PARKING HEATER PRODUCTS®

53W ENGINE HEATER

- Technical Description
- Installation Instructions
- Operating Instructions
- Troubleshooting and Parts

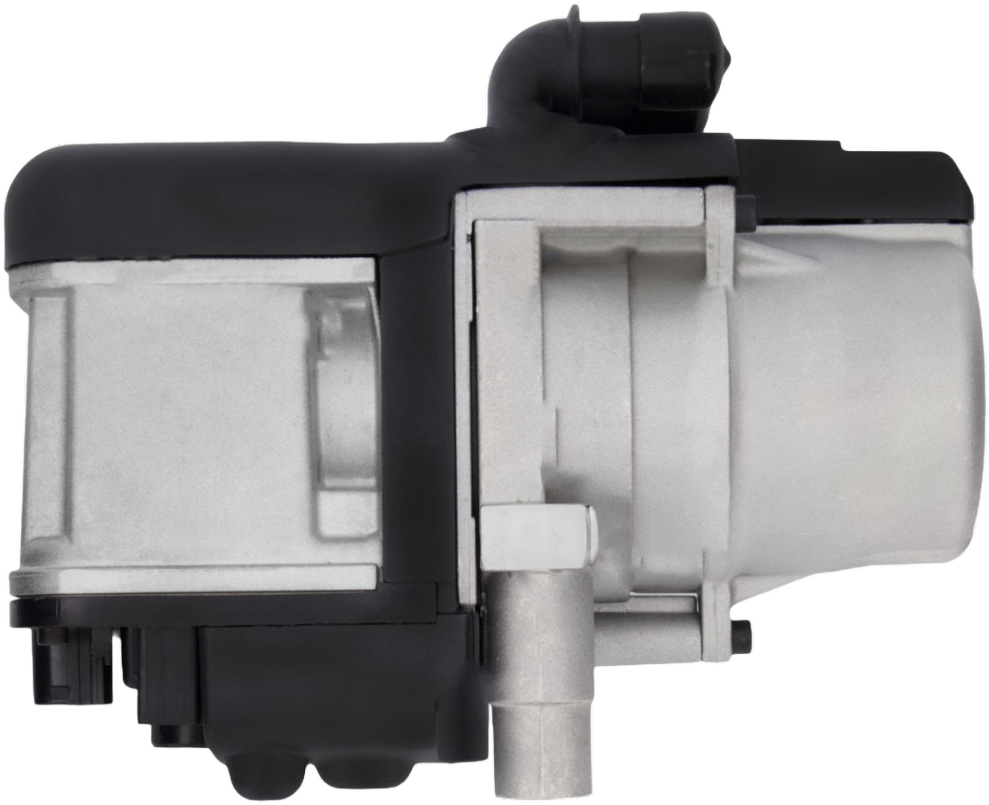
Table of Contents

Introduction

Thank you for purchasing our 53W heater kit.

The 53W heater is designed to preheat your engine by using on-board diesel fuel and battery systems. Operation is simple and the heater provides a safe and reliable alternative to cold engine starting or need for electrical plug ins.

Please take a moment to familiarize yourself with this manual, safety warnings and heater requirements before installing or operating your heater.



Heater Warnings

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.

⚠ Warning - Installation Hazards

- The installation of this kit requires trained decision-making concerning locating and integrating components, tying components together, rerouting, or relocating OEM components, etc.
- It is impossible to describe all of the safety and operational considerations in the installation instructions. Therefore, the technician must exercise professional judgment to achieve a safe and quality installation.
- 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 Hazards

- Heater must be turned off while re-fueling.
- Do not install heater in enclosed areas where combustible fumes may be present.

⚠ Warning - Fire Hazards

- Exhaust pipe must maintain a minimum a distance of 50mm (2") from any flammable or heat sensitive material.
- Ensure there are no leaks in the fuel system.

⚠ Warning - Asphyxiation Hazards

- Ensure that exhaust fumes cannot enter passenger compartments.

⚠ Warning - Burn Hazards

- Ensure a proper mixture of water and antifreeze to prevent coolant from Freezing.
- Ensure that the coolant flow can never be blocked while heater is in operation.
- Blocking coolant flow can result in extreme pressure, bursting hoses and release of scalding coolant.

Caution - Operational Considerations

Bio-Diesel

This heater is not designed for use with straight bio-diesel (Blends of bio-diesel up to 10% are acceptable)
Operating outside of these conditions may plug the heater with soot and result in combustion failure.

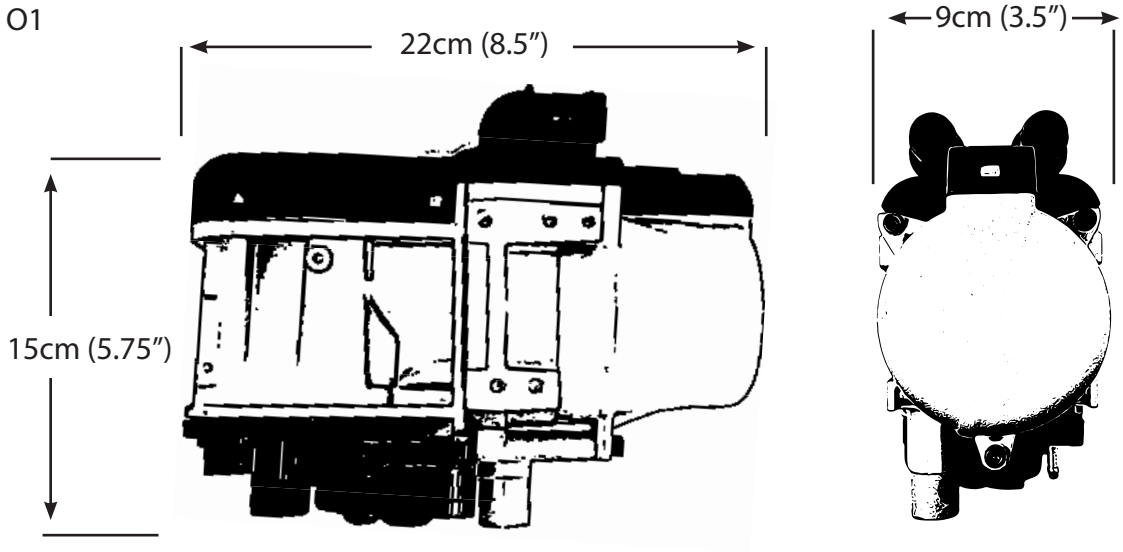
High Altitudes

This heater is not designed to operate continuously at altitudes above 1500 meters (4920').
Operating in these conditions may plug the heater with soot and result in combustion failure.

