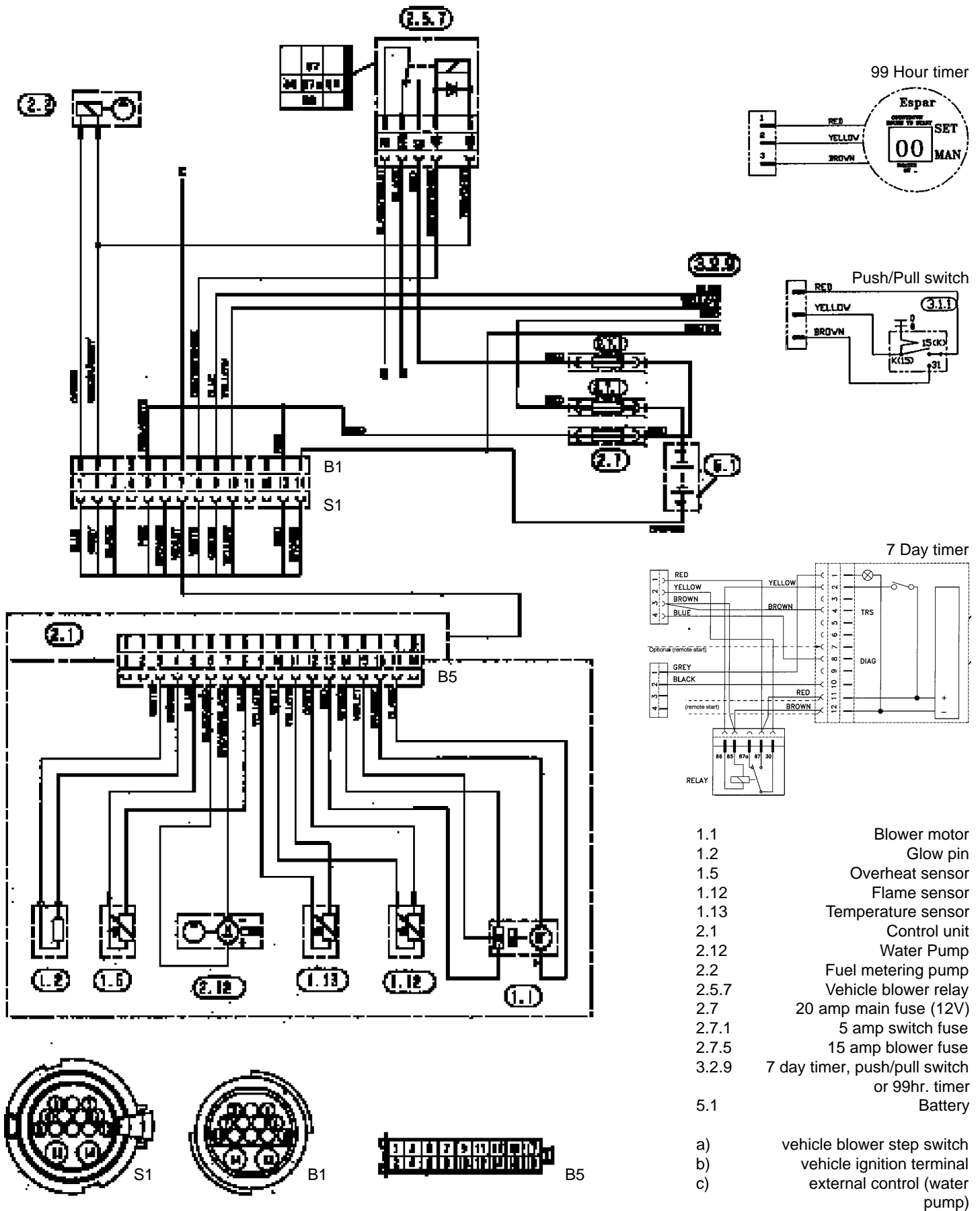




D9W Wiring Diagram - 24Volt



D9W Wiring Diagram Universal Harness





Maintenance Troubleshooting & Repairs

Periodic Maintenance

- Check coolant hoses, clamps, and make sure all valves are open. Maintain the engine manufacturers recommended coolant level and ensure that the heater is properly bled after service on or involving the coolant system.
- Visual check of all fuel lines for leaks. Check and if necessary replace fuel filter inserts.
- Visual check of electrical lines and connections for corrosion.
- Run your heater at least once a month during the year (for a minimum of 15 minutes).
- Maintain your batteries and all electrical connections in good condition. With insufficient power the heater will not start. Low and high voltage cutouts will shut the heater down automatically.
- Use fuel suitable for the climate (see engine manufacturers recommendations). Blending used engine oil with diesel fuel is not permitted.
- Check the glow pin and replace if necessary

Troubleshooting

Basic Troubleshooting

In the event of failure there are several items which should be checked first before any major troubleshooting is done. **Check:**

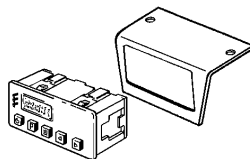
- Circuit breakers and fuses.
- Electrical lines and connections
- For interference in Combustion air and Exhaust pipes.
- That there is fuel in the tank.
- Battery voltage
- Coolant flow
- **If combustion is sooty, check:**
 - combustion air and exhaust ducts - clear if necessary
 - fuel metering pump delivering too much - measure fuel delivery, if necessary, replace fuel metering pump

Self Diagnostics

The heater is equipped with self diagnostic capability. You can retrieve information on the heaters last 5 faults using the Espar 7 day timer or Espar's Fault Code Retrieval Device.

7 Day Timer

Espar's 7 day timer has a fault code retrieval device built into the unit. This function automatically activates if the heater is experiencing problems.

