



Timberline[®]

Hydronic Heating System by Elwell Corp.

Compact-5B
Compact-5D

Service manual

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Compact-5B, Compact-5D

Service Manual

Introduction

This Service Manual ("SM") is intended for use by the maintenance personnel servicing Compact-5B and Compact-5D hydronic pre-heaters ("pre-heaters").

This manual contains techniques for troubleshooting, as well as for determining whether various units and parts are in good condition or need to be replaced. It also contains general technical specifications and descriptions of the units and their purpose as parts of the pre-heater, as well as tips for their maintenance and particular features of the various models.

The operating manual and the catalogue of parts and assemblies must be used alongside this manual during the repair of the pre-heater.

This Service Manual may not include information about minor design alterations made by the manufacturer after the publication date of this SM.

Contact Elwell Corporation for support

Tel: 360-608-0916 • Email: info@elwellcorp.com
680-C South 28th St. Washougal, WA 98671

1. Main Technical Characteristics

See Table 1 for the main technical characteristics of the pre-heater. The technical characteristics include a $\pm 10\%$ tolerance and are specified for operation at the rated power supply voltage and air temperature of 68°F.

Table 1.

Parameter description	Model	
	Compact-5B	Compact-5D
Heat capacity, BTU	17,060	
Rated power voltage, V	12	
Operating power voltage range, V	9.5 - 16	
Fuel type	Gasoline	Diesel
Fuel consumption (max.), GPH	0.18	0.21
Heat transfer agent	DEX-Cool Antifreeze	
Electric power consumed, pump included, (max.), W	45	45
Power consumed at startup (100 s), W	65	65
Maximum liquid heating temperature, °F	+194	
Ignition mode	Manual or Automatic	
Preheater weight in full configuration, lbs, max.	19.8	

2. Safety Measures

- | | | | |
|-----|--|-----|---|
| 2.1 | Relevant workforce safety rules must be observed during the repair. | 2.6 | Do not use the pre-heater with in confined spaces and in poorly ventilated rooms. |
| 2.2 | Failure to observe pre-heater operation instructions may cause fire. | 2.7 | Do not switch off power to the pre-heater before the purging cycle ends. |
| 2.3 | A workplace must be equipped with fire-fighting means. | 2.8 | Where flame appears at the exhaust nozzle, turn the heater off and repair the fault after it stops. |
| 2.4 | Do not refuel an operating pre-heater. | | |
| 2.4 | Do not operate the pre-heater with the fuel system poorly sealed. | | |

3. Construction & Description of the Main Units of the Heater

- | | | | |
|-----|--|-----|--|
| 3.1 | The construction, main units and parts of the pre-heater are shown in the CPA (catalogue of parts and assemblies). | 3.2 | The electric circuit diagram is shown in the operating manual. |
|-----|--|-----|--|

4. Possible Heater Faults, their Root Causes and Troubleshooting Methods

A fault may occur during operation of the pre-heater. A fault may be diagnosed by a malfunction code indicated on the control panel, as described in Table 2.

There may be faults that are not identifiable via the control unit, such as loss of sealing in the heat exchanger (burning out) or loss of heat capacity due to fouling of the inner surface of the heat exchanger. The above faults may be diagnosed by visual inspection.

Caution: Do not operate the pre-heater with a poorly sealed heat exchanger.

During pre-heater operation, its separate units may fail to operate, and some of them may be replaced without removing the entire pre-heater from the vehicle. Such units include, for example, the fuel pump or the control panel.

A PC (laptop) with a USB socket may be used for diagnosing the condition of the pre-heater units. To do so, connect the PC to the pre-heater in place of the control panel using the USB adapter (supplied separately).

Possible Faults and Replacement of Parts in the Timberline Heating System Components

Table 2.

Codes	Malfunction Description	Malfunction Root Cause	Recommended Troubleshooting Methods
01	Overheating (upper temperature limit exceeded).	Heat exchanger temperature near the temperature sensor > 110°C.	1. Perform complete test of the fluid loop.
02	Potential overheating	Exceedingly high difference in temperatures measured by the overheating sensor and the temperature sensor.	2. Check the pump; replace if necessary. 3. Check overheating sensor and temperature sensor; replace if necessary.
03	Temperature sensor 1 fault	Short or open circuit in the electric wiring.	Replace both sensors (section 5.6).
04	Temperature sensor 2 fault		
05	Flame detector fault	Short circuit to frame or open circuit in the detector wiring.	Check the flame detector (see 5.3) and replace, if necessary.
06	Control unit temperature sensor fault	The temperature sensor is faulty (located in the control unit, cannot be replaced)	Replace the control unit (section 5.5).
07	Flame blowoff in "LOW-DUTY" mode	Poor conditions for combustion. Lack of fuel/air, the heat exchanger is fouled, the exhaust pipe is clogged.	Check the air intake, the gas exhaust pipeline, and fuel supply, resolve the faults and replace the fuel pump or the flame detector if necessary.
08	Flame blowoff in "FULL-DUTY" mode		
09	Glow plug fault	Short or open circuit, control unit fault	Test glow plug. Replace if necessary. Check the control unit; replace if necessary (see 5.1).