Specifications

Principal Dimensions

*Figure O1



Performance Specifications		
Heating Mode	High	Low
Heating Capacity kW/hr (BTUs/hr)	5.0 (17,060)	2.5 (8,530)
Fuel Consumption L/hr (US Gal/hr)	0.6 (0.16)	0.3 (0.08)
Power Consumption - WATT	56	35
Power Consumption In Standby - WATT	27	
Start-up Power Consumption - WATT	< 150	
Min. Water Through-put L/hr (US Gal/hr)	250 (66)	
Fuel Type	Diesel	
Nominal Voltage	12 Volt & 24 Volt	
Lower Voltage Limit	10.5 / 21.0 Volts over 20 seconds	
Upper Voltage Limit	16.0 / 32.0 Volt over 20 seconds	
Overheat Protection	115° C (239° F)	
Allowed Ambient Temperature	40° C to 80° C (-40° F to 176° F)	
Weight	3 kg (7 lbs)	

Above Specifications (± 10%)

Heater Kit List

QTY	Description	Part Number
1	5 kW Engine Heater	P53W-T801

QTY	Description	Part Number
1	Operating Switch	P53W-X303

QTY	Description	Part Number
1	Mounting Bracket	P52W-X701

QTY	Description	Part Number
1	Wiring Harness 5M (16') Power Harness, 20A Fuse 5M (16') Fuel Pump Harness 7.5M (25') Switch Harness, 5A Fuse 0.5M (20") Coolant Pump Harness	P53W-X301

QTY	Description	Part Number
1	Flexible Stainless Steel Exhaust, 0.6M x 22mm	U65D-X519
1	Combustion Air Intake Tube, 0.6M x 22mm	U65D-X522
2	"P" Clamp	NPN
1	24 – 26 mm Exhaust Clamp	U65D-X502
1	24 – 26 mm Combustion Air Hose Clamp	NPN

QTY	Description	Part Number
1	Coolant Pump	P53W-T602

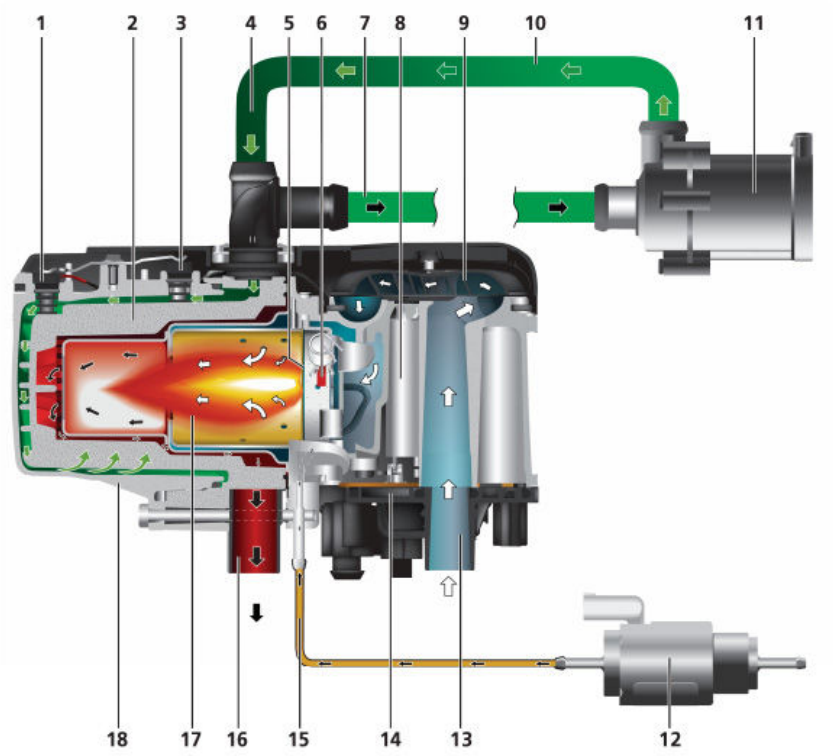
Heater Kit List

QTY	Description	Part Number
1	Fuel Pickup Tube & Fuel Tube Hardware Kit - Compression Fitting - Large Flat Washer - Small Flat Washer - Large Rubber Gasket - Large Hex Nut - Brass Hex Nut - Brass Securing Body	U65D-X405
1	Fuel Metering Pump	P53W-T401
1	Fuel Pump Holder	U65D-X407
1	Black Rubber Fuel Line, 0.3M (12") 7mm ID	U65D-X414
4	5mm x 50mm Fuel Line Connectors	U65D-X409
1	"Z" Mounting Bracket	U65D-X704
1	Clear Plastic Fuel Line, 5M (16') 1.5 mm ID	U65D-X403
12	Small Fuel Line Clamps, 9-11 mm	U65D-X401

QTY	Description	Part Number
1	"Z" Mounting Bracket	U65D-X704
2	"L" Brackets	U65D-X706
4	M6 x 15 Screws	NPN
6	M6 x 25 Screws	NPN
6	M6 Hex Nuts	NPN
4	M6 Flat Washers	NPN
2	#8 Self Drilling Screws	NPN
11	6mm Lock Washers	NPN

Main Components and Operating Concept

*Figure O2



1. Overheat Sensor
2. Heat Exchanger
3. Temperature Sensor
4. Coolant Inlet
5. Atomizer
6. Glow Pin / Flame Sensor
7. Coolant Outlet
8. Blower Motor
9. Combustion Air Blower
10. Return Coolant
11. Coolant Pump
12. Fuel Metering Pump
13. Combustion Air Inlet
14. ECU
15. Fuel Inlet
16. Exhaust Outlet
17. Flame Tube
18. Heat Exchanger

Main parts of 53W Engine Heaters

Here is a basic overview of the operation of the heater.

- Fuel is delivered to the heater via the heater's fuel pump.
- Combustion air is delivered to the heater via the heaters 12v combustion air blower.
- Fuel is atomized and the fuel / air mixture is ignited using a glow pin.
- The flame is contained in a flame tube and exhaust gases expelled.
- The heater's coolant pump takes cold coolant from the engine, circulates it through the heater's water jacket, then it pumps hot coolant back to the engine.