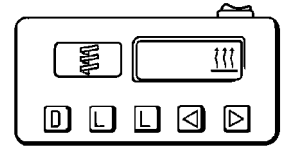



- Fault codes appear on the LCD display screen
- Codes can then be translated from the charts on the following pages.
- See instruction sheet that comes with the timer

Fault Code Retrieval Device

Equipment Face and Controls

Symbols seen on the display face are as follows:



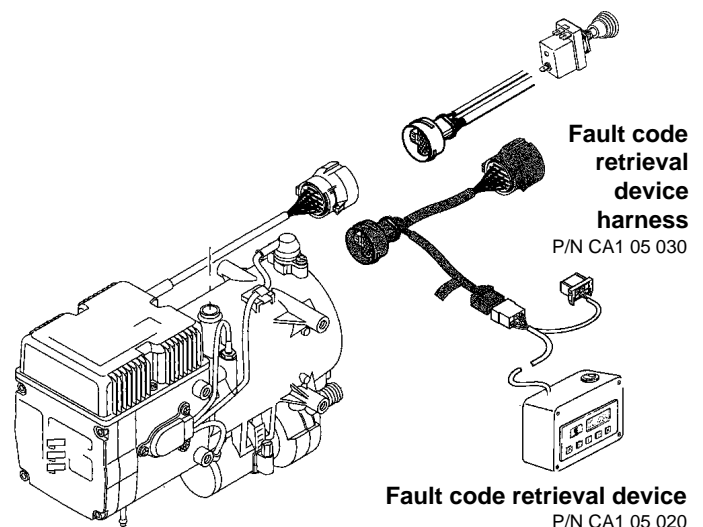
- AF** Actual fault.
- F1-F5** Up to five stored faults can be accessed. The AF and F1 are the same number.
 This sign is displayed when the heater is in operation.
- DIAG** The word (Diagnostic) will come on when the diagnostic number is requested.
- 000** Three digit diagnostic fault code number.

Hook Up

- Disconnect the main harness from heater and insert adapter cable harness between them
- Connect adapter cable to the cable loom of the Fault code retrieval device
- Start diagnostic unit - switch heater on from switch

Instructions:

- Switch the fault code retrieval device on and wait 10 seconds.
- Press the "D" button.
- Wait 3-5 seconds for the current fault code to appear (AF).
- To review the previous faults use the arrow buttons (F1= Most Recent, F5= Oldest).
- To erase the faults that are in memory press both "L" keys at the same time.
- See the fault code chart on following pages for code number descriptions.



Fault Code	Fault Description	Causes / Repair
000	Normal Operation	
001	Advanced warning - overvoltage	Check to see if voltage between pins 13 and 14 of control unit (external plug) is greater than 15 V or 30V
002	Advanced warning - undervoltage	Check to see if voltage between pins 13 and 14 of control unit(external plug) is less than 10 V or 20V
010	Overvoltage shutdown	Check voltage between pins 13 and 14 at the control unit (external plug) is greater than 15 V or 30V. Check vehicle charging system.
011	Under voltage shut down	Check voltage between pins 13 and 14 at the control unit (external plug) is less than 10 V or 20V. Check batteries and connections.
012	Overheating	Check for possible causes of overhear, check water through flow (water circuit), sensor. Temperature at temperature sensor is greater than 115°C. Impedance at temperature sensor < 400 . Check difference at the control unit, dismantle the control unit, disconnect the internal plug from the control unit and measure the difference between pins 5 and 8. Overheat sensor values: 150 kohms at -25°C 10 kohms at +25°C
013	Excessive temperature at flame sensor	Flame sensor signals temperature of greater than 700°C. Difference at flame sensor > 3400 ohms. Check the impedance at the control unit (internal plug), dismantle the control unit, disconnect the internal plug from the control unit and measure the impedance between pins 10 and 12. Flame sensor values: 900 ohms at -25°C 1100 ohms at +25°C
014	Possible overheating detected	Difference of measured values at temperature sensor >70°C (difference evaluation) Check temperature sensor and overheating sensor, open heater slide valve and check water throughflow. Check the impedance between 5 and 8 at the control unit (internal plug). Over temperature sensor values: 150 kohms at -25°C 10 kohms at +25°C
015	Too many overheats	The control unit is interlocked after three successive overheats (error codes 012, 013 and 014). Eliminate the case of the over-heat. Cancel the interlock by clearing the error memory with the diagnostic unit/PC.
020	Open circuit - glow pin	Check glow pin (nominal value: 2 ohms), replace if necessary.
021	Short circuit - glow plug	Check pin 4(white) on the control unit (internal plug) leading to glow plug to terminal 3 (brown) for continuity/short-circuit. If O.K.-> replace control unit.



Fault Code	Fault Description	Causes / Repair
033	Combustion air blower motor	<p>Speed deviation for longer than 60 seconds.</p> <p>Nominal values: 5600 rpm (full-load) 1850 rpm (part load)</p> <p>* Check burner motor: apply supply voltage to motor. Connect + to 1.5 black and - to 1.5 orange. Motor does not turn —> replace burner motor with integrated sensor.</p> <p>* Check sensor supply. Switch on heater and measure voltage between output 13 (0.25 red) and 14 (0.25 green) at the control unit (internal plug). Nominal value: 8 V. If deviation —> replace control unit.</p> <p>* Check sensor: Measure voltage between terminal 15 (0.25 violet) and 14 (0.25 green) with an analog voltmeter when the blower is running. Nominal value: 4 V (+ 0.3 V) average value (8 V square-wave signal). If deviation —> replace motor with integrated sensor. If sensor signal is O.K., then the speed controller is defective —> Change control unit.</p>
037	Water pump is not working	Check water pump (driven externally)
042	Water pump short-circuit	Check water pump and leads
043	Short circuit at external components	Check terminal 2 (1 green) of control unit (external plug) for short-circuit. Check connected components (max. current 6A), replace them if necessary.
047	Short circuit - fuel metering pump	Check terminal 1 (1 blue) of control unit (external plug) and leads up to metering pump for short-circuit/interruption. Check the metering pump. Nominal value: approx. 20 ohms. Replace if necessary.
048	Open circuit - fuel metering pump	
050	Too many no start attempts	The control unit is interlocked after it has been switched on 10 times in succession (=20 failed starts) without flame detection (fault code 052). Check the fuel supply, glow plug, exhaust piping, combustion air piping and flame sensor. Cancel the interlock by clearing the error memory with the diagnostic unit/PC.
051	Faulty flame recognition	<p>Flame sensor signals a temperature of greater than 80 °C despite 4 minutes of cooling with cold air. Impedance at flame sensor > 1300 ohm. If no combustion takes place —> check the flame sensor, replace it if necessary. Flame sensor values:</p> <p>900 ohms at -25°C 1100 ohms at +25°C</p>
052	No start safety time exceeded	<p>No flame was detected during the start-up phase. Flame sensor value of less than 90 °C (1350 ohms). Check the fuel supply, glow plug, exhaust piping, combustion air piping and flame sensor. Flame sensor values:</p> <p>900 ohms at -25°C 1100 ohms at +25°C</p>