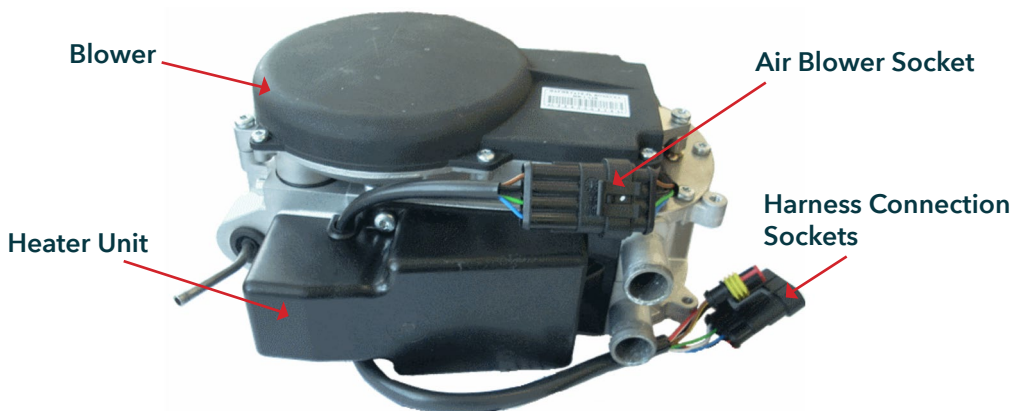
10	Air blower fault. Speed lower than rated	Foreign particles obstruct spinner movement, or the spinner hits the air blower cover.	Check the electric wiring. Check the AB for dirt. Correct the fault; replace the air blower if necessary (see section 5.4).
11	Overheating (heating rate is too high)	The temperature sensors heat too rapidly.	1. Check the entire liquid circuit for any possible air blocks upstream of the pump preventing the coolant to be pumped through the heating element. 2. Check coolant 3. Check the pump; replace if necessary.
12	Shutdown due to overvoltage.	Power supply voltage > 16 V	Test voltage at connector XS2 on the heater. Test the battery, the vehicle voltage regulator, and power supply wiring.
13	All attempts to start failed	Failure to ignite (after two attempts)	Check the fuel line, the fuel pump, and the air blower. Check the exhaust pipe. Check the combustion chamber, clean the Ø2.8 mm opening if necessary (see 5.7 and 5.2)
14	Pump fault	Short or open circuit of current-conducting parts, contaminated pumping elements.	Check short circuit and discontinuity of circulation pump wiring; check the pump; replace if necessary. Clean the pumping elements of the pump. (section 5.9).
15	Shutdown due to undervoltage	Power supply voltage < 9.5 V	Test voltage at connector XS2 on the heater. Test the battery, the vehicle voltage regulator, and power supply wiring.

16	Ventilation time exceeded	The flame sensor is not cooled down by purging sufficiently.	Check the air intake and the gas exhaust pipe. Check the flame detector; replace if necessary.
17	Fuel pump fault (short circuit)	Short circuit in the fuel pump wiring	Test the fuel pump power wiring for short circuit, replace if necessary.
20	No communication between the control unit and the touchscreen	Short or open circuit in the wiring	Check circuits in terminals.
21	Flame blow off in "WARMUP" mode	Poor conditions for combustion. Lack of fuel/air, the heat exchanger is fouled, the exhaust pipe is clogged.	Check the air intake, the gas exhaust pipeline, and fuel supply, resolve the faults and replace the fuel pump and the flame detector if necessary.
22	Fuel pump fault (open circuit)	Open circuit in the fuel pump wiring	Test the fuel pump power wiring for breaks, replace if necessary.
27	Air blower fault.	The motor does not rotate (movement is possibly obstructed)	Check the AB for mechanical obstruction of its rotation.
28	Air blower fault.	The motor rotates uncontrollably (possible fault in the 5 V power supply to the control unit).	Test wiring, the air pump, and the control unit; replace if necessary.
29	All ignition attempts failed with the pre-heater in operation	Ignition has been tried more than 4 times.	Check the fuel system. Check the security of the fuel line clamps, the seal of the fuel line and the fuel pump nozzle, and the fuel pump capacity.
41	External Air Temperature Sensor Fault	Open circuit in the wiring	Check the wire harness for any cut or unplugged wiring.
42	External Air Temperature Sensor Fault	Short circuit in the wiring	Check the wire harness for any cut or miss pinned wiring.

43	Heat Exchanger Sensor Fault	Open circuit in the wiring	Check the wire harness for any cut or unplugged wiring.
44	Heat Exchanger Sensor Fault	Short circuit in the wiring	Check the wire harness for any cut or miss pinned wiring.
45	Tank Temperature Sensor Fault	Open circuit in the wiring	Check the wire harness for any cut or unplugged wiring.
46	Tank Temperature Sensor Fault	Short circuit in the wiring	Check the wire harness for any cut or miss pinned wiring.
47	No communication between the control unit and the control panel.	Short or open circuit in the wiring	Check circuits and terminals
48	No communication between the control unit and the heater.	Short or open circuit in the wiring	Check circuits and terminals

5. Purpose, Repair, and Replacement of Pre-heater Units

The main units of the heater are shown in the CPA (catalogue of parts and assemblies). Compact-5B and Compact-5D pre-heaters differ in terms of control units, fuel pumps, and combustion chambers. Partial disassembly of the heater is required to check the condition of heater units or to replace them.