Heater Mounting

Mounting Considerations:
- Protect from road spray
- Mount below engine coolant level to avoid air blockage.
- Keep coolant hoses short to maximize flow and minimize heat loss.
- Keep power wiring short to minimize voltage drop.
- Keep fuel lines short to ensure good combustion.

Suggested Locations:
- Step box
- External storage compartments (Not inside cab)
- Inside frame rail
- Inside engine compartment

⚠ Warning - Asphyxiation Hazards

Do not mount the heater inside passenger compartments where poisonous exhaust fumes may be inhaled.

Caution

Guard the heater against excessive road spray to minimize corrosion and avoid ingestion of debris.

Mounting:
Mount the heater using the mounting bracket provided with the installation kit.
Provide shielding as required to protect the heater from environmental conditions.
Orientate the heater within permissible mounting configurations shown in Figure M1.

Heater Mounting

*Figure M1

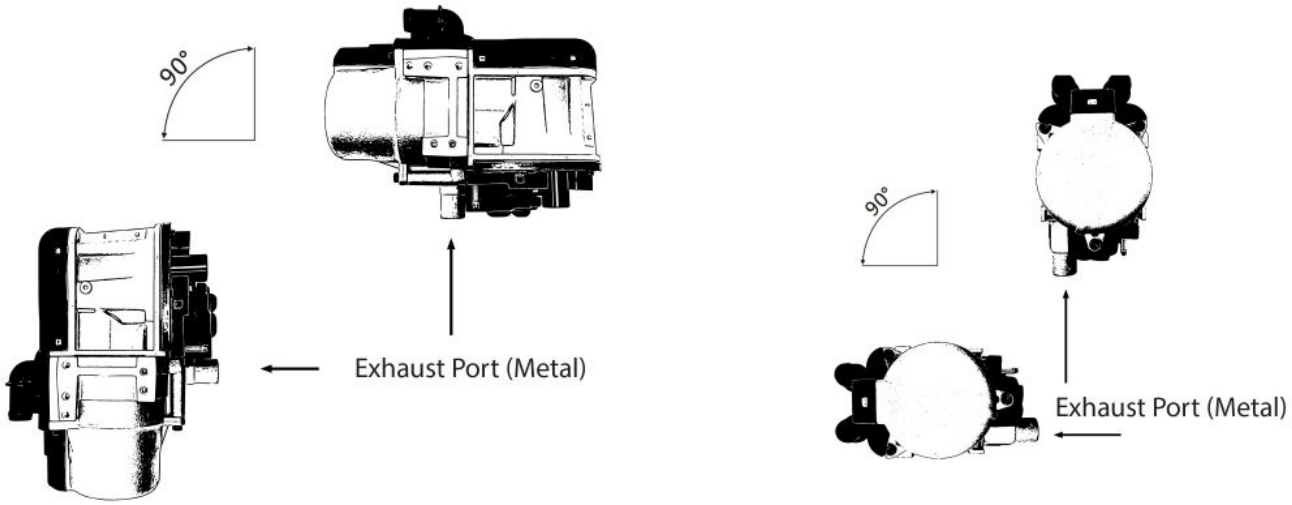
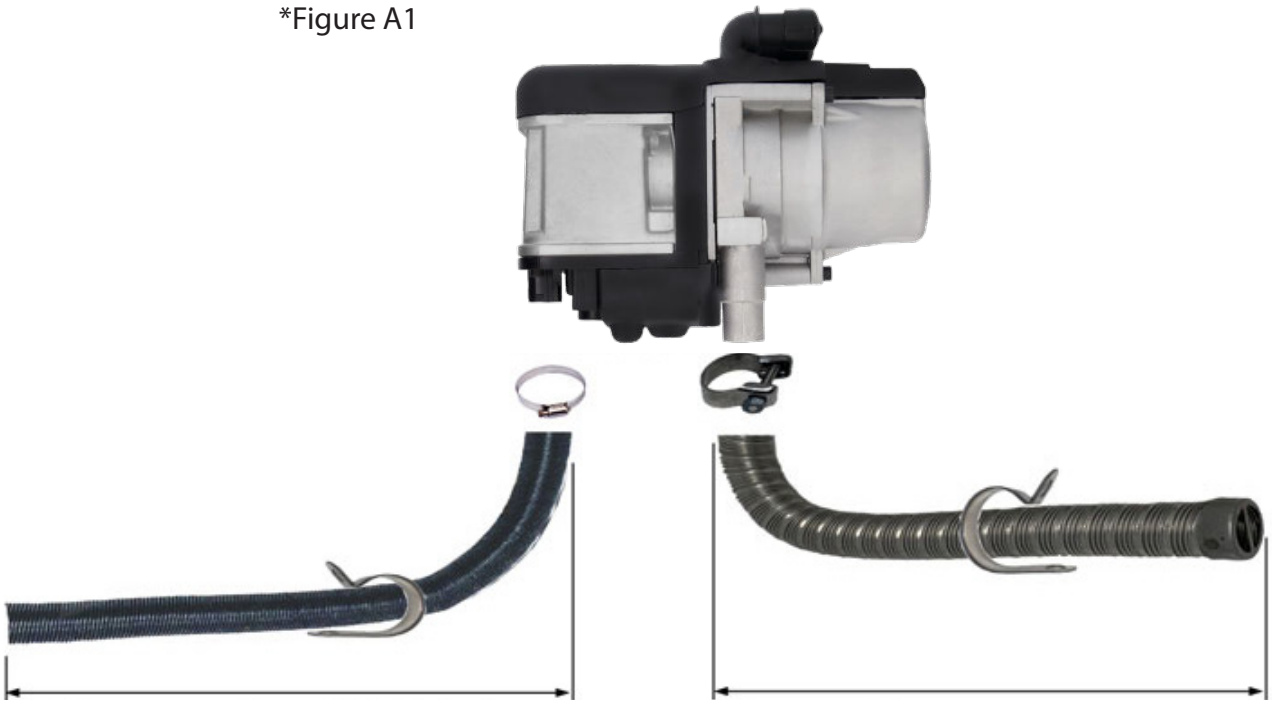


*Figure M2

Heater Mounting Bracket

Exhaust & Combustion Air Intake Connections

*Figure A1



Combustion Air Intake
Max. 1M (3’)

Exhaust
Min. 0.2M (8”) **Max. 2M (6’)**

⚠ Warning - Fire Hazards

The exhaust is hot, keep a minimum of 5 cm (2”) clearance from any heat sensitive material.