Fault Code	Fault Description	Causes / Repair
053 054 ply, 056 056	Flame cutout in boost mode Flame cutout in high mode Flame cutout in medium mode Flame cutout in low mode	Heater has started (flame detected) and indicates flame loss in a power setting. Check fuel flow rate, blower speed, fuel sup-exhaust pipe and combustion air piping. If combustion is O.K., check flame sensor, replace if necessary. Flame sensor values: 900 ohms at -25°C 1100 ohms at +25°C
059	Water temperature rises to quickly	Check water circulation (012) and temperature control sensor (060/061)
060 061	Temperature control sensor interruption Short circuit - temperature control	Control sensor signals temperature value outside measurement range. Check the connecting leads (0.35 yellow). For this purpose, dismantle the control unit, disconnect the internal plug from the control unit and measure the impedance between 9 and 11. Impedance between terminals 9 and 11 of the control unit (internal plug): greater than 10 kohms (in the event of interruption) less than 100 ohms (in the event of short circuit). Temperature sensor values: 650 ohms at -25°C 1000 ohms at +25°C
064 065	Open circuit - flame sensor Short circuit - flame sensor	Flame sensor signals temperature value outside measurement range. Check the connecting leads (0.35 green). Impedance between terminals 10 and 12 of the control unit (internal plug): greater than 50 kohms (in the event of interruption) less than 100 ohms (in the event of short-circuit). Flame sensor values: 900 ohms at -25°C 1100 ohms at +25°C
071 072	Open circuit - overheat sensor Short circuit - overheat sensor	Overheat sensor signals temperature value outside measurement range. Check the connecting leads (0.35 blue). Impedance between terminals 5 and 8 of the control unit (internal plug): greater than 700 kohms (in the event of interruption) less than 100 ohms (in the event of short-circuit). Overheat sensor values: 150 kohms at -25°C 10 kohms at +25°C
090 093 094 097	Control unit defect (internal fault) Control unit defective(ROM error) Control unit defective(RAM error) Control unit defective (power failure)	Internal control unit error in microprocessor/memory detected. Replace control unit.



Fuel Quantity Test

The fuel Quantity should be tested if the heater has difficulty starting or maintaining a flame.

Note: Measure the fuel quantity when the battery is sufficiently charged. At least 11V/22V and at most 13V/26V should be applied at the control unit during measurement.

Preparation

- Pull the fuel line from the heater and insert into a graduated measuring glass (size:50cm³)
- Switch the heater on, when fuel delivery is uniform (approximately 40 seconds after switching on), the fuel line is full and bled.
- Switch the heater off and empty the measuring glass.

Measurement

- Switch heater on
- Fuel delivery starts automatically approximately 40 seconds after switching on
- After 73 seconds of fuel delivery, it will shut off automatically
- Wait for restart.
- Fuel pump is automatically switched off after another 153 seconds.
- Switch off the heater.
- Measure the fuel in the measuring glass

Evaluation

Nominal value: 18ml± 10%

If the quantity is less than 16.2ml or greater than 19.8ml, replace the fuel metering pump

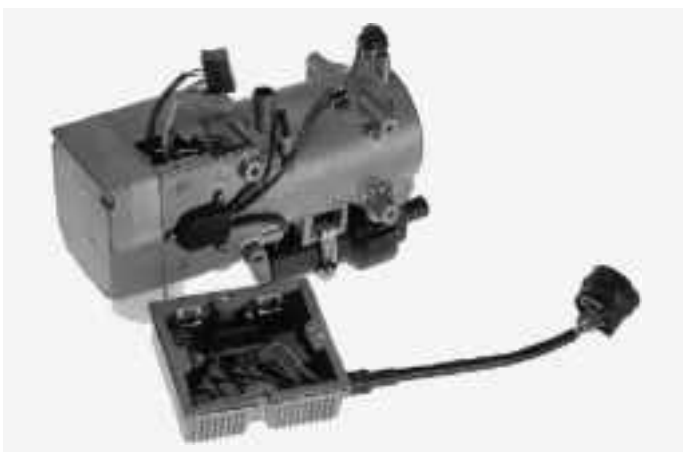
Repair Steps

Disassembly / Assembly

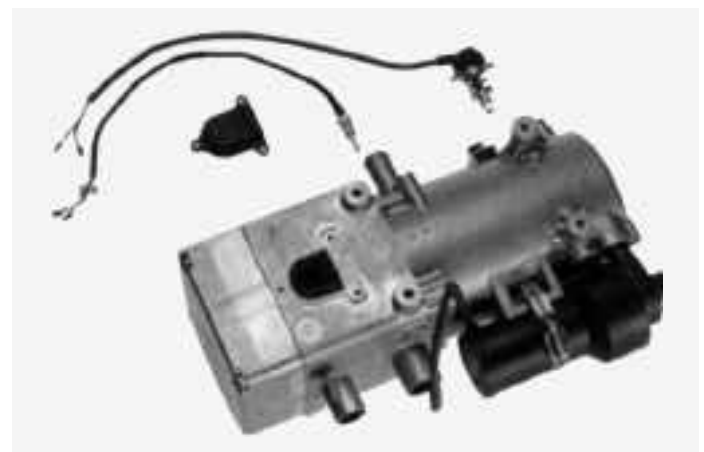
- 1 Control unit
- 2 Glow pin cable
- 3 Glow pin
- 4 Overheat cutout switch/ temperature sensor
- 5 Cover Blower
- 6 Flame sensor/heat exchanger fastening screws