5.1 Purpose, Check, and Replacement of the Glow Plug

The glow plug ensures ignition of the air-fuel mixture as the pre-heater starts. To check the operation of the plug and replace the plug:

- Disconnect the control unit connectors from the harness
- Remove the screws fastening the control unit to the pre-heater housing, remove the control unit from the pre-heater, thus providing the required access
- Disconnect the plug outputs from the control unit
- Unscrew the plug
- Check plug operation by connecting its terminals to a 12 V battery: the plug must glow bright red (temperature approx. 1000°C) from its tip to about its middle part. After 30 seconds, measure current consumption. Current consumption must be within 3 to 5.2 A. Continue the test for no more than 90 s. Wait no less than 180 s before repeating the test
- If the plug is fault-free, check its operation from the control unit. To do that, clean and tighten plug terminals and then, without screwing the plug into the combustion chamber, connect its terminals to the terminals of the control unit.

Connect the control unit terminals to the harness and turn the pre-heater on. The plug must gradually heat up to the same temperature as when connected to the battery. If it is not the case, replace the control unit.

If the heating element works faultlessly after the replacement of the control unit, the one removed must be deemed faulty and should be replaced.

If the plug does not meet at least one of the above requirements, replace it. Replace the plug in the reverse order. Prior to mounting the plug, install the washer and the bushing (fig. 2) on it and only then screw the plug into the combustion chamber nozzle.

Note: For a gasoline-operated pre-heater, install the screen onto the plug as well (Fig. 2a).

Caution: Do not use voltage above 12 V to check the plug!

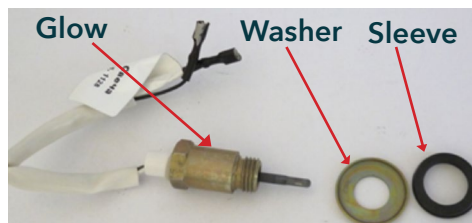


Fig. 2. Plug with an installation kit (for a diesel pre-heater)



Fig. 2a. Plug with an installation kit (for a gasoline pre-heater)

5.2 Purpose, Check, and Replacement of the Plug Screen

A glow plug screen is installed to equalize the fuel supply to the combustion chamber.

When changing or checking the plug, check the screen for fouling or clogging as well. If the screen is fouled, replace it. Install the screen into the diesel chamber nozzle using the mandrel, as shown on Fig. 3 and 4.

For a gasoline chamber, the screen is installed onto the plug (Fig. 2a) and then screwed all the way in. To prevent clogging, clean a $\varnothing 2.8$ mm opening located on the lateral cylindrical

surface of the nozzle before installing the screen into the nozzle

The screen must be installed fully tensioned. Where it is installed without having complete contact with the end face, the pre-heater may fail to launch.

When installing the screen for a Compact-5B (gasoline-operated), visually inspect the screen (Fig. 3a) for burrs (Fig. 3b). Carefully cut off any found burrs with scissors. Install the screen onto the plug as shown on Fig. 2a and screw it into the combustion chamber.

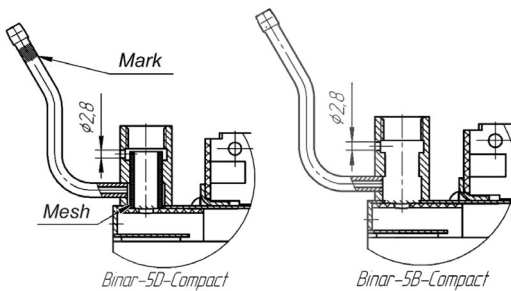
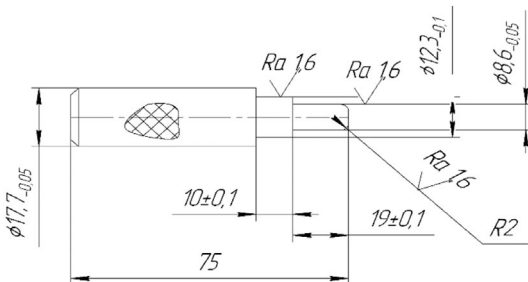


Fig. 3. Installing the screen into combustion chamber nozzle



1 Material: 40XH steel GOST 4543-71 or similar
2 HRC 45.....50

Fig. 4. Mandrel sizes



Fig. 3a.
Compact-5B Screen



Fig. 3b.
A burr on the screen

5.3 Purpose, Dismounting, and Replacement of the Flame Detector



Fig. 5. Flame detector

The flame detector (Fig. 5) is used to detect flame in the combustion chamber. It is comprised of a pipe with a thermocouple with two outputs inside.

Check the flame detector if malfunctions described in Table 2 occur.

If the fault appears during the pre-heater startup:

Disconnect the control unit connectors from the harness

Remove the screws fastening the control unit to the air blower housing

Disconnect the LED wires from the control unit

Check the flame detector for open circuit with a multimeter. An open circuit means the flame detector is faulty

Check the insulation resistance between the outputs and the FD housing. It must not be lower than 100 M Ω at 100 V. Measure the resistance at 15–35°C and relative humidity not above 80%. If the insulation resistance does not meet this criterion, replace the FD.