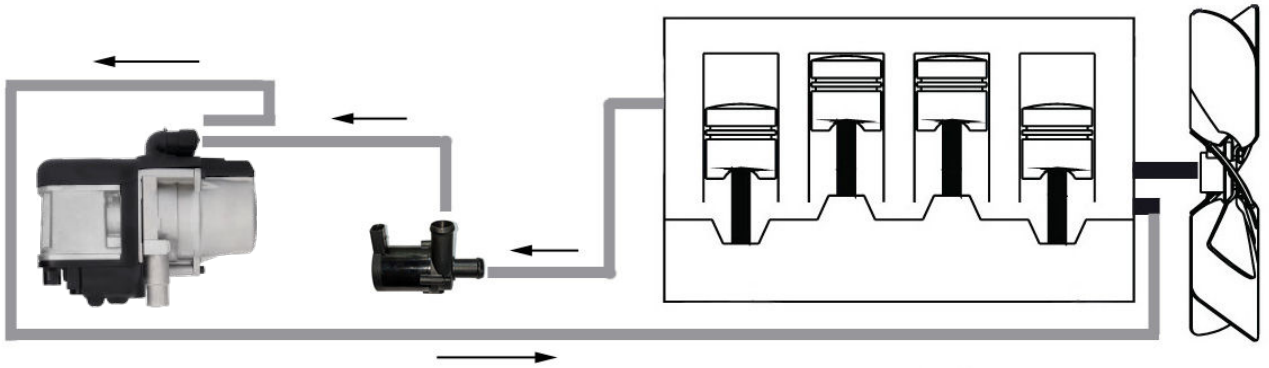
⚠ Warning - Asphyxiation Hazards

Route exhaust beyond the skirt of the cab and outside of the frame area.
Failure to comply with this warning could result in Carbon Monoxide Poisoning.

Heater Plumbing

Understand that connecting your heater to the engine makes it an integral part of the engine's cooling system. It is impossible to describe all of the safety and operational considerations in these installation instructions. Therefore, the technician must exercise professional judgment to achieve a safe and quality installation. It is important to try to optimize the coolant flow to get the best heat distribution and heater operation.

*Figure P1

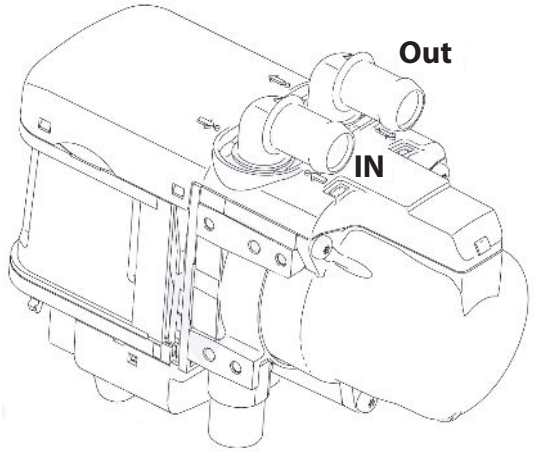


Installation Procedure:

- Plan the heater plumbing circuit.
- Install the coolant pump in a protected location close to the heater
- Install fittings, valves and run hoses as required.
- Bleed the air out of the system (Run engine to help circulate coolant).
- Top up coolant as required.
- Test the heater to ensure proper flow.

Heater Plumbing

*Figure P2



Follow these guidelines and considerations:

- There are a few plumbing accessories included with the kit (Connectors and molded hoses)
- Use 3/4" hoses to optimize coolant flow.
- Keep the pick up and return points as far apart as possible.
- Take coolant from a high pressure point of the engine (ie. back of block)
- Return coolant to a low pressure point of the engine (ie. engine's coolant pump).
- Use ball valves to isolated the system when not in use.
- Take the coolant from a low point on the engine to minimize aeration.
- Mount heater and coolant pump low to allow the purging of air.
- Consider using insulation around the hoses.
- A heat exchange can be incorporated into the system. However, ensure that the heater flow can never be completely blocked by a flow control valve.

⚠ Warning - Burn & Explosion Hazards

- Do not work on the plumbing system when it is hot or under pressure.
- Do not work on the heater or plumbing system when the heater or engine are in operation.
- Always wear safety gloves and appropriate eye protection.
- Ensure system has pressure relief protection limiting maximum system pressure to 15 PSI (1 bar).
- Coolant flow must never be blocked during heater operation (ie. flow control valves).