- 7 Housing including heat exchanger, dismantled
- 8 Burner
- 9 Burner dismantled
- 10 Heat exchanger
- 11 Heat exchanger dismantled

- 1 Control unit



- 2 Glow pin cable



3 Glow pin



4 Overheat cutout switch/ temperature sensor



5 Cover Blower



6 Flame sensor/heat exchanger fastening screws



7 Housing including heat exchanger, dismantled



8 Burner



9 Burner dismantled



10 Heat exchanger

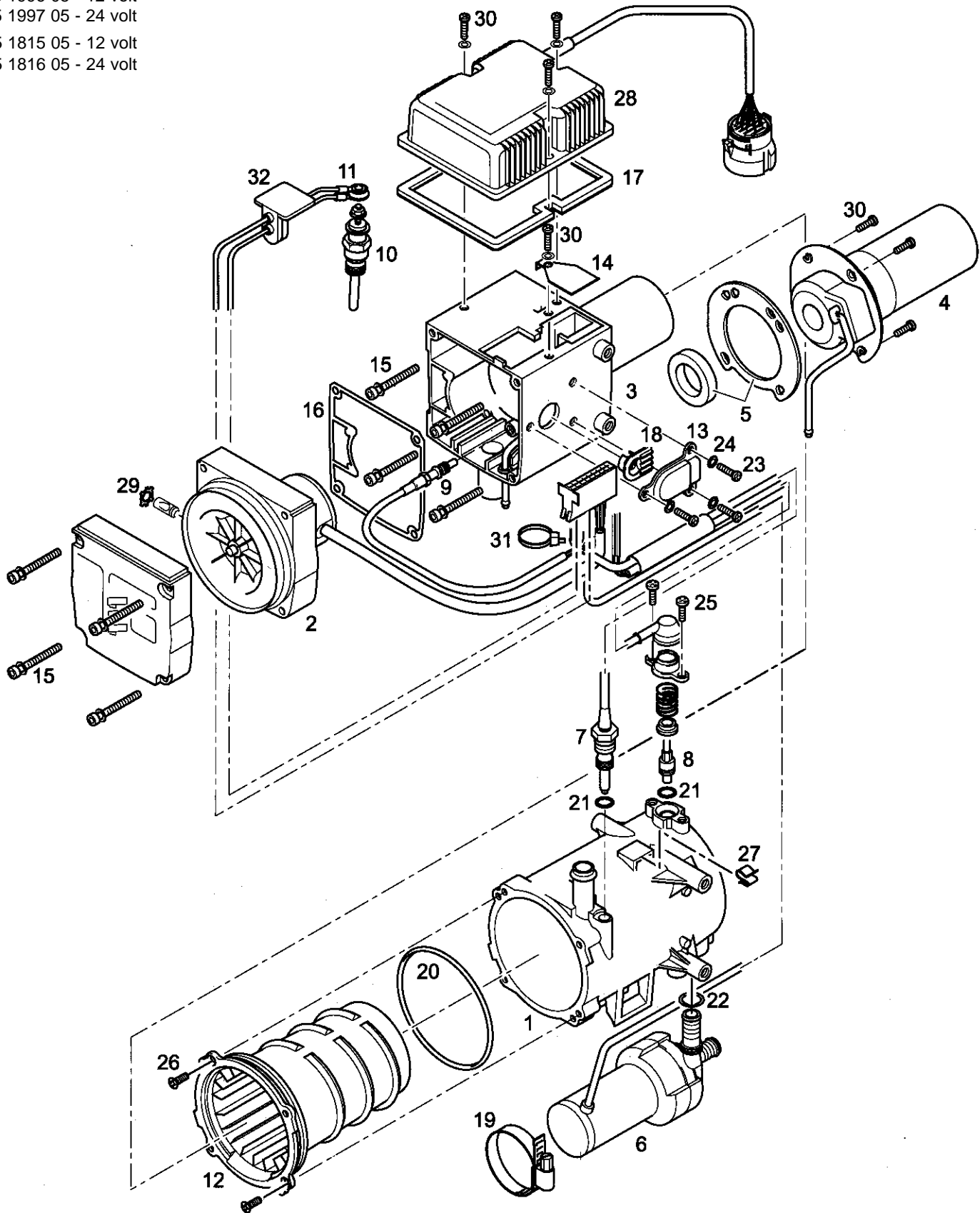


11 Heat exchanger dismantled



D9W Parts Diagram

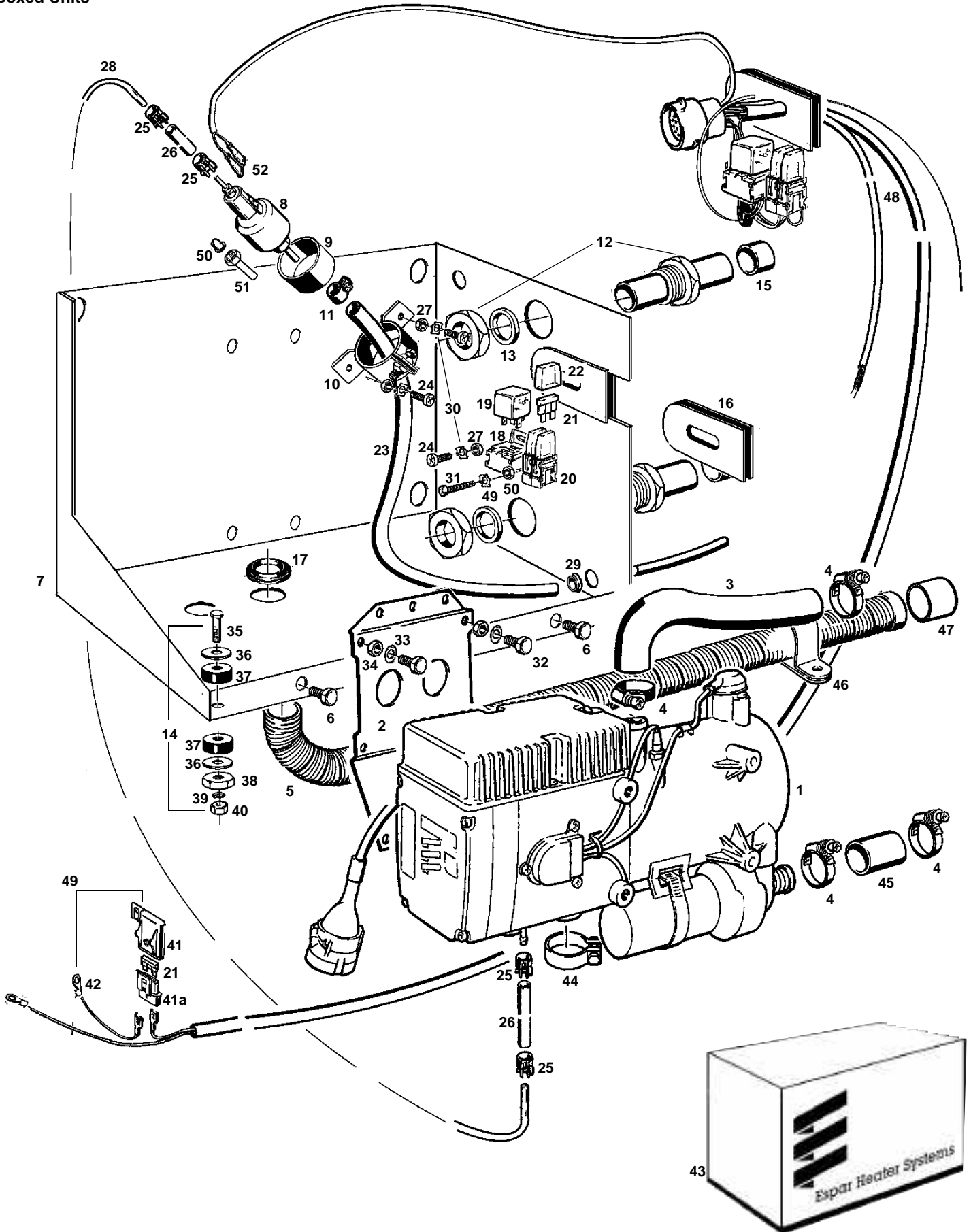
25 1996 05 - 12 volt
 25 1997 05 - 24 volt
 25 1815 05 - 12 volt
 25 1816 05 - 24 volt




D9W Description & Part #'s

Ref. No.	Description	Part Number	Model #	25 1815 12V	25 1816 24V	25 1996 12V	25 1997 24V
1	Outer casing	25 1816 01 00 02 25 1997 01 00 02		•	•		
2	Combustion air blower with cover	25 1815 99 15 00 25 1816 99 15 00		•		•	
3	Burner assembly	25 1816 11 00 00		•	•	•	•
4	Flame tube and burner	25 1816 11 01 00		•	•	•	•
5	Seal	25 1816 99 11 07		•	•	•	•
6	Water pump	25 1815 25 01 00 25 1816 25 01 00		•		•	