If an error appears during the heating element operation, there is either a crack in the weld of the FD thermocouple (i.e. the circuit is open), or the polarity of the FD connection is reversed. The fault may be revealed using two methods:

Method 1.

Remove the FD from the housing (Fig. 6), connect the terminals of the FD to a multimeter (at the temperature measuring terminals), and heat up the FD, for instance, with a lighter. The temperature must increase gradually. If it increases in surges or goes down to the initial value, the FD is damaged. In this case, however, the circuit may close after the FD has cooled down.



Fig. 6. Flame detector

5.3 Purpose, Dismounting, and Replacement of the Flame Detector

Continued

Method 2.

Remove the FD from the housing and measure the voltage at outputs of the FD that is being heated up. When the FD housing is heated up to +100°C (boiling water temperature), its outputs must provide voltage at about 3 mV. The positive pole is marked with a red tube and the negative with a black one.

In case of an open circuit, the FD must be deemed faulty and should be replaced.

To check the FD channel of the control unit, install a jumper in place of the FD (Fig. 6a). Connect the control unit sockets to the harness. If a malfunction code related to the FD (malfunction code 5) does not appear after the pre-heater launch, the CU is fault-free. Remove the jumper and connect a fault-free FD.

Replace the FD in the reverse order.

Where the fault persists, check the polarity of the FD connection (the wire with a black mark must be connected with the CU connector marked with a black dot, as shown in Fig. 6b). An error in the placement of the marking on the FD wires is also possible. To remedy this situation, swap the FD terminals in the control unit socket.



*Fig. 6a.
Jumper*



*Fig. 6b.
FD to CU connection*

5.4 Purpose, Dismounting, and Replacement of the Air Blower

The air blower (Fig. 7) consists of an electric motor with a scroll housing attached. A spinner is installed on the motor shaft. When the motor shaft is revolving, the spinner and the scroll generate air flow going to the combustion chamber to ensure burning as well as to blow off the combustion chamber to cool it down and remove residual fuel and moisture before the beginning and the end of the burning process.

When the motor or the spinner are faulty (the spinner hits the scroll or the cover), locate the cause of hitting and remove it and, if impossible, completely replace the air blower with a new one.

To identify the fault correctly:

Check the cleanliness of the air blower terminals connected to the control unit. Remove the air blower cover and check for foreign particles on the spinner or if the scroll hits the cover during rotation.

Dismount the air blower in the following order:

- Ensure access to the air blower (if necessary, remove it from the vehicle)
- Disconnect the air blower socket
- Remove the screws fastening the air blower to the air blower housing
- Dismount the air blower
- Remove the screws fastening the cover to the air blower housing

Visually inspect the spinner for foreign particles, clean if necessary. If the foreign particles are hard to clear away, remove the spinner from the motor shaft. Remove the lock washer and dismount the spinner. Pay attention to the adjustment washers under the spinner. Make sure not to lose them! Clean off all foreign particles and install the spinner back onto the motor shaft (with a new lock washer).

If the spinner hits the cover, grind the touch points on the spinner and the cover with fine abrasive paper. Screw the cover in and check whether the spinner hits the cover once again.

Mount the air blower in the reverse order. Visually check the condition of O-rings.

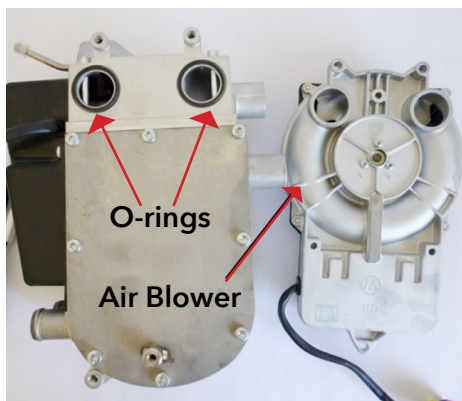


Fig. 7. Air blower

5.5 Purpose, Dismounting, and Replacement of the Control Unit

The CU (Fig. 8) performs the following functions:

1. Initial diagnostics (functional check) of pre-heater units at startup.
2. Functional diagnostics of pre-heater units during operation.
3. Sending information to the control panel.
4. Pre-heater startup.
5. Pre-heater shutdown:
 - Following a signal from the panel, after a set time period
 - Upon failure of one of the controlled units
 - Upon exceeding allowable limits of the temperature and voltage
 - Upon flame blow off in the combustion chamber

While troubleshooting the control unit, first ensure all parts of the pre-heater, as well as the control panel, are in working order. If the pre-heater works faultlessly after the replacement of the control unit, the one removed must be deemed faulty and should be replaced.

To dismount the control unit:

- Disconnect the control unit connectors from the harness
- Disconnect the air blower socket
- Remove the screws fastening the control unit to the air blower housing

- Disconnect the plug wires from the control unit
- Disconnect the FD wires from the control unit
- Remove the fastening clamp of the temperature sensors
- Remove the control unit

Reinstall the control unit in the reverse order.