Caution

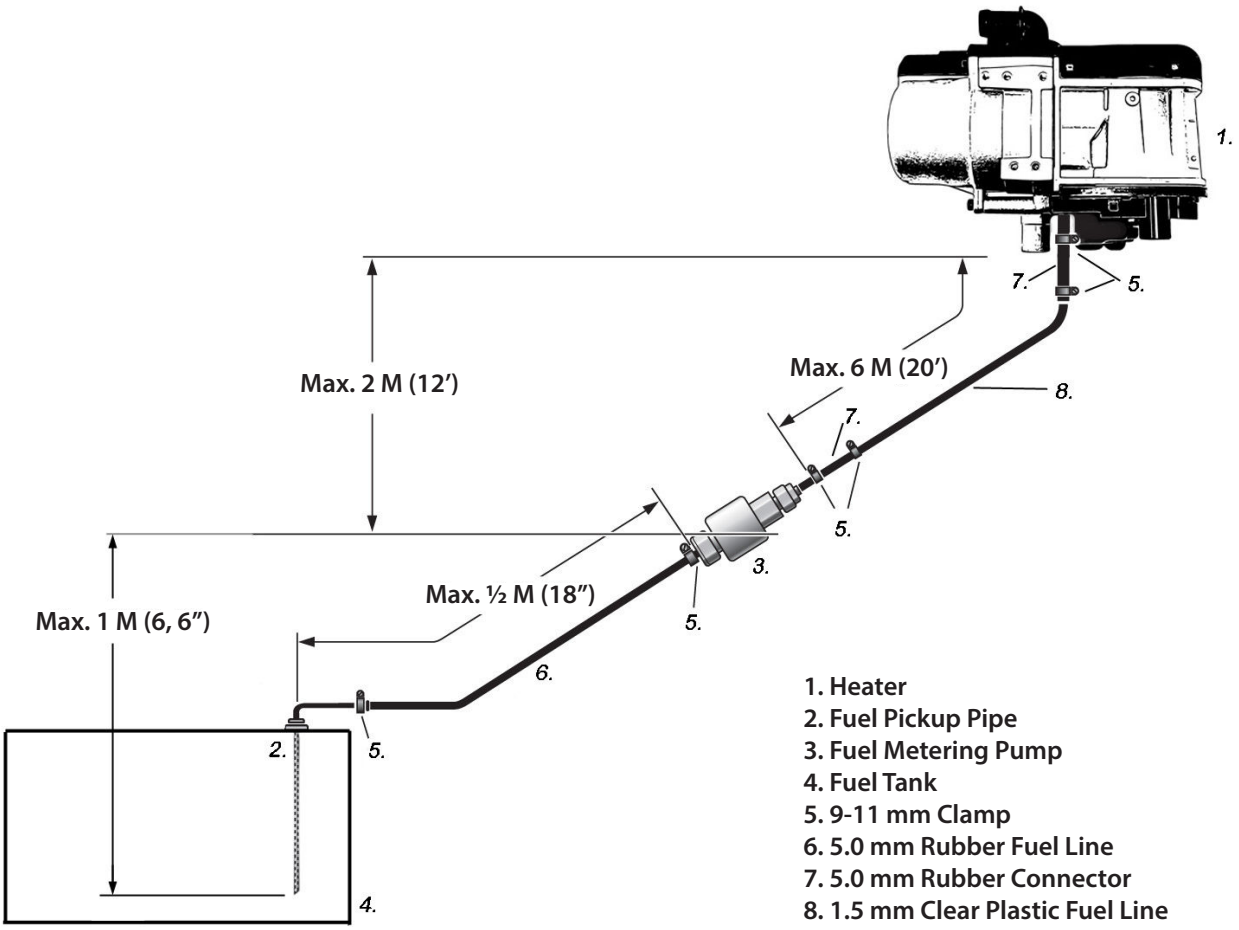
The coolant liquid must contain at least 10% antifreeze all year round as a corrosion protection.

Tech Tip:
Test the flow by feeling the incoming and outgoing hoses. In a system with proper coolant flow, the output temperature will not exceed the input temperature by more than 10°C (18°F).

Fuel System

The 53W fuel pump and fuel system are the heart of the heater. The fuel pump not only delivers fuel to the heater but also controls the amount of fuel delivered. The pump is designed to operate like an electric solenoid and works using electric pulses. Each time it is energized, it provides a measured dose of fuel. It is critical to the heater's operation to stay within parameters outlined below and only use the components provided. (Figure F1)

*Figure F1



1. Heater
2. Fuel Pickup Pipe
3. Fuel Metering Pump
4. Fuel Tank
5. 9-11 mm Clamp
6. 5.0 mm Rubber Fuel Line
7. 5.0 mm Rubber Connector
8. 1.5 mm Clear Plastic Fuel Line

System Layout & Considerations

- Keep the length of the fuel system short as possible.
- Mount the fuel pump as close to the fuel pickup as possible (pump pushes better than it sucks).
- Minimize vertical rise.
- Mount the fuel pump in a protected location away from road spray.
- Choose a mounting location for the fuel pickup pipe that is close to the heater and offers installation access.
- Design your fuel system so that Figure F1 fuel line limits are not exceeded.

Fuel System

*Figure F2

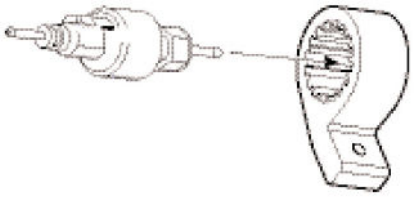
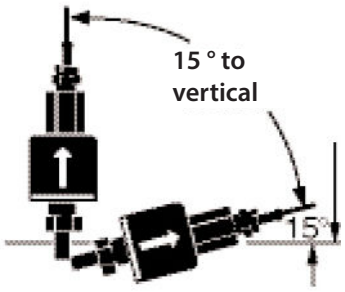


*Figure F3

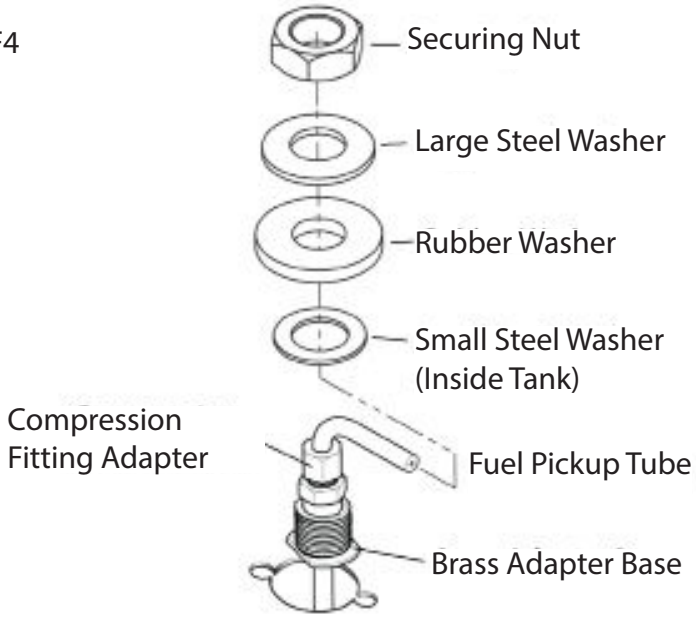


Fuel Pump Mounting

- Using the bracket and rubber mount provided, install fuel pump as shown. (Figure F2)
- Isolating the pump with the rubber holder helps to minimize noise created during operation.
- Ensure that the proper mounting angle is observed to avoid cavitation. (Figure F3)

Fuel Pickup Pipe

*Figure F4



Fuel Source

- Connect directly into the fuel tank using our dedicated fuel pickup tube.
- Teeing into the existing vehicle fuel lines is not recommended.
- There are three common methods to install a fuel pickup tube.
- Use NPT / compression fittings if available
- Use spare fuel gauge plate if available
- Drill dedicated holes into the tank.