7	Temperature Sensor	25 1816 99 01 11		•	•	•	•
8	Overheat sensor	25 1816 99 41 00 25 1997 99 41 00		•	•		•
9	Flame sensor	25 1816 01 03 00		•	•		
10	Glow pin	12V 25 1815 01 01 00 24V 25 1816 01 01 00 12V 25 1996 99 01 01 24V 25 1997 99 01 01		•		•	
11	Glow plug cable	25 1816 01 04 00		•	•	•	•
12	Heat exchanger	25 1816 06 00 01		•	•		
13	Cover	25 1816 01 00 11		•	•	•	•
14	Holder	25 1816 01 00 06		•	•	•	•
15	Screw	25 1816 01 07 00		•	•	•	•
16	Seal	25 1816 01 00 04		•	•	•	•
17	Seal	25 1816 01 13 00		•	•	•	•
18	Sleeve	25 1816 01 00 12		•	•	•	•
19	Clamp	10 2065 05 00 70		•	•	•	•
20	O-ring	320 75 109		•	•	•	•
21	O-ring	320 75 111		•	•	•	•
22	O-ring	320 75 110		•	•	•	•
23	Fillister head bolt	103 10 320		•	•	•	•
24	Spring washer	171 22 101		•	•	•	•
25	Taptite screw	109 00 042		•	•	•	•
26	Taptite screw	109 10 023		•	•	•	•
27	Clip	156 22 021		•	•	•	•
28	Control unit	25 1815 99 50 01 25 1816 99 50 05 25 1996 99 50 02 25 1997 99 50 06		•			•
29	Hexagon nut	171 19 254		•	•	•	•
30	Taptite screw	109 10 020		•	•	•	•
31	Twist tie	209 31 080					
32	Sealing Joint	301 00 016		•	•	•	•