-
1. Plug Connection Sockets
 2. Flame Detector Sockets
 3. Air Blower Sockets
 4. Clamp
 5. Temperature Sensors

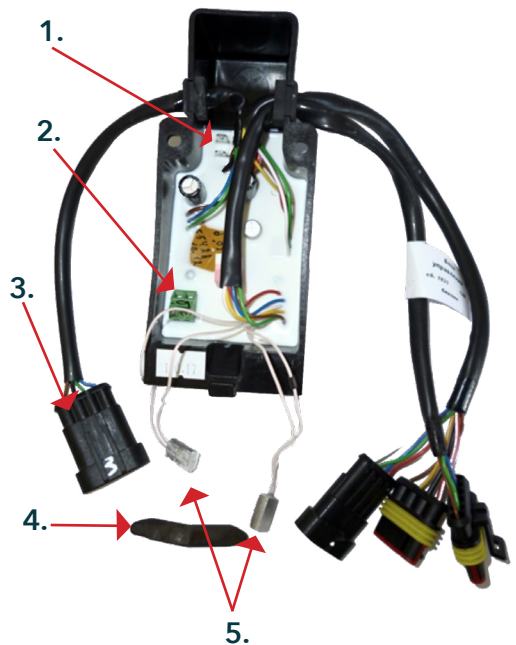


Fig. 8. Control unit

5.6 Purpose, Dismounting, and Replacement of Temperature Sensors

The overheating and temperature sensors (Fig. 8 and 9) monitor the temperatures of the heat exchanger.

If the temperature exceeds 110°C, the control unit shuts the pre-heater down with malfunction code 01; if the coolant circulation is insufficient, overheating may be caused by a large temperature gradient between the inlet and outlet (malfunction code 02) or by rapid heating of the sensors (malfunction code 11). If failures are caused by the sensors and not by quality of coolant or the pump, replace both sensors.

To dismount and replace the sensors:

- Remove the control unit (see 5.5).
- Cut the wires between the temperature sensors and the control unit. Make sure to remember the position of the wires marked black.
- Strip the wire ends and solder new sensors to them. Cover the connection spots with a heat-shrink tube or a duct tape.

Reinstall the control unit in the reverse order.



Fig. 8. Control unit

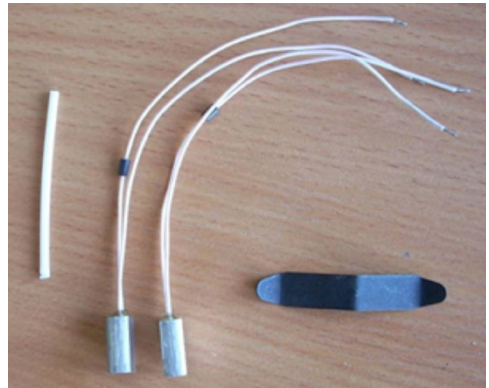


Fig. 9. Temperature sensors.

5.7 Purpose, Dismounting, and Replacement of the Combustion Chamber

The evaporative type combustion chamber is used for creating and burning the air-fuel mixture

Symptoms of combustion chamber faults are: a failure to start the heater (provided other parts are fault-free), a burnt out housing or inner parts of the chamber.

A faulty combustion chamber must be replaced. Dismount the combustion chamber in the following order:

- Remove the heater from the vehicle
- Disconnect the air blower socket
- Remove the control unit (see 5.5)
- Remove the screws fastening the air blower to the air blower housing
- Dismount the air blower
- Unscrew the plug
- Remove the screws fastening the combustion chamber cover to the heating element
- Remove the combustion chamber cover
- Remove the combustion chamber fixing screws
- Remove the combustion chamber.

Reinstall the combustion chamber in the reverse order.



Fig. 10. Combustion Chamber

While replacing the combustion chamber, inspect the heat exchanger.

Heat exchanger faults include a loss of heat conductivity, an increased temperature of exhaust gases ($> 500^{\circ}\text{C}$), burnt-out heat exchanger walls. Such faults are caused by deposits of fuel combustion products (soot) onto the inner walls and fins of the heat exchanger as a result of using low quality fuel.

After removing the combustion chamber, clear the inner part of the heat exchanger of burnt deposits and soot (if any).

5.8 Purpose, Troubleshooting, Dismounting, and Replacement of the Fuel Pump

5.8.1

The fuel pump (Fig. 11) is used for metered fuel supply to the combustion chamber.

Main characteristics of the fuel pump:

- Rated supply voltage 12 V,
- Coil resistance 6.0 Ω .

Possible pre-heater fuel pump faults:

- Fuel is not supplied to the fuel pipe of the heater during launch, and a characteristic knocking noise from the fuel pump is absent
- The fuel pump operates, but no fuel is supplied to the fuel pipe of the pre-heater
- Combustion stops when the pre-heater is switched to the "max." operation mode, which means the fuel pump does not provide the required capacity

5.8.2

To repair faults and determine the capacity of the fuel pump:

- Before troubleshooting, first check the presence and quality of fuel in the tank
- Check the condition of the wiring and connectors
- Check whether the fuel pump launches when the pre-heater is launched and emits the characteristic noise of the piston moving inside the pump
- Check the seal of the fuel line over its entire length from the tank to the fuel pump and from the fuel pump to the heater

You may dismount the fuel pump and shake it to release the piston jammed inside the pump after long storage or failure to observe the preventive maintenance specified in the operating manual.