Fuel System

*Figure F5

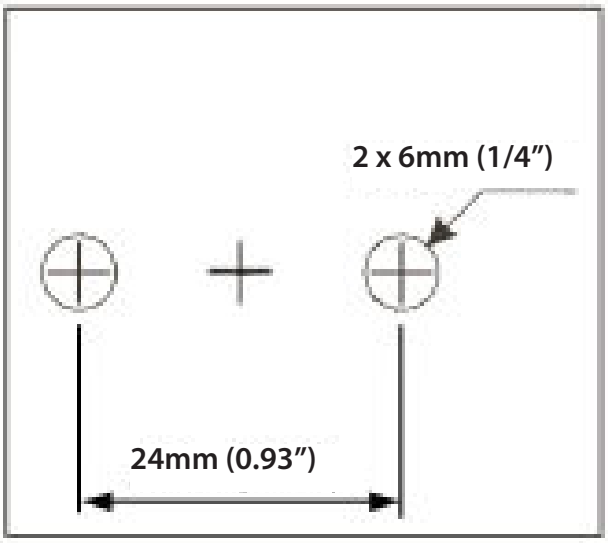
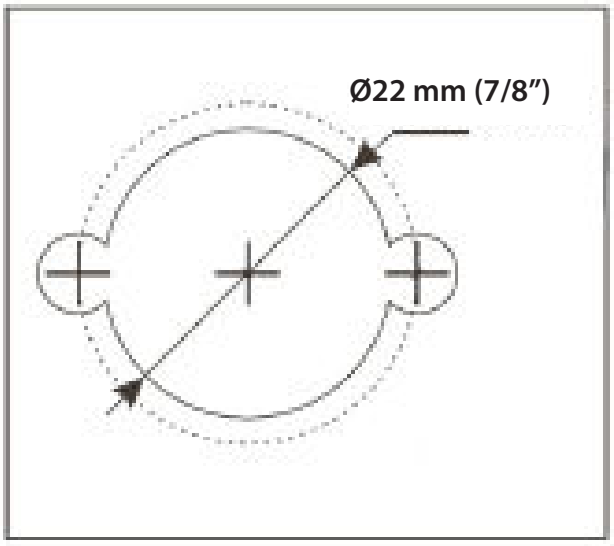


*Figure F6



Fuel Pick-Up Pipe Installation (Drill Option)

- Drill mounting holes in tank to accommodate pick-up pipe as shown in Figure F4
- Drill the two (1/4") holes first. (Figure F5)
- Drill a 7/8" hole. (Figure F6)
- Mount the fuel pick-up assembly pipe as shown.
- Position pick-up pipe 4" from bottom of tank (1" for flat tanks)

Fuel Line Connections

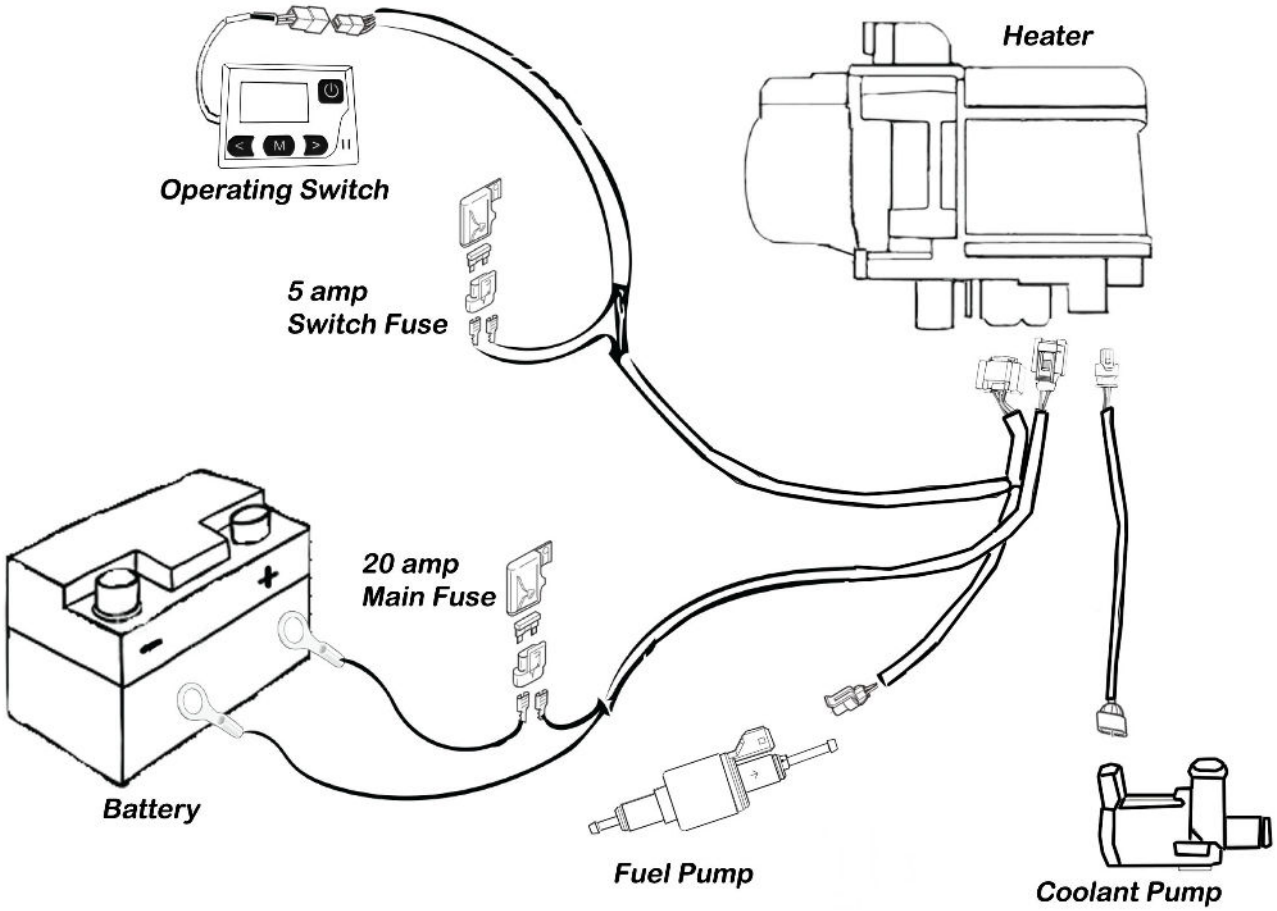
- Route fuel lines from the fuel pick-up pipe to the heater.
- Use only fuel lines provided (Other sizes or types of fuel lines may inhibit proper fuel flow)
- Make proper butt joints using clamps and connector pieces as shown.
- Use a sharp utility knife to cut plastic fuel lines to avoid fuel line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

Electrical Connections

Electrical System Installation

The heater harness that comes with the heater has all the electrical connections preassembled for easy installation.