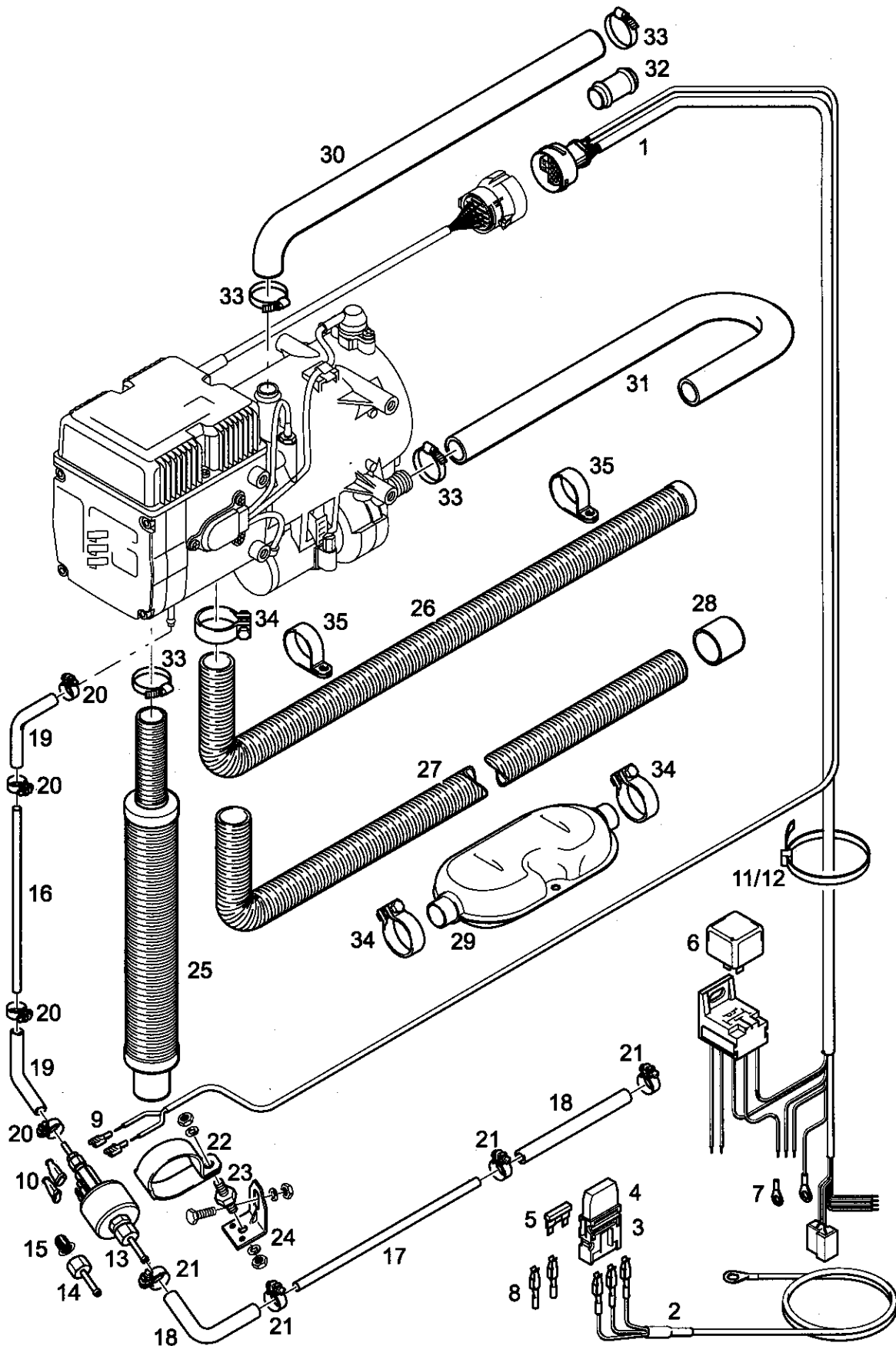
D9W Parts Diagram
Boxed Units




D9W Description & Part #'s

Ref. No.	Description	Part Number	Model #	25 1815 12V	25 1816 24V	25 1996 12V	25 1997 24V
1	D9W heater	25 1816 05 25 1996 05 25 1997 05			•	•	•
2	Heater mounting bracket	25 1816 80 00 01		•	•	•	•
3	Molded hose	CA0 11 023		•	•	•	•
4	Spring loaded clamp 17-32mm	CA1 10 046		•	•	•	•
5	Flexible Exhaust w/ end cap	25 1816 80 08 00		•	•	•	•
6	Bolts 5/16x1/2 #18 stainless	CA3 00 102-001		•	•	•	•
7	Box Base	CA0 10 069		•	•	•	•
8	Fuel metering pump	25 1425 45 00 00 25 1426 45 00 00		•	•	•	•
9	FMP rubber ring	20 1449 00 10 01		•	•	•	•
10	Fuel metering pump holder	25 1156 20 00 11		•	•	•	•
11	Clamp 11mm	10 2063 01 10 98		•	•	•	•
12	Bulk head hose connector 3/4"	CA0 11 011		•	•	•	•
13	Washer Bulkhead	CA3 00 311		•	•	•	•
14	Heavy duty shock mount kit	CA0 00 061		•	•	•	•
15	Dust cap - bulkhead fitting	CA0 11 016		•	•	•	•
16	Grommet	CA0 11 061		•	•	•	•
17	Silicon Seal - exhaust	25 1216 88 03 01		•	•	•	•
18	Blower relay block	203 00 085		•	•	•	•
19	Relay	203 00 065 203 00 066		•	•	•	•
20	Fuse holder	204 31 004		•	•	•	•
21	Fuse inserts	5 amp 204 00 079 15 amp CA1 07 002 20 amp CA1 07 005		•	•	•	•
22	Fuse holder cover	204 31 005		•	•	•	•
23	Fuel hose	360 75 350		•	•	•	•
24	Hex bolt M6x12	CA3 00 103		•	•	•	•
25	Clamp 9mm	10 2063 00 90 98		•	•	•	•
26	Fuel hose 3.5mm	360 75 300		•	•	•	•
27	Hex nut	CA3 00 208		•	•	•	•
28	Plastic fuel line 2mm	090 31 117		•	•	•	•
29	Grommet	20 1280 09 01 03		•	•	•	•
30	Washer 6mm	CA3 00 308		•	•	•	•
31	Screw M3x30	CA3 00 115-001		•	•	•	•
32	Bolt M8x16	CA3 00 137		•	•	•	•
33	Washer 8mm	CA3 00 309		•	•	•	•
34	Nut hex 8mm	CA3 00 029		•	•	•	•
35	Bolt M8x50	CA3 00 128		•	•	•	•
36	Washer fender 5/16"x1.25	CA3 00 305		•	•	•	•
37	Shock mount 8mm	CA3 00 128		•	•	•	•
38	Threaded washer	CA3 00 333		•	•	•	•
39	Spring washer 8mm	CA3 00 302		•	•	•	•
40	Hex nut 8mm	CA3 00 209		•	•	•	•
41	Fuse holder cover	CA1 07 009		•	•	•	•
41a	Fuse holder base	CA1 07 005		•	•	•	•
42	Ring terminal 3/8" awg 10-12	CA1 90 014		•	•	•	•
43	Box cover	CA0 10 070		•	•	•	•
44	Exhaust clamp 30-33mm	152 10 061		•	•	•	•
45	Coolant hose for boxed unit	CA0 11 023		•	•	•	•
46	Clamp "C" 34mm	152 10 043		•	•	•	•
47	End sleeve	25 1785 80 02 00		•	•	•	•
48	Harness boxed	12V FMP in CA1 60 903 24V FMP in CA1 60 901 12V FMPout CA1 60 904 24V FMPout CA1 60 905		•	•	•	•
49	Power pig tail	12V CA1 60 901-002 24V CA1 60 901-001		•	•	•	•
50	Cup sieve	20 1312 00 00 06		•	•	•	•
51	Fuel connection piece	20 1621 45 00 02		•	•	•	•
52	Rubber boot	320 31 120		•	•	•	•