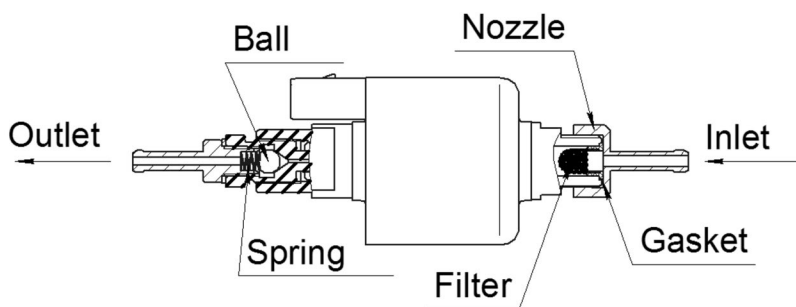


Fig. 11. Fuel pump

5.8 Purpose, Troubleshooting, Dismounting, and Replacement of the Fuel Pump *Continued*

The pre-heaters are supplied with two pump types:

- Diesel pumps (manufactured by Autoterm 000);
- Gasoline pumps (manufactured by Thomas Magnete).

In case of fault in a Thomas Magnete fuel pump, it must be replaced.

In case of a fault in an Autoterm 000 fuel pump, do the following:

- Check whether the filter is clean. Remove the inlet nozzle of the fuel pump and visually inspect the filter. Flush it with petrol and purge with compressed air, if necessary.
- Check air tightness of the connection between the fuel pump body and the inlet nozzle (Fig. 11). To check it, use air under pressure of max. 1 kg-f/cm². Supply the air from the inlet after plugging the outlet nozzle. If the connection is not airtight, replace the nozzle gasket (Fig. 11).

If all of the above faults are repaired, check the capacity of the fuel pump. The fuel pump capacity must be 4.4-3%+5% ml for diesel and 4.0 -3%+5% ml for gasoline per 100 cycles. If the capacity is below or above that specified, replace the fuel pump.

To dismount and reinstall the fuel pump:

- Loosen the clamps and disconnect the fuel lines from fuel pump nozzles
- Disconnect the wiring from the fuel pump
- Loosen the screw on the clamp and remove the fuel pump

Reinstall the fuel pump in the reverse order.

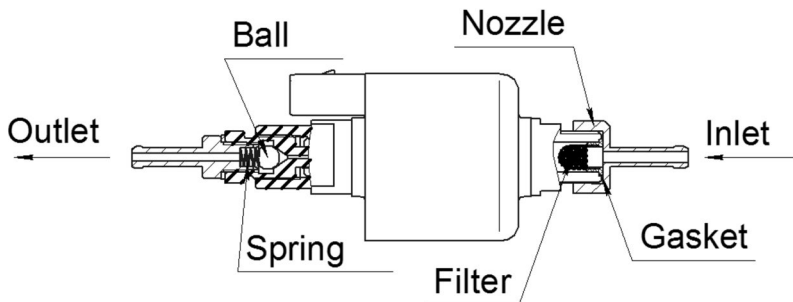


Fig. 11. Fuel pump

5.9 Purpose, Troubleshooting, Dismounting, & Replacement of the Pump

The electric motor and the pump (Fig. 12) are used to circulate coolant across the vehicle engine/cabin heating systems.

The pump may fail to operate for the following reasons:

- Poor coolant quality (frozen coolant)
- Foreign particles inside the liquid circuit
- Short or open circuit in the electric wiring
- Wear on the working parts of the pump.

If the coolant is frozen (has turned into a snow-like mass) inside the pump, the pump may continue to operate but will not be able to circulate any coolant. Unfreeze the pump and replace the coolant with that of better quality.

Where there are foreign particles (such as fine chippings or sawdust) inside the liquid circuit, they may obstruct pump operation. A clear symptom of a contaminated pump is poor circulation of the coolant.

To clean the pump, partially disassemble it in the following order:

- Remove the pump from the vehicle
- Remove the four screws and remove the cover
- Clean the cover and the spinner of foreign particles
- Reinstall the cover and check the pump operation

If the pump does not turn on, check the wiring.

If the wiring is not visibly damaged, connect an electric source at the pump operating voltage directly to the pump terminals for a short period. If the pump starts, it is fault-free. Check the wiring with a multimeter.



Fig. 12. Electric motor with a pump

6. Domestic Water Heat Exchanger



Fig. 13. Domestic Water Heat Exchanger

If the temperature on the touch panel for the heat exchanger is incorrect. Inspect the wiring between the control box and heat exchanger sensor. If there are no issues unplug the sensor and replace it with a new sensor.

If you are not getting hot water out of your domestic water faucet or shower, (and the heating system is running with no faults) inspect the heat exchanger for any physical damage or swelling to the plates. If you see physical damage to the unit, you will need to replace it. Check to see if the coach has been in freezing temperatures without the heating system operating.

If the heat exchanger is leaking fluid, check all connections on the top of the exchanger. If it is leaking out of one of the four connections, tighten the connection the with a crescent wrench.

If the leaking does not stop, remove the fitting and check for physical damage to the thread. If there is no

damage, apply new thread sealant and reinstall the fitting. If the leaking persists, you may need to replace the heat exchanger.