- Route cables using either an existing cable passage or drill holes as required.
- Seal the hole around the cables and make sure they are protected from chaffing and pinching.
- Below is a summary of the wiring connections required.



Electrical Connections

A. Power Harness	2 Core, 5M (16') Long – Red & Brown Route power harness section from heater to vehicle batteries. Connect red wire ring terminal to battery (+). Connect brown wire ring terminal to battery (-). Install 20 amp main fuse (Last step of installation)
B. Switch Harness	6 Core, 8M (25') Long – Red, Brown/White, Grey/Red, Yellow Route switch harness section from heater to switch location. Attach connector to main operating switch connector Connections should match as follows: Switch – Harness Brown – Brown / White Yellow – Yellow Red – Red Orange – Grey / Red This circuit is protected by a 5 amp fuse located near the main harness connection.
C. Fuel Metering Pump Harness	2 Core, 5M (16') Long – Green/Red, Brown Route fuel metering pump harness to fuel pump. Connect to fuel pump
D. Coolant Pump Harness	2 Core, 0.5M (20") Long – Black. Orange Separate harness with preinstalled connectors. Route coolant pump harness to coolant pump and to heater and connect.

Operating Switch Mounting

The 53W is provided with a multifunctional controller. It is capable of manual and timer controlled switching of the heater and conveys heater operational parameters and diagnostics. Refer to the Operating Switch Instructions for operational details.

Mount timer and bracket in a suitable location.
Connect the switch harness to the connector at the heater and run the harness to the control location.
Connect switch connectors at switch.

Notes:
All exposed electrical connections should be coated with protective grease.
Power wire must be inserted into fuse holder prior to terminating.

Caution

To avoid accidental shorting, connect the heater to the battery and install the fuse as the last step.
This should only be completed once all other installation steps are completed.

Operating Switch

Set Time:

Press "**M**" to enter set mode

Adjust hours using arrow buttons

Press "**M**"

Adjust minutes using arrow buttons

Press and hold "**M**" to save and exit

Set Run Time:

Press "**M**" to enter set mode

Run time options are 0:10 to 1:50 (10 minute intervals), 2:00 or 9:99 (continuous)

Press "**M**" to save, exit and proceed to setting Target Temperature

Set Desired Target Temperature:

The target temperature at which you wish to achieve can be adjusted here.

This Target temperature can range from a minimum of 30 °C to maximum of 90 °C
(Default is set for 85 °C)

Adjust using arrow buttons (5 °C intervals)

Press "**M**" to save and exit

Operating Switch

Establishing Automatic Preset Start-up Times:

Once Initial Setup is complete, you can establish automatic Preset times.
There are three different Presets available.
Once a Preset is activated, the heater will start up automatically and run for the set run time.

Press and hold "**M**" to enter set mode.

"**1**" icon will appear for Preset #1

Adjust hours using arrow buttons

Press "**M**" to proceed to minutes

Adjust minutes using arrow buttons

Press and Hold "**M**" to save and proceed.

Adjust on / off (On = activated, Off = deactivate) using arrow buttons.

Press and Hold "**M**" to save and proceed to Preset #2

"**2**" icon will appear for Preset #2

Adjust hours using arrow buttons

Press "**M**" to proceed to minutes

Adjust minutes using arrow buttons

Press and Hold "**M**" to save and proceed.

Adjust on / off (On = activated, Off = deactivate) using arrow buttons.

Press and Hold "**M**" to save and proceed to Preset #3

Operating Switch

"**3**" icon will appear for Preset #3

Adjust hours using arrow buttons

Press "**M**" to proceed to minutes

Adjust minutes using arrow buttons

Press and Hold "**M**" to save and proceed.

Adjust on / off (On = activated, Off = deactivate) using arrow buttons.

Press and Hold "**M**" to save and exit to home screen (Time of day).

Notes:
Home screen will display "**1**", "**2**", or "**3**" icons to indicate that the associated Preset is activated.

Start Up:

Press and hold Power button for 3 seconds.

Blower and glow pin icons appear while heater is in start up.

Target temperature is displayed.

Operating Switch

Screen Display:

While heater is operating, there are three different screen displays available.

Press "**M**" momentarily to switch between screen displays

Target Temperature
Current Temperature
Run Time

Shut Down:

Press and hold the Power button for 3 seconds to switch heater off manually.

The heater will gradually commence a cool down cycle before switching off completely.

Self Diagnostics:

If the heater's ECU detects a fault during operation, the display will flash and an error code. Refer to the diagnostic fault code legend in manual for further direction

Heater Operation

Pre-Start

- Check all fuel, electrical and plumbing connections.
- Refill the engine coolant.
- Bleed air from the coolant system & top up coolant.

Start Up

Upon signal from the operating switch, the heater conducts a sequenced start procedure.

- ECU executes electrical systems check
- Coolant pump and combustion air blower activate.
- Glow pin begins preheat (20-50 seconds)
- Fuel Metering pump starts to pulse.
- Gradual acceleration of blower and increased pulse frequency of fuel metering pump.
- Combustion is established.
- ECU recognizes temperature change via the flame sensor.
- Once acceptable level of combustion is established, the glow pin is switched off
- Typical start up is 1 ½ to 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.
Tech Tip: Heater has a Priming function. (See Operating Switch Instructions).

Running

Upon ignition, the heater will continue to operate as follows:

- Temperature is monitored at the heat exchanger.
- Once coolant approaches within 15°C of the set target temperature, the heater will automatically switch to Low Heat mode.
- The blower motor and fuel pump pulse frequency will both slow to create this mode.
- If the temperature continues to rise and meet target temperature, the heater will switch off.
- The fuel pump will stop, the blower will continue through a cool down then stop.
- Coolant pump continues circulation and ECU monitors temperature.
- Heater re-starts once coolant temperature reaches 15°C below the target temperature.
- Heater continues to operate until switched off, either manually, automatically by timer or heater malfunction shutdown.

Note: If flame out occurs, heater will automatically attempt one restart.
If successful, it will continue to operate. Otherwise, it will shut down completely with a cool-down cycle.

Note: If voltage drops to 10.5 volts or rises above 16 volts, heater will shut down.