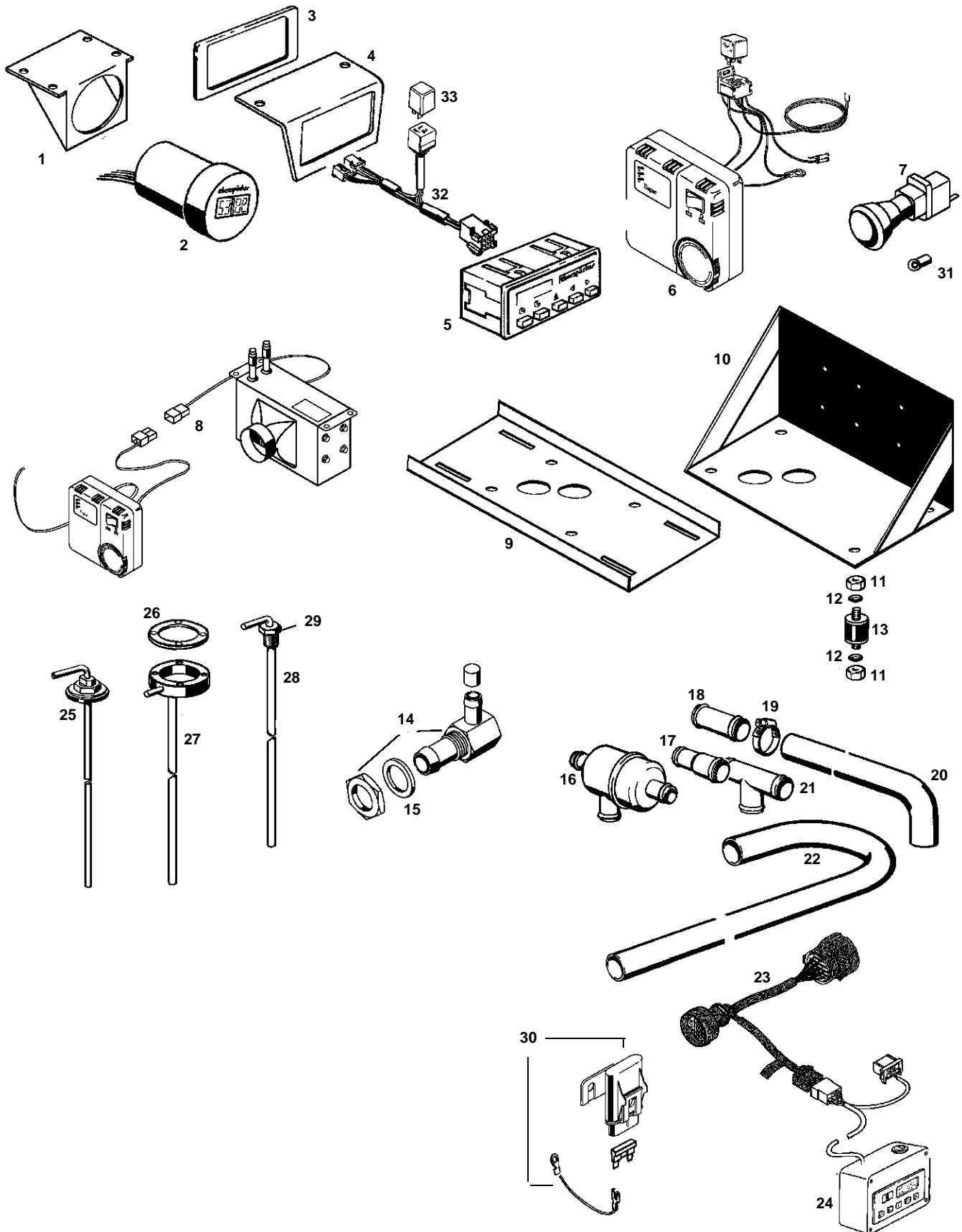
D9W Parts Diagram
Universal




D9W Description & Part #'s

Ref. No.	Description	Part Number	Model #	25 1815 12V	25 1816 24V	25 1996 12V	25 1997 24V
1	Universal Harness	25 1816 80 07 00		•	•		
2	Cable	20 1668 80 05 00		•	•	•	•
3	Fuse holder bottom	204 31 004		•	•		
4	Fuse holder cover	204 31 005		•	•	•	•
5	Fuse inserts	5 amp 15 amp 20 amp		•	•	•	•
		204 00 079		•	•	•	•
		CA1 07 002		•	•	•	•
		CA1 07 005		•		•	
6	Relay	203 00 065		•		•	
		203 00 066			•		•
7	Ring terminal 3/8" awg 10-12	CA1 90 014		•	•	•	•
8	Twin leaf spring contact awg 12	206 73 033		•	•	•	•
9	Terminals	206 73 033		•	•	•	•
10	Rubber boot	320 31 120		•	•	•	•
11/12	Tie cables	CA1 00 005		•	•	•	•
13	Fuel metering pump	25 1425 45 00 00		•		•	
		25 1426 45 00 00			•		•
14	Cup sieve	20 1312 00 00 06		•	•	•	•
15	Fuel connection piece	20 1621 45 00 02		•	•	•	•
16	Fuel line	090 31 117		•	•	•	•
17	Fuel line- suction side	090 31 101		•	•	•	•
18	Fuel hose	360 75 350		•	•	•	•
19	Fuel hose-pressure side	360 75 300		•	•	•	•
20	Clamps	10 2063 01 90 98		•	•	•	•
21	Clamp (suction side)	10 2063 01 10 98		•	•	•	•
22	"C"clamp	152 10 040		•	•	•	•
23	Metal rubber buffer	20 1185 00 00 01		•	•	•	•
24	Angle	20 1348 03 00 04		•	•	•	•
25	Intake silencer	25 1786 80 02 00		•	•	•	•
26	Exhaust (flexible)	25 1816 80 08 00		•	•	•	•
27	Flexible spiral tubing	360 61 580		•	•	•	•
28	End sleeve	25 1785 80 02 00		•	•	•	•
29	Muffler	25 1806 80 01 00		•	•	•	•
30	Coolant hose	20 1673 80 00 01		•	•	•	•
31	Coolant hose	20 1673 80 00 03		•	•	•	•
32	Connection piece	20 1534 88 00 01		•	•	•	•
33	Clamps	10 2065 02 00 32		•	•	•	•
34	Hose clamps	152 10 061		•	•	•	•
35	Muffler clamps	152 10 049		•	•	•	•

D9W Accessories




D9W Description & Part #'s

Ref. No.	Description	Part Number	Model #	25 1815 12V	25 1816 24V	25 1996 12V	25 1997 24V
1	Bracket - 99 hour timer	CA0 00 032		•	•	•	•