To replace the heat exchanger, drain the domestic water in the system before removal. Pinch off the coolant lines in front of the unit and remove. Once you have replaced the unit, refer to section 13 for purging the system.

7. Air Sensor



Fig. 14. Air Sensor

If the touch panel is displaying the incorrect temperature for the ambient air. You will need to inspect the wiring for the air sensor. If there is no issues with the wiring, you will need to replace the air sensor. To replace the air sensor unplug the old sensor and replace it with the new sensor.

8. Water Solenoid Valve



Fig. 15. Water Solenoid Valve

If the thermostat is on and the fans are on, but they are blowing cold air, check the voltage at the red and black wire on the solenoid valve.

If you have 12 volts, check to be sure the valve is engaging when the system is turned on. If it is not engaging, you will need to replace it. If it is engaging, check inside the Timberline tank to be sure there is the correct amount of fluid movement in the system.

If there is no fluid movement inside the tank, refer to section 5.9 in order to check the circulation pump.

To replace the solenoid valve, pinch off the fluid lines on each side of the unit, remove the spring clamps, and pull the unit out. Install new unit. After the reinstallation, purge the unit (refer to section 13.)

9. Heating Fans



Fig. 16. Heating Fans

If the coach is not heating, check the functionality of the heating fans. The fans should be blowing hot air if the Timberline system is on and the thermostat is not satisfied. If there is no air movement out of the fans, check the voltage at the red and black wire on the back of the fan. If there is voltage but the fans are not coming on, the unit will need to be replaced. If there is no voltage, inspect the wiring for damage or cut wires.

To replace the heating fans, pinch off the fluid lines on the back of the fan unit, remove spring clamps, and remove the unit. Install new fans. After the reinstallation, purge the unit (refer to section 13.)

10. Timberline Tank



Fig. 17. Timberline Tank

Caution: High risk of electrical shock!
Do not attempt to diagnosis unless you are a trained technician!

In case the element is not heating. First check to see that the coach is plugged into shore power and the element emblem on the bottom right of the touch screen is red. After you have checked these things unplug the unit from the wall and test the ohms across the plug. You should have 10.1 ohms. If you are not getting the correct amount of ohms, check the red and black wire on the 12 volt/120 volt relay for 12 volts. If you do not have 12 volts, inspect the wiring between the tank and the timberline control box. Next you will need to check the high temperature shutoff. If this has been set off you will need to reset it by pressing the red button. If all of this is correct, check for 120 volts across the top of the element. **-Warning risk of high voltage shock-** If you do not have the correct voltage here. You will need to replace the element.

To replace the element first unplug the unit. Then you will need to remove the plug in the left side of the tank and drain the coolant into a container.

Pinch off the coolant lines on the bottom of the tank. You will then need to tilt the tank on its side to remove the old element and install the new element. You will need to refill the unit with Dex cool antifreeze.

To replace the tank first unplug the unit. Then you will need to remove the plug in the left side of the tank and drain the coolant into a container. Pinch off and remove the coolant lines on the bottom of the tank. Remove the old unit. When you install the new unit you will need to fill it with Dex cool antifreeze.

If the temperature on the touch screen for the tank is not reading correctly. You will need to inspect the wiring between the control box and the tank. If there are no issues with the wiring you will need to replace the temperature sensor inside the cap of the tank. **Unplug the unit before replacing the sensor!** Unpin and remove the sensor from the tank. Pin the new sensor in the four pin molex plug and install on the tank. Do not overtighten the bolts!

If the 12 volt/120 volt relay is not opening and closing. You will need to replace the unit. To replace it pull the wires off and plug them into the new unit. Place the new unit.

11. Pinout and Replacement of the Control Box

All of the data and power in the system is ran through the control box, except for the power to the Compact, circulation pump, and fuel pump. If you are having electrical troubles with the system check the fuses in the control box first. Check the pins placements and wiring for the control box. If you are still having trouble you will need to replace the control box.

To replace the control box simply unplug the control box and replace it with the new unit.

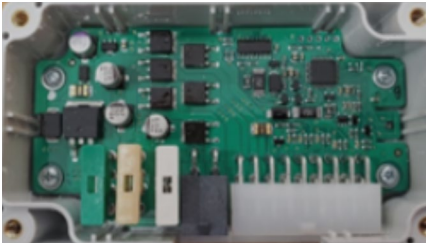


Fig. 18. Timberline Control Board



Fig. 18.a. Timberline Control Box

Fuses	Purpose	
1. Green	Control Box	30 amp
2. Tan	Touch Panel	5 amp
3. White	Fans	25 amp

Pin Number	Purpose	
1	Ground	Black 16 AWG
2	+ 12 Volt	Red 16 AWG
3	Fans (-)	Black 18 AWG
4	Fans (+)	Red 18 AWG

Pin Number	Purpose	
1	Not Used	
2	Heater wire (GND)	Blue
3	Touch Screen (GND)	Blue
4	Heat Exchanger	Black/White
5	Tank Sensor	Black/White
6	Air Sensor	Blue
7	Heater Data	Green
8	Tank Relay 12 V	Black
9	Solenoid Valve	Black
10	Touch Screen Data	Green
11	Heater Data 2	White
12	Touch Screen Data 2	White
13	Heat Exchanger	White
14	Tank Sensor	White
15	Air Sensor	White
16	Touch Screen	Red
17	Tank Relay 12 V	Red
18	Solenoid Valve	Red