Heater Operation

Switch Off / Cool Down

Upon switch off;

- Heater commences a controlled cool down cycle.
- Fuel delivering stops and flame is extinguished.
- Combustion air blower and coolant pump continue to run for 3 minute cool down.
- Heater shuts off.

Operating Switch Operation Instruction

Refer to: Operating Switch Instructions

Safety Systems

- ECU monitors operations through temperature sensor, overheat sensor and flame sensor.
- Heater will shut down the heater in case of a malfunction.
- ECU conducts circuit check on start up.
- Heater will shut down after two consecutive, unsuccessful, 90 second attempts.
- Heater automatically attempts to restart upon flame out.
- Heater will shut down in case of overheat.
- ECU monitors voltage and will shut down heater if outside 10.5V to 16.0V for 20 seconds.

⚠ Warning - Fire Hazards

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

⚠ Warning - Asphyxiation Hazards

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

Heater Operation

Fault Code Chart

Error Code	Description of Error	Diagnostic Instruction & Correct Action & Repair
1	High Voltage	Check supply voltage
2	Low Voltage	Check supply voltage
3	Fuel Pump Open Circuit	Check fuel pump wiring connections Check resistance across fuel pump terminal
4	Fuel Pump Short Circuit	Check fuel pump wiring connections Check resistance across fuel pump terminals
5	Glow Pin Open Circuit	Check glow pin connectors Check resistance across glow pin
6	Glow Pin Short Circuit	Check glow pin connectors Check resistance across glow pin
7	Blower Motor Open Circuit	Check blower motor wiring Check blower motor for free rotation
8	Blower Motor Short Circuit	Check blower motor wiring Check connection to blower Check for damage inside blower
9	Flame Extinguished	Check fuel flow Check combustion air flow
10	Failed Ignition	Check Voltage Supply Check fuel flow
11	Over Temperature	Check coolant flow Check water pump operation
12	Inlet Sensor Open Circuit	Check sensor connections Check resistance across sensor
13	Inlet Sensor Short Circuit	Check sensor connections Check resistance across sensor
14	Not Applicable	
15	Water Pump Failure Open Circuit	Check water pump wiring, Replace Pump Check resistance of pump
19	ECU Malfunction	Replace ECU
20	Flame Sensor	Replace Flame Sensor

Troubleshooting & Parts

Maintenance

- Switch heater ON at least once monthly for 10 minutes
- Clear combustion air supply and the exhaust system after longer standstill periods.
- Ensure that the vehicle batteries are maintained

Note: Batteries have significantly reduced capacity in cold weather

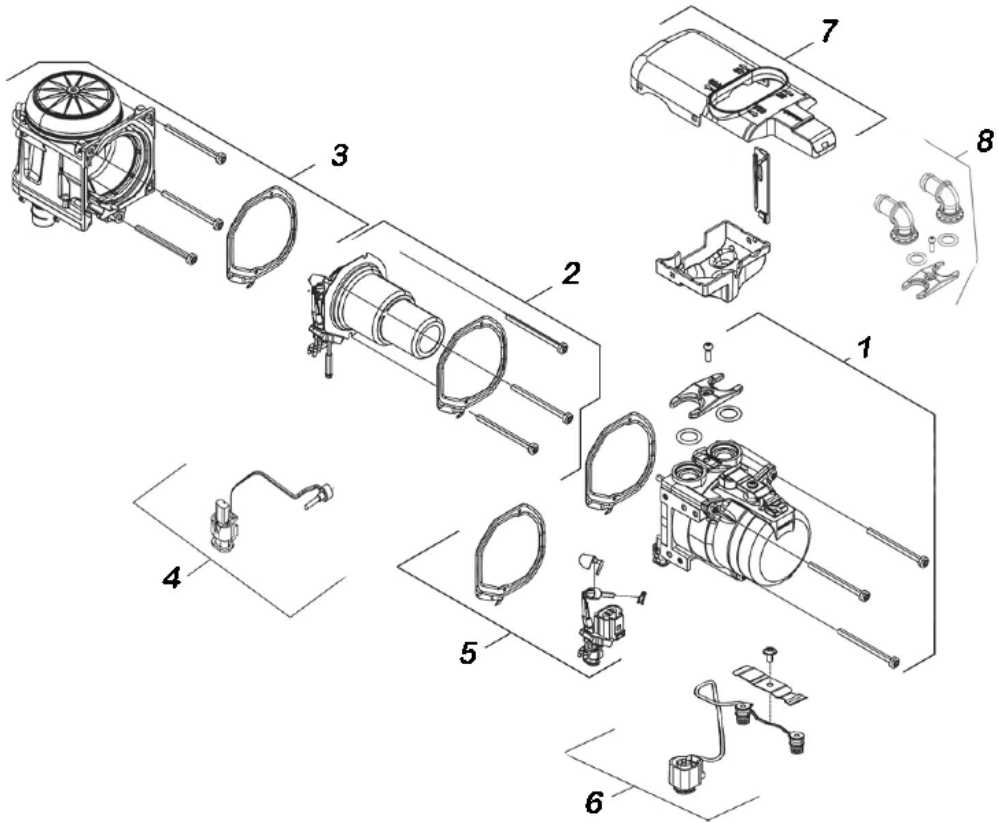
Troubleshooting

The 53W is equipped with self diagnostic capabilities. In the event of failure, an error code will be displayed on the operating switch. Refer to the Fault Code Diagnostic Chart for direction. In addition, consider our basic troubleshooting steps.

Basic Troubleshooting:

- Look for error code on timer and consult Fault Code Diagnostic Chart for direction.
- Ensure sufficient fuel.
- Check wiring & connections for breaks or corrosion
- Check to make sure the voltage going to the heater is not too low or high.
- Check the fuses to make sure they are not burned out.
- Remove power for 5 minutes or via main fuse at the battery, reinstall the fuse and restart.
- Install and test the heater with a new controller.
- Install a new ECU

Heater Components



53W Replacement Parts

Note: Refer to Kit List section for additional part listing.

Item	Description	Part Number
1	Heat Exchanger	P52W-X101
2	Burner (Flame Tube)	P52W-X102
3	Combustion Blower & Integrated ECU	P53W-T101
4	Flame Sensor	P52W-X103
5	Glow Pin	P52W-T102
6	Temperature and Overheat Sensors	P52W-X104
7	Cover	P52W-X201
8	Coolant Fittings	P52W-X602

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