2	99 hr timer with bracket	CA1 00 050		•	•	•	•
	99 hr timer without bracket	CA1 00 051		•	•	•	•
3	7 day timer bezel	25 1482 70 01 00		•	•	•	•
4	Bracket for 7 day timer	CA0 10 061		•	•	•	•
5	7 day timer with kit (harness & relay)	CA1 00 135		•	•	•	•
6	Thermostat only	12V CA1 00 135		•		•	
		24V CA1 00 134			•		•
	Thermostat bunk relay kit	12V CA0 10 097		•		•	
7	Push / Pull switch	12V CA1 00 003		•		•	
		24V CA1 00 004					
8	Thermostat w/ Espar heat exchanger	CA1807 81		•		•	
9	Cross frame mounting tray	CA0 10 028		•	•	•	•
	with hardware	CA0 10 022		•	•	•	•
10	Side mount bracket	CA0 10 057		•	•	•	•
11	Hex nut 5/16"	CA3 00 203		•	•	•	•
12	Spring washer 8mm	CA3 00 309		•	•	•	•
13	Shock mount 5/16" - 1 piece	CA0 00 040		•	•	•	•
14	90° bulkhead hose connector	CA0 11 037		•	•	•	•
15	Washer - bulkhead	CA3 00 311		•	•	•	•
16	Water thermostat 3x18	330 00 160		•	•	•	•
17	Reducing piece 20x18mm	20 1645 89 00 06		•	•	•	•
18	Connecting pipe	20 1534 88 00 01		•	•	•	•
19	Clamp 20mm - 32mm	10 2065 02 00 32		•	•	•	•
20	Coolant hose 90°	20 1673 80 00 01		•	•	•	•
21	T-piece 20x20x20mm	20 1673 80 11 00		•	•	•	•
22	Coolant hose 180°	20 1673 80 00 03		•	•	•	•
23	Fault code harness	CA1 05 030		•	•	•	•
24	Fault code retrieval device	CA1 05 020		•	•	•	•
25	Fuel pick up pipe	CA0 12 058		•	•	•	•
26	Gasket	CA0 12 040		•	•	•	•
27	Single pick up with ring fitting	CA0 12 012		•	•	•	•
28	Custom straight pick up	16" CA0 00 030		•	•	•	•
		24" CA0 12 053		•	•	•	•
29	Compression fittings	1/4" NPT CA0 12 044		•	•	•	•
		3/8" NPT CA0 00 031		•	•	•	•
		1/2" NPT CA0 12 005		•	•	•	•
30	Fuse link power harness	12V CA1 60 901-002		•		•	
		24V CA1 60 901-001			•		•
31	Bulb (push/pull switch)	12V 207 00 005		•		•	
		24V 207 00 005			•		•
32	7 day timer harness adapter	CA1 60 008-001		•	•	•	•
33	Relay	203 00 093		•	•	•	•

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