12. Touch Panel

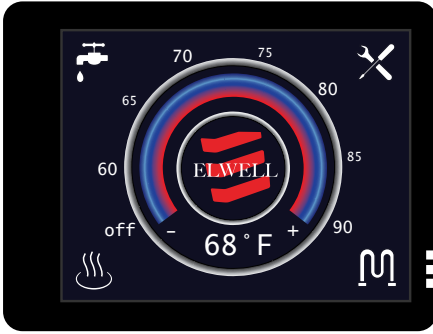


Fig. 19. Timberline Touch Panel

If you cannot get the touch panel to start up. Check the tan 5 amp fuse inside the control box and inspect the wiring between the control box and touch panel. If there are no issues you will need to replace the touch panel. To replace the touch panel simply unplug the old unit and replace it with the new touch panel.

13. Purging the System

If you have replaced one of the following components follow step 1.

- Compact Heater
- Timberline Tank
- Circulation Pump
- Heat Exchanger
- Solenoid Valve

If you have replaced the fans please follow step 2.

Step 1.

Before starting the purging process **make sure the thermostat is off!**

Check to make sure all clamps are installed correctly on the replaced component. Remove your pinch off pliers and plug the component into the wiring system. Select the pump override on the touch panel and let the system purge for 10 minutes.

Once this is done select the burner option and the hot water option, then let the system run for another 15 minutes. If you have no codes on the touch panel after 10 minutes, your system is purged correctly.

Step 2.

When starting the purging process make sure the thermostat is on and the element option is selected. You will need a head pressure pump, like a Shurflo, to purge the system correctly. Find a good place under the vehicle to add the pump into the system.

Make sure the radiator is on top on the timberline tank before you turn the pump on to purge. Turn the pump on and let it purge for 10 minutes. After 10 minutes remove the pump. Turn on the furnace with the thermostat on and let the system purge for 10 more minutes.

If you have no codes on the touch panel after 10 minutes, your system is purged correctly.

14. Pre-heater Check after Installation

When the pre-heater is installed on a vehicle after repair, it must be checked for correct operation with and without the vehicle engine running.

Connect the pre-heater to the power source, the fuel tank and the liquid circuit. Remove air from the fuel system and the liquid circuit.

Using the control panel, set the pre-heater operation duration to 20 min. Start the pre-heater. Check whether the pre-heater operates correctly in every mode displayed on the panel (for more information on operation modes, see the operating manual).

Check the pre-heater for abnormal noises during operation. Check the security of the clamps (no coolant leaks are allowed).

When a fault occurs during the pre-heater launch or operation and the pre-heater shuts down, a malfunction code appears on the control panel. See the meaning of the code in the operating manual. Repair the fault and repeat the test.

15. Manufacturer's Warranty

15.1 The manufacturer's warranty is only valid if the user observes the rules for operation of the pre-heater specified in the operating manual.

15.2 Every pre-heater repaired by a company authorized by the manufacturer must have an entry in the warranty certificate indicating a description of the maintenance, the replacement of units, and parts and bearing a stamp of the organization performing the maintenance.

15.3 Warranty does not apply to the control panel, the control unit, the heater, and the fuel pump with evidence of repair attempts.

During the repair operation marked with a * (replacement of circulation pump, fans, Compact heater, water heat exchanger, solenoid valve) - **THE COOLANT SHOULD NOT BE DRAINED! USE CLAMPS TO PINCH OFF THE HOSES!**

During the replacement operation marked with ** (Timberline tank replacement) 2 gallons of the coolant will need to be drained so that the tank will be empty during removal and installation.

15. Manufacturer's Warranty Continued

Warranty Part Replacement Labor Time

	Description of Part Replacement Operation	Timberline System Compact 5D/5B
1	Diagnosis	0.5
2	Glow Plug Replacement	0.25
3	Flame Detector Replacement	0.35
4	Air Blower Replacement	0.35
5	Fuel Pump Replacement	0.15
6	Control Unit/Sensor Board Replacement	0.3
7	Circulation Pump Replacement	0.5*
8	Fan Replacement	0.3*
9	Combusting Chamber Cleaning with Heater Removed	0.5
10	Heater Removal and Reinstallation	0.6*
11	Touch Panel Replacement	0.15
12	Timberline Control Box Replacement	0.15
13	Tank Sensor Replacement	0.15
14	High Limit Aquastat	0.25
15	120 V Relay Replacement	0.25
16	Timberline Tank Replacement	0.5**
17	External Air Temperature Sensor Replacement	0.25
18	Domestic Water Heat Exchanger Replacement	0.5* See Section 9
19	Heat Exchanger Sensor Replacement	0.15
20	Solenoid Valve Replacement	0.5*
21	Testing the System after Part Replacement	0.25
22	Purging and Testing the System after Coolant Part Replacement	0.5



360-608-0916

info@elwellcorp.com

680-C South 28th St.
Washougal, WA 